Transactions of the Wisconsin Academy of Sciences, Arts and Letters. volume XLII 1953

Madison, Wis.: Wisconsin Academy of Sciences, Arts and Letters, 1953

https://digital.library.wisc.edu/1711.dl/B44YAM2CN6YXH8B

TRANSACTIONS

OF THE

WISCONSIN ACADEMY

OF

SCIENCES, ARTS AND LETTERS

VOL. XLII

NATURAE SPECIES RATIOQUE

MADISON, WISCONSIN
1953

The publication date of Volume 42 is
August 27, 1953

OFFICERS OF THE WISCONSIN ACADEMY OF SCIENCES, ARTS AND LETTERS

PRESIDENT

Katherine G. Nelson, *Milwaukee–Downer College*

VICE PRESIDENTS

IN SCIENCE: William H. Barber, *Ripon College*
IN ARTS: Ella M. Martin, *Wisconsin State College, Platteville*
IN LETTERS: Berenice Cooper, *Wisconsin State College, Superior*

SECRETARY-TREASURER

Robert J. Dicke, *University of Wisconsin*

LIBRARIAN

Halvor O. Teisberg, *University of Wisconsin*

COUNCIL

The President
The Vice Presidents
The Secretary-Treasurer
The Librarian
Charles E. Allen, *past president*
Paul W. Boutwell, *past president*
A. W. Schorger, *past president*
H. A. Schuette, *past president*
L. E. Noland, *past president*
O. L. Kowalke, *past president*
W. C. McKern, *past president*
E. L. Bolender, *past president*

COMMITTEE ON PUBLICATIONS

The President
The Secretary-Treasurer
A. W. Schorger, *University of Wisconsin*

COMMITTEE ON LIBRARY

The Librarian
C. A. Elvehjem, *University of Wisconsin*
A. M. Fuller, *Milwaukee Public Museum*
H. A. Sequin, *Wisconsin State College, Superior*

COMMITTEE ON MEMBERSHIP

The Secretary-Treasurer
Lois Almon, *Wisconsin State College, Eau Claire*
J. W. Thomson, *University of Wisconsin*
L. Zellmer, *Wisconsin State College, Platteville*

Representative on the Council of the American Association for the Advancement of Science

Robert J. Dicke

TABLE OF CONTENTS

SPENSER, 1552–1952

MERRITT Y. HUGHES

I. HIS CHALLENGED ART

Not long ago a Wisconsin writer in need of refreshment after finishing a detective novel decided to go back to Spenser's *Faerie Queene* for a change of air. He found the poem better than he remembered it from his undergraduate days and ended by reading it entire to his wife and two friends. His pleasure in the poem surprised him for he had vaguely accepted the standards by which Spenser is relegated to an almost juvenile status with his knights and ladies and monsters and unchartable, make-believe world that adult taste puts away with other childish things. The spinner of detective yarns may have been lured on from stanza to stanza by the verbal music of the poem, as Mr. Mark Van Doren confesses is his case in spite of his low rating of the poet's art and mind. And Mr. Van Doren speaks for the majority of American readers when he says that, in spite of Spenser's mastery of "a certain style which nobody else can use, at his centre he is an intellectual amateur, a gentleman moralist, a high-Renaissance Englishman who writes better than he thinks or feels."[1] Spenser, thinks Mr. Van Doren, loved "poetry more than he loved truth," and the key to his mind is simply the fact that he was "drunk with allegory." The effect of his intoxication —according to Mr. Cleanth Brooks in *Modern Poetry and the Tradition*—was to reduce poetry for him and all his tribe to "an allegorical construct, an abstract framework of statement which was to be illustrated and ornamented by overlaying the framework with concrete detail."[2] Mr. Brooks is so struck by the gulf between the art of the Spenserians and the wit of John Donne and the Metaphysical poets that he would rewrite the history of English poetry in the light of the contrast between the intellectual and imaginative immaturity of the Spenserians all the way down to Tennyson on the one hand, and on the other the mature mastery of the radical image and the poetic symbol by the school of Donne in the seventeenth century and by its heirs, with Mr. T. S. Eliot as their guide, in the twentieth.

By an interesting historical paradox, it was Spenser's most powerful though not his most devoted champion in the twentieth

[1] Mark Van Doren. *The Noble Voice*. New York, 1946. P. 232.
[2] Cleanth Brooks. *Modern Poetry and the Tradition*. Chapel Hill, 1939. P. 220.

century, William Butler Yeats, who first suggested that he was the victim of something very like what Mr. Eliot has named "dissociation of sensibility." As early as 1907, in *Discoveries,* Yeats stressed the split between intellect and emotion, the divorce between the "higher" and "lower faculties" in the post-Renaissance world as so inimical to poetry that, by the beginning of the twentieth century, "the highest faculties had faded, taking the sense of beauty with them, into some sort of vague heaven, and left the lower to lumber where they best could."[3] Yeats saw the "conflict between the aesthetic and moral interests" in Spenser no less clearly, though he left it to the next generation to condemn the poet—as Mr. Traversi has done in *Scrutiny*—for his fatal "attraction to Neo-Platonism," the evil that drove him and Milton, "by their very genius, to crush the true poetic genius of English."[4] For Mr. Traversi Neo-Platonism is one with Puritanism—the puritanism of Calvin the damned, and Luther, and all the rest of these blighters whom, as Mr. Ezra Pound protested in *Jefferson and/or Mussolini,* "we Americans have, whether we like it or not, on our shoulders."[5] In Spenser Mr. Traversi sees simply the Puritan with a "disembodied and destructive intellect preying on the body to kill the soul." That, for him, is "the importance of Spenser and Milton, and the relation of their development to the English tradition." Everywhere down to the age of Tennyson he finds "their pallid successors . . . producing a dead poetic language—sterile emotions issuing in sterilized speech."[6] Mr. Traversi bulldozes a royal road to understanding of English poetry over the buried reputations of all the Spenserians from Milton to Tennyson. Mr. F. R. Leavis rides the same way with equal disregard of the cost to the Golden Treasury when he derives Tennyson "from Spenser by way of Milton and Keats," and declares that Milton's acknowledgment of Spenser as his "original" is given an "obvious significance by the mention of Tennyson."[7]

In biology we would suspect a theory of sterility as a typically heritable trait, and in literature we should hesitate to attribute it to a poet whose distinctive qualities appear for three centuries after his death as dominant characteristics in his tribe. When the world was under Spenser's spell the poets gloried in their inheritances from him—traits, for example, like the "elegant

[3] William Butler Yeats. *Discoveries*. Dundrum, 1907. P. 7.
[4] *Scrutiny*. Vol. V (1937). Pp. 284–285.
[5] Ezra Pound. *Jefferson and/or Mussolini. L'ideale statale. Fascism as I have seen it*. London, 1935. P. 44.
[6] *Scrutiny*. Vol. V. P. 291.
[7] F. R. Leavis. *Revaluation*. London, 1936. P. 56.

turns on the word and on the thought"[8] that Dryden called the finest things in English poetry and confessed that he had deliberately derived from Spenser. To Mr. Van Doren these "elegant turns" of Spenser are not apparent or are the vices of his "extensive art," which fails for "lack of force, because its imagery never short-circuits itself, never generates heat by resisting convention."[9] In the ecology of modern poetics it is a dogma that imagery can never have a healthy growth under the shadow of allegory; that in its presence sensibility is always ununified and stultified. Mr. Brooks by implication accepts the dogma when he contrasts Yeats' *Blood and the Moon* on this score with *The Faerie Queene*. In *Blood and the Moon* he sees a "very fine example of unification of sensibility" simply because the poem "refuses to be reduced to allegory—allegory which is perhaps the first attempt which man makes to unite the intellect and the emotions when they begin to fall apart—Spenser's *Faerie Queene* for example."[10]

It may be unfair to Mr. Brooks to hold him strictly for his short work with allegory. He can hardly intend to condemn it in its entire range from its direct variety (to use Mr. Rex Warner's terms) in Bunyan through its intermediate forms in Spenser and the allegorical *dramatis personae* of Strindberg and the expressionists, to its indirect forms in Kafka. The time has passed for off-hand dismissal of Spenser's allegory in Lowell's words as "imagination adapted for beginners in words of one syllable and illustrated with cuts."[11] Lowell wrote under the spell of Hazlitt's famous dictum that if Spenser's readers would not "meddle with the allegory, it would not meddle with them."[12] For over a century Hazlitt's doctrine could be applied to all the classical allegorists. Even an artist of Henry James' gift for the allegory that revolves around symbols—as it appears in *The Wings of the Dove, The Golden Bowl,* and *The Ivory Tower*—could condemn Hawthorne's symbolism as an "element of cold and ingenious fantasy," impotent and "passionless." Herbert Read is probably right in quoting these words[13] as evidence that James could not appreciate Hawthorne, Spenser, or Bunyan though his own creative gift developed in their direction. Modern fiction and poetry, even while they move toward allegory, are shy of approval of

---

[8] John Dryden in the *Essay on Satire*. In *Essays of John Dryden*. Selected by C. D. Yonge. London, 1882. Pp. 102–103.

[9] Mark Van Doren in *The Noble Voice*. P. 247.

[10] Cleanth Brooks in *Modern Poetry and the Tradition*. P. 181.

[11] *The Writings of James Russell Lowell*. London, 1890. Vol. IV. P. 324.

[12] *Complete Works of William Hazlitt*. London, 1930. Vol. V. P. 38.

[13] Herbert Read in *The Sense of Glory*. Cambridge, 1928. P. 161.

Spenser's medium. Stephen Spender's attempt to get away from "the substantive" to

> "the general and from thence
> To an almost Spenserian and occult
> Prosopopoeia,"

as Karl Shapiro reminds us,[14] was far from successful. Although at first he

> "Used the abstraction as a metaphor,
> Concretely and with humor,"

he was foredoomed to failure in the end because

> "the figure,
> Full of the serum of old melancholy,
> Distended in its shell and burst."

The grounds of our aversion to Spenserian allegory lie deeper in our contemporary culture than we can dig. One of the deepest-rooted of them is indicated by Miss Tuve when she observes that as "the painter of the poets" Spenser stands in danger of the modern abomination of "painting" by the symbolists in their "flight with Yeats from painted symbolic object to symbol."[15] On evidence mainly negative, the extent of the desertion of "the poets' poet" by the poets of the twentieth century is hard to measure. More significant than their shyness of ecstatic Spenserian echoes like those of the young Keats in *Sleep and Poetry* is the sadness or bitterness of modern reminiscence of Spenser. A typical case is Mr. Eliot's evocation of the Thames of Spenser's *Prothalamion* in contrast with the foul river whence

> "The nymphs are departed,
> And their friends, the loitering heirs of city directors;
> Departed, have left no addresses.
> Sweet Thames, run softly till I end my song,
> Sweet Thames, run softly, for I speak not loud or long."

Or, as in Ruth Pitter's *Song of Thames,* we drop to a symbol of hope in her cygnet from the confident images of pride in the swans of the *Prothalamion*—the swans which convoy the "two honorable and Vertuous ladies, the ladie Elizabeth and the ladie Katherine Somerset," as they are rowed to their spousal by barge from the river stairs of Somerset House. In Miss Pitter's poem, after her vision of the city scourged by vice and war, the

---

[14] Karl Shapiro in *Essay on Rime.* London, 1947. P. 42.

[15] Rosamond Tuve in *Elizabethan and Metaphysical Imagery.* University of Chicago Press, 1947. P. 6.

swan can emerge only as an incongruous symbol of beauty's perennial defiance of engulfing ugliness:

> "... on the polluted river,
> Thick with impurity yet crowned with honour,
> There sails a creature raised above pollution,
> Proud and immaculate as winter ermine,
> He who was last year's cygnet ..."

Perhaps the only spirit among twentieth-century poets to be powerfully kindled by a Spenserian love of Platonic beauty has been Bridges, the only voice proclaiming that

> "All earthly beauty hath one cause and proof,
> To lead the pilgrim soul to beauty above."

Even among the later Victorians there were few to hail Spenser as Charles Doughty did in *The Clouds:*

> "Dear Master Edmund, since from thy pined flesh,
> Thou was unbound: is fallen thy matchless Muse;
> Alas the while! on many evil days:
> Wherein, as waxed untuneable, can men's ears
> Now, no more savour thy celestial lays!"

In unqualified admiration for Spenser Doughty stands alone. How far the prophetic morality and archaic language and highly personal rhythms of *The Dawn in Britain* are indebted to *The Faerie Queene* is a dark question. Certainly they perpetuate less of the spirit and style of Spenser than Doughty piously intended that they should.

The only outstanding twentieth-century poet to champion Spenser has been the man whose influence and example have perhaps most told against him, the young Yeats. In 1906 Yeats found him a good enough companion to select nearly three hundred of his pages to "remember and carry about." Dated though Yeats' edition is by its precious illustrations, it could (if it were again cheaply reprinted) become the most viable road to pleasure in Spenser for modern readers who ignore or distrust him. Its choice of four eclogues from *The Shepheardes Calendar* to put beside some "Gardens of Delight" from *The Faerie Queene,* its representation of "Happy and Unhappy Love" by minor pieces like *An Hymne of Heavenly Beautie* and the *Epithalamion* as well as by the epic episodes of Florimell and Marinell from *The Faerie Queene,* put the poetry under rubrics that are valid for devout Yeatsians. If the selections make Spenser seem too much at home among those "smooth pastoral scenes and lovely effeminate islands" that the young Yeats thought "made him a poet,"[16]

[16] *Poems of Spenser.* Selected with an Introduction by W. B. Yeats. References are to the reprint of London, 1926.

they do not make him an idle singer or master of a merely escapist idyllic poetry. Under the caption "Emblems and Qualities" he gathered up all the Spenserian passages to which he had found that he responded most spontaneously himself. As the "finest invention" among them he selected that "Vision of Scudamour" in the Fourth Book of *The Faerie Queene,* canto x, which Van Doren dismisses as one of "several pretty places" that are "concocted by recipe." As the essence of Spenser Yeats included what he called the "House of Love" together with the "Houses" of Despair, Richesse, and Friendship to stand with the "Wandering of the Stars" and the cantos of *Mutabilitie.*[17] Whenever he returned to these "emblems," Yeats found himself transported out of the realm of allegory, where he was "for the most part, bored," into the symbolism that he admired. All of them, he thought, "either, like the House of Mammon (Richesse), have enough antient mythology, always in implicit symbolism, or, like the Cave of Despair, enough sheer passion to make one forget or forgive their allegory, or else they are, like the vision of Scudamour, so visionary, so full of a sort of ghostly midnight animation, that one is persuaded that they had some sort of strange purpose and did truly appear just in that way to some mind worn out with war and trouble."[18]

The Romantic poets themselves never paid a more devout homage than this of Yeats to Spenser. But to Yeats the Romantic devotion to Spenser seemed blind, and he denied that Shelley had a right to be regarded as a true Spenserian. To prove his point he took a stanza from *Laon and Cythna* (as a narrative poem fairly comparable with *The Faerie Queene*) and contrasted "its varied and trouble rhythms" and its "indolent wandering hither and thither at the beckoning of fancy" with the steady "rush of Spenser's verse on to some pre-ordained thought." This criticism contrasts with recent objection to *The Faerie Queene* as an expression of will rather than of free imagination—an objection with certain sides of which Yeats himself sympathized. Certainly in his own work Yeats deliberately determined to take as free a course as did Goethe or André Gide or any modern writer. The pre-ordained ethical and political intention that Spenser professed in his letter to Raleigh at the head of *The Faerie Queene* is perhaps the main modern stumbling block to enjoyment of the poem. On the political even more than the ethical point Spenser is vulnerable for there is little dissent today from Robert Graves'

---

[17] Yeats took the "House of Love" from *The Faerie Queene,* IV, x; Despair from I, ix; Richesse from II, vii; and Friendship from IV, —. "The Wandering of the Stars" is the Prologue to Book V.

[18] *Poems of Spenser.* P. xlv.

opinion that, "Poets, insofar as they are behaving poetically, steer well clear of politics."[19] Yeats himself was angry with Spenser because he "gave his heart to the state," and for that reason questioned his right to occupy himself "with moral and religious questions at all."[20] For us the crucial question about Spenser is whether the rush "of his verse to some pre-ordained thought" may not be a consequence of his engagement (to use Sartre's term with a difference) in politics, ethics, and even metaphysics.

II. His Unpopular Politics

Spenser's heart, it must be acknowledged, *was* given to the state, and his poetry is full of faith in a hierarchical society. To these convictions we owe the poetry that was born of his pragmatically ideal synthesis of politics, ethics, and metaphysics. Sympathy with his thought may be difficult in this four-hundredth year after his birth. In a democratic world his social principles are alien, and his approval of England's active military policies in Ireland and Holland easily passes as bigoted or imperialistic today. His best informed Irish critic, Pauline Henley, exonerates him of religious fanaticism in his support of the sternest and most aggressively Protestant of Elizabeth's Lords Lieutenant in Ireland, and she also clears him of "conscious" hypocrisy in his "worship of the state."[21] Yet she is harder than Yeats on Spenser for his severity to Ireland in his *View* of the country and in the Fifth Book of *The Faerie Queene*. She carries her political quarrel to the point of questioning whether the English were justified in supporting "the revolt of the Netherlands" and the effort of the Dutch to throw off "the foreign yoke of Philip II, securing control over their own government, and establishing their right to practice the religion of their choice."[22] Opposite to Miss Henley we have Edwin Greenlaw's robust acceptance of Spenser as a spokesman for "British imperialism." For Greenlaw Spenser was "a man of action as well as a writer of verse,"[23] and his ideas about Ireland were but one aspect of more ambitious visions which he shared with Raleigh, Drake, and Walsingham. In common with Elizabeth's more aggressive counsellors Greenlaw saw Spenser as committed by the historical and political allegory of *The Faerie Queene* to war to the death with Spain, and after the defeat of the Spanish Armada in 1588

---

[19] Quoted in *The London Times Literary Supplement,* 30 September, 1949.
[20] *Poems of Spenser.* P. xxviii.
[21] Pauline Henley. *Spenser in Ireland.* Cork, 1928. Pp. 184 and 170.
[22] *Ibid.* P. 177.
[23] Edwin Greenlaw. *Studies in Spenser's Historical Allegory.* Baltimore, 1932. P. 160.

to the suppression of all spirit of rebellion in Ireland and to the establishment of new colonies farther west, in America, "in opposition to those of Spain."[24] Only if we read Renaissance history as Greenlaw did can we share his enthusiasm for the causes that Spenser loved or agree that his poems give us "an interpretation of Elizabethan political idealism without parallel elsewhere."[25] Most modern readers of Spenser, however, are so little stirred by the historic struggles of his time that they are glad to take refuge with one of the most learned trackers of the literary sources of his political thought in avoiding the "shouting and tumult"[26] of the international scene as it appeared to Spenser in Ireland in the two last decades of the sixteenth century. It is easy to see Spenser against that background as an "imperialist," and from that opprobrious view of him it is still easier to go on to condemn the very basis of his political thought, as Miss Henley did, as undemocratic, "anti-equalitarian," and tainted with the poison of John Calvin's superstitious reverence for "success in life" as "the mark of Divine Love."[27]

As the key to Spenser's politics Miss Henley pointed to the allegory of communism overthrown by the Knight of Justice, Artegall, in the Fifth Book of *The Faerie Queene*. The communist spokesman is no dialectical materialist though he is a "mighty gyant"[28] and "admired much of fooles, women, and boyes."[29] Intellectually, he is a man of straw as he boasts that he will balance heaven and hell, fire and air together, reform all kingdoms,

> "And all things would reduce unto equality."[30]

Practically, the giant is a dangerous demagogue as he attracts "the vulgar," who

> ". . . cluster thicke unto his leasings vaine,
> Like foolish flies about an hony crocke,
> In hope by him great benefite to gaine,
> And uncontrolled freedome to obtaine."[31]

The giant's equalitarian logic lacks the speciousness of the reasoning of Marx and Lenin, but it had the ring of actuality for Spenser's readers because it recalled the slogans of the Peasants' War in Germany in 1525 and of Ket's rebellion in Norfolk in

---

24 *Ibid.* P. 159.
25 *Ibid.* P. 165.
26 H. S. V. Jones. *Spenser's Defense of Lord Grey.* Urbana, 1919. P. 10.
27 *Spenser in Ireland.* P. 188.
28 *The Faerie Queene,* V, ii, 30, 1.
29 *Ibid.,* V, ii, 30, 9.
30 *Ibid.,* V, ii, 32, 9.
31 *Ibid.,* V, ii, 33, 1–5.

1549. Artegall's reply is two-fold: a formal plea for a social hierarchy and a final application of force. The act of force, the violent overthrow of the giant by Artegall's iron squire Talus, is intolerable to readers who, like Miss Henley, see the entire episode as a "scathing attack on democracy and its aspirations." Talus is not ingratiating. The best that can be said for him is that he does his duty without a trace of sadism and follows the behests of Justice with perfect alacrity. But to modern readers he smacks of the Gestapo and OGPU. The common reader's reaction to him is that of Keats, who wrote in his copy of *The Faerie Queene* the prophecy that Spenser's equalitarian giant would one day learn to use the press so well that, "meeting Artegall and Talus grim,"[32] he would strike them both with blindness. To accept Talus as a poetic image in even the qualified way that Coleridge did,[33] we should have to share his conception of the truth of reason which is recognizable because "it can come forth out of the moulds of the understanding only in the disguise of two contradictory conceptions."[34] Unfortunately, Coleridge did not develop his allusion to Talus as an imperfect poetic image. Had he done so, he might have seen Talus and Artegall as coalescing in a conception of the value of justice and its sanctions, while the levelling giant becomes an image of the popular aspirations that challenge and in the end enlighten and purify justice itself.

Artegall's plea for a social hierarchy is not original, and to those who regard Spenser as a willing tool of the state it is unconvincing. For he is simply paraphrasing the parallel in the *Homily of Obedience* (1547)[35] between God's assignment of "kings princes with other governors under them, all in good and necessary order," with "the water above" that "raineth down in due time" and "the sun moon stars" etc. that "do keep their order." Says Artegall:

> "The hils doe not the lowly dales disdaine;
> The dales doe not the lofty hils envy.
> He maketh Kings to sit in soverainty;
> He maketh subjects to their powre obay;
> He pulleth downe, He setteth up on hy;
> He gives to this, from that He takes away;
> For all we have is His: what He list doe, He may."[36]

---

[32] *Keats.* Edited by Horace E. Scudder. Boston, 1899. P. 9.

[33] *Coleridge's Miscellaneous Criticism.* Edited by Thomas M. Raysor. London, 1936. P. 38.

[34] Quoted from *Table Talk,* April 30, 1830, by I. A. Richards in *Coleridge on Imagination.* Second edition. London, 1950. P. 166.

[35] Quoted at length by E. M. W. Tillyard in *The Elizabethan World Picture.* London, 1943. P. 82.

[36] *F. Q.:* V, ii, 41, 3–9.

For readers who reject both hierarchy and divinity Artegall's social hierarchy by divine right is a hard doctrine. It can easily be distorted, as it is by Mr. Van Doren when he says that Spenser's "chief fear seems to be lest the poor get money and the gentry be dethroned."[37] It would be less unfair to Spenser and more illuminating for the reader if Mr. Van Doren were to try to place Artegall's speech in the tradition that reaches from far behind the *Homily of Obedience* through *The Faerie Queene* to the famous speech of Ulysses on order and degree in society in Shakespeare's *Troilus and Cressida:*

> "The heavens themselves, the planets, and this centre
> Observe degree, priority, and place . . ."[38]

One reply to Mr. Van Doren's criticism may be found in Spenser's Sixth Book, the "Legend of Courtesy," though the virtue is defined in terms of the social hierarchy that Artegall defends. Spenser made the "roote of civill conversation" itself consist in the art of bearing one's self

> "aright
> To all of each degree, as doth behove.
> For whether they be placed high above
> Or low beneath, yet ought they well to know
> Their good, that none them rightly may reprove
> Of rudenesse, for not yeelding what they owe."[39]

This rule is best tested by the Knight of Courtesy, Sir Calidore, when he finds himself among shepherds whose wealth is more than enough to make him welcome as an honored, non-paying guest. He has his condescending moments, but there is also generosity in his treatment of a churlish rival for a shepherdess who, like Perdita in *The Winter's Tale,* finally proves to be a princess. In terms of wealth Calidore's host is sure that he has been wise to drop a successful career at court for a rustic life where he finds that "the little that (he has) growes dayly more."[40] And Calidore agrees with him that "It is the mynd that maketh good or ill,"[41] and is ready to join him in

> "this safe retyre
> Of life, which here in lowlinesse ye lead,
> Fearelesse of foes, or Fortunes wrackfull yre,
> Which tosseth states, and under foot doth tread
> The mightie ones, affrayd of every chaunges dread."[42]

---

[37] *The Noble Voice.* P. 244.
[38] *Troilus and Cressida,* act I, scene iii, lines 85–86, ff.
[39] *F. Q.:* VI, ii, 1, 3–9.
[40] *F. Q.:* VI, ix, 21, 5.
[41] *F. Q.:* VI, ix, 30, 1.
[42] *F. Q.:* VI, ix, 27, 5–9.

The upshot of the "Legend of Courtesy" is that Calidore has to learn—as Mr. Empson notes—that "the refined thing must be judged by the fundamental thing, because strength must be learned in weakness and sociability in isolation." The great point of Spenser's "Book of Courtesy" seems to Mr. Empson to be this basic paradox about social values. And it is interesting to find him adding that "Spenser's ideas are very well suited to a socialist society, and have been made to fit in very well with the dogma of the equality of man," though they hardly seem admissible in "a rigid proletarian aesthetic."[43]

Another reply to Mr. Van Doren is to be found in Spenser's "Legend of Temperance." In the Second Book of *The Faerie Queene* that virtue is only less political than it is ethical, as it is in Aristotle's *Politics* and, from the Christian point of view, in Langland's *Vision of Piers Plowman.* On the basis of parallels between Spenser's first two books and the masques that entertained Elizabeth on some great occasions in her reign Greenlaw held that "Spenser's temperance, like his holiness, was a political virtue."[44] From the political point of view the most interesting canto in Book II is the seventh, in which Guyon visits "Mammon's Delve" and proves himself temperate enough—in the high Aristotelian and Christian senses of the virtue—to withstand all temptations of wealth and power. The canto is not only an allegory of personal self-discipline; it is a challenge to the main weakness of the new, plutocratic Tudor nobility; it is an effort to solve the problem of a true élite. In Mammon's Delve the wealth of the world is Guyon's for the taking, and he refuses it even when Mammon appeals to his passion for glory and tells him that this "worldly mucke" is the sinews of the great wars that make ambition virtue. The language of the god of wealth is patterned on Satan's words to Christ in the Gospel when, after displaying "the kingdoms of this world and the glory of them," the Devil says, "All these things will I give thee, if thou wilt fall down and worship me."[45]

> "Wherefore, if me thou deigne to serve and sew,
> At thy command, lo! all these mountaines bee,"[46]

says Mammon to Guyon. On the latter's refusal, we are given to understand, rests more than the safety of his own soul. Critics may quarrel as to whether Guyon's unyielding virtue is that of a Stoic rejecting "Mammon's offers of wealth in favor of 'un-

---

[43] William Empson. *Some Versions of Pastoral.* London, 1935 & 1950. P. 20.
[44] *Studies in Spenser's Historical Allegory.* P. 93.
[45] Matthew, 4, 8–9.
[46] *F. Q.:* II, vii, 9, 1–2.

troubled nature,' "[47] or of Aristotle's liberal man despising all wealth that is valued merely for its own sake. There is no reason for the debate if we think of Guyon as a public as well as a private figure. If his temptation is a threat to the integrity of a man with public responsibility, we need not follow one school of critics who find it unnatural that he "is not even much tempted by the gross worldly wealth laid before him in the House of Mammon."[48]

Opinions may differ as to whether the Knight of Temperance ever became a poetic image, a true symbol of the practice of the most necessary and prosaic of the virtues. There is no doubt of the power of the images that surround him in his delve: Mammon himself and his daughter Philotimé, who is the passion for earthly glory that assaults heaven and creates hell; and the slaves in the delve must have been as moving a symbol for the Elizabethans as ever the dwarfs in the *Nibelungenlied* were for the mediaeval Germans. The slaves at Mammon's anvil provoke the timeless revulsion against the spiritual bondage of the passion for wealth; their resentment of Guyon's aloofness mirrors the fanaticism of the profit motive in its truceless war with the spirit.

In the "Legend of Temperance" the political moral should be perennially acceptable under all constitutions and even under a plutocracy. We all condemn corruption and applaud honesty. But not many of us approve of the doctrine of degree or social hierarchy in Books V and VI or of its complement, the doctrine of cosmic and civil concord, in Book IV, the "Legend of Friendship." The virtue of the Third Book, the "Legend of Chastity," we accept only when it becomes clear that its heroine, Britomart, is to represent married love and maternity. We are not by any means so sympathetic as were Spenser's contemporaries with the politico-ecclesiastical allegory of his First Book, the "Legend of Holiness," for today the very title suggests self-righteousness and the fanaticism of the wars of religion. Nor are we reassured when in canto viii we find St. George, who in the political allegory is England just as in the moral allegory he is Everyman, being made a captive by the embodiments of spiritual pride and falsehood, Archimago and Duessa. His rescue by Prince Arthur has traditionally been interpreted as signifying England's assertion of its Protestantism against Rome. The interpretation is not inevitable, but with due allowance for Spenser's respect for the older faith, it cannot be far wide of the mark. If this is the sum

---

[47] C. S. Lewis. *The Allegory of Love.* Oxford, 1936. P. 328.
[48] Herschel Baker. *The Dignity of Man.* Cambridge, 1947. P. 314.

of the historical allegory in Book I, the modern reader who has nothing but a plague for both the houses in the wars of religion, must be profoundly disappointed.

There is a way, however, to read the story of St. George as a political allegory above the mêlée of ecclesiastical strife. The political allegory may be read as a counterpart of the moral one, which is that of every young idealist who, like St. George, becomes the champion of Truth, who is always in the position of the persecuted damsel Una in Spenser's story. St. George's adventures with her can be read on the religious level of the wayfaring Christian finding truth through experience both in retreat and in action rather than by any simple commitment to implicit faith in any creed or church. But St. George's adventures may also be read as an allegory of the experience that is always being repeated at one stage or another on the public or national level. In essence, it is the bitter but comic experience that is implied in Lincoln's observation that you can fool all the people some of the time but not all of them all the time. St. George, Spenser tells us, was "a clownish young man" whose bane was his credulity. We find him forever being beguiled by Hypocrisy in the form of Archimago and by Error in that of Duessa. There is irony in his first deception as he sits under a tree that speaks with a human voice to warn him that it was once a man like himself before its metamorphosis by

> "one Duessa, a false sorceresse,
> That many errant knights hath brought to wretchednesse."[49]

Without the faintest suspicion that his companion is that same Duessa, St. George follows her trustingly to the House of Pride. After disillusion there he is as ready as ever to be deceived again under another green tree when

> "The witch approaching gan him fairly greet,
> And with reproch of carelessenesse unkind
> Upbrayd, for leaving her in place unmeet."[50]

Forgetful that the desertion had been hers rather than his, St. George succumbs to her charms and is once more betrayed to pride, which now takes the sadistic form of her lover and his persecutor, Orgoglio.

Almost to the end Una's "fresh, unproved knight" remains the fool of the witch and the enchanter. From every misadventure St. George emerges a sadder but a not much wiser man. When at last he goes into retreat in the House of Holiness and tries to

---

[49] *F. Q.:* I, ii, 34, 8–9.
[50] *F. Q.:* I, vii, 3, 6–8.

learn something from a kind of monastic discipline he is so immature that he wishes to renounce the world out of hand with all its "deedes of armes . . . and ladies love."[51] From this dream of a royal road to sanctity he has to be recalled to his promise to Una to travel a way that must lead finally to a supreme deed of arms in her service. Her patience, fortunately, is limitless, for she is humble and perhaps remembers her own failure on one critical occasion to recognize the enchanter Archimago. One of the strangest things about Una is that she too has to learn by experience. Her failure to recognize Archimago for what he is until the very end of her story seems to one of Spenser's most sympathetic contemporary readers "the most bewildering thing about her."[52] Bewildering it certainly is unless we regard her as more or less than absolute Truth in a Platonic or Christian sense. In her story she is one of Spenser's most human characters, and the touch of gullibility about her seems to be a part of her innocence. It is because she is perfectly innocent that she escapes being comic like her champion though she must share his predicament.

Spenser's "Legend of Holiness" is a divine comedy in the mediaeval sense that it is a tale with a happy ending. If he had completed *The Faerie Queene* as he planned it, St. George and Una might have reappeared in some final cantos at least distantly rivalling the close of Dante's *Paradise*. But Spenser's First Book is also comic in the modern sense for on the politico-ecclesiastical level it is a parable of John Bull muddling through the Reformation to the Elizabethan settlement. And on the moral and psychological levels it is comic because its clownish hero is Everyman in quest of what all men must seek though few find. But St. George is also the people whose patron saint he traditionally is. And through the very fallible saint Spenser confessed his country's worst mistakes in its pilgrimage towards what we call the Elizabethan Settlement. But the religious question, Spenser knew, can never be settled by any act of a queen or parliament, and that is why, at the end of the story, St. George must break off his honeymoon with Una to return for the duration of an indefinite emergency to the service of the Fairy Queen.

III. His Not Quite Obsolete Ethics

The conclusion of Spenser's Second Book in the destruction of the Venusberg of its Circe-like villain, the witch Acrasia, by the Knight of Temperance, is not defensible, like the close of his

[51] *F. Q.:* I, vii, 47, 5–6.
[52] W. B. C. Watkins. *Shakespeare and Spenser.* Princeton, 1950. P. 157.

First Book, on grounds of mingled wisdom and humor in a beatific vision with this-worldly meaning on both the psychological and political levels. Guyon's final act in his Legend is the most severely criticized scene in *The Faerie Queene* because it exposes Spenser's dualistic ethic so starkly against one of his most enchanting backgrounds. The canto is shot through with reminiscences of Homer's story of the transformation of Ulysses' men into beasts on the isle of Circe. But to many modern readers Spenser's version of the story suffers in comparison both with Homer's and with its most recent recreation in fiction, by James Joyce in *Ulysses.* Among Homeric commentators in the Renaissance there was all but unanimous agreement on an ethical allegory as the substance of the story, and Spenser's Knight of Temperance is patterned on Homer's Odysseus not fancifully like Joyce's Leopold Bloom, but simply in the light of the contemporary view of the Odyssey as a spiritual pilgrimage. Spenser's Guyon is committed by his rôle to be the reverse of Bloom's timidity, fecklessness, and aimlessness. Readers who regard Marion Bloom's reverie of unashamed lust as the fitting capstone of Joyce's work can hardly rejoice in Guyon's condemnation of the hog Gryll, who, alone among the rout of Circean beasts in Acrasia's bower, refuses to be restored to human form. When the miracle is performed in spite of him, he curses its operator, the Palmer who stands beside Guyon as a kind of embodiment of a Socratic daimon or incarnation of Aristotle's practical wisdom, for bringing him "from hoggish form to naturall." And the canto ends with Guyon's outburst:

> "See the mind of beastly man,
> That hath so soone forgot the excellence
> Of his creation, when he life began,
> That now he chooseth with vile difference
> To be a beast, and lacke intelligence!"

To whom the Palmer thus:

> "The donghill kinde
> Delightes in filth and fowle incontinence:
> Let Gryll be Gryll, and have his hoggish minde:
> But let us hence depart whilest wether serves
> and winde."[53]

So the "Legend of Temperance" ends in an edifying burst of moral indignation against the kind of nature that portrays itself in Marion Bloom's soliloquy.

As a whole, Spenser's treatment of the gardens of Acrasia challenges comparison with Joyce's *Walpurgisnacht* in the Dublin

[53] *F. Q.:* II, xii, 87.

slum, in the brothel of his Circe, Bella Cohen. If we judge the two scenes from the point of view of the purity (in the aesthetic sense) of their art, *i.e.*, from their freedom from the didactic and the kinetic elements which Joyce said in *The Portrait of the Artist as a Young Man* were equally inimical to the stasis of pure aesthetic experience, then the decision is not obvious. Spenser's conclusion may be didactic, and it must be acknowledged that there is a trace of the kinetic in some of Guyon's adventures—particularly in the kindling of "secrete signes of lust" in his eyes by "two naked damzelles" bathing in a fountain and not caring

> "to hyde
> Their dainty partes from view of any which them eyd."[54]

We have the word of a French critic[55] that, at least for the frail reader, the effect of the bathing beauties is distinctly kinetic. In Joyce's *Walpurgisnacht* in Bella Cohen's establishment we have the word of a United States judge that there is nothing pornographic, but are we certain that in Joyce's scenes there is nothing didactic—nothing approaching Guyon's "Let Gryll be Gryll"? Joyce's critics protest too much that didacticism and pornography are equally abhorrent to him; that in "the pandemoniac welter of motile apparitions" in the Dublin brothel "the artist keeps a tight rein on the tigers of wrath which draw his chariot through the inferno."[56] According to another commentator, however, Stephen Daedalus' adventure is an iconoclast's assault upon "commercialism, ignorance, prejudice, and inertia."[57] In Joyce's Dublin Mr. Foster Damon finds "disgust" (something not far from indignation) prevailing over the horror and pity that "assail us on all sides."[58] We are told that Joyce's objective handling of his material contains a curse upon it, and so by a short step we reach the declaration that Ulysses has "a universal message—a weird cry from the very depths of Dublin to the rim of the world—the cry of tortured conscience, 'ayenbite of inwit.' "[59] In the brothel scene it "appropriately" breaks out in the echo of Blake's lines:

> "The harlot's cry from street to street
> Shall weave old England's winding sheet."

In any artistic treatment of the subject of Joyce's *Walpurgisnacht* and Spenser's Bower of Acrasia a modicum of both the

---

[54] *F. Q.:* II, xii, 68, 7–9.

[55] J. A. A. Jusserand. *A Literary History of the English People.* London, 1925. Vol. II. P. 497.

[56] Stuart Gilbert. *James Joyce's "Ulysses"*. London, 1930. P. 312.

[57] Richard M. Kain. *Fabulous Voyager.* Chicago, 1947. P. 241.

[58] S. Foster Damon. "The Odyssey in Dublin," in *The Hound and Horn,* III (1929). P. 13.

[59] P. J. Smith. *A Key to the "Ulysses" of James Joyce.* Chicago, 1927. P. 99.

didactic and the kinetic or pornographic is hard to exclude. In the presence of lust most men feel a pull towards both libertinism and puritanism. Cries of pain over the didacticism of the "Legend of Temperance" as Neo-Platonism feeding, vampire-like, on the flesh, are as absurd as attempts to condemn Joyce by the guilt of his association with the psychoanalysts. Joyce's bitter realism and absorption in personal confession in his *Walpurgisnacht* may be incommensurable with Spenser's impersonal and traditional treatment of the Homeric story of Circe. The kinetic element in Joyce, the "obscenity" and "deliberately flaunted filth" of which one critic speaks with regret and explains as "the direct result of a startled recoil from the terrific mental and moral repression of the Church,"[60] can hardly be paralleled in *The Faerie Queene.* The didactic element, if Stephen Daedalus' searing rage and mordant wit in Bella Cohen's brothel be acknowledged as in any way parallel with Guyon's contempt for Gryll, can hardly be denied. And it certainly cannot be denied that the parallel extends to the imagery that is essential to both Spenser's allegory and Joyce's realism, the animal imagery of the story of Circe.

The bestial aspect of Joyce's *Walpurgisnacht* seems to be of its essence. Joyce himself spoke of Bloom as suffering "a feral metamorphosis," and said that the tap of Bella Cohen's fan (Circe's wand) completed his "metamorphosis into utter animalism." Although he spoke of it as "a costume episode," with Bloom changing clothes half a dozen times, he also called it "an animal episode, full of animal allusions, animal mannerisms." In attributing these words to Joyce in a conversation in a café in the Rue de la Grenelle in Paris, Frank Budgeon interprets his attitude toward his Circe episode as almost that of a pathologist studying the "brutal one-sidedness of vice."[61] He seems to have regarded Joyce as a psychoanalyst rather than as in any way affected by "ayenbite of inwit." Certainly he thought of the *Walpurgisnacht* differently from Mr. Gilbert, who found it like "a mediaeval bestiary" in its "perpetual interplay of human and bestial forms."[62] The reference to the bestiaries suggests at least the possibility that Joyce thought in terms of the dualistic ethic of those mines of *exempla* for mediaeval preachers. If this unjustifiable interpretation is pushed too hard, it may make Joyce guilty of the Neo-Platonic heresy of feeding the spirit on the flesh by imagining life as an unceasing struggle between the individual's bestial and human instincts, or between the former and

[60] H. S. Gorman. *James Joyce. The First Forty Years.* London, 1941. Pp. 126–127.
[61] Frank Budgeon. *James Joyce and the Making of "Ulysses."* London, 1934. P. 234.
[62] *James Joyce's "Ulysses."* P. 312.

his divine potentialities. In Pico della Mirandola's treatise *On the Dignity of Man* that doctrine was restated for Italy and all Europe on the eve of Spenser's century. His symbolism was radically determined by it, as we know from his use of its mediaeval form in the procession of the Seven Deadly Sins in the "Legend of Holiness[63] and from his use of the animals again as symbols of the sins in the attack on the castle of the soul in the "Legend of Temperance."[64] In the cases of both men it is easy to interpret fascination by "feral metamorphosis" as betraying susceptibility to the puritanism as well as to the Neo-Platonism that Mr. Traversi found nefariously at work in *The Faerie Queene*. And to complete the false impression in Joyce's case we might misapply his famous resolve at the end of *The Portrait of the Artist* to devote his powers to forging the conscience of his race. Certainly it was to that object that Spenser's work was devoted.

As a critical *tour de force* the resemblances between the ethics of the two men might be carried further. If it is taken for granted that Joyce was no puritan, no Neo-Platonist, and no ethical dualist, and if it is further taken for granted that the *Walpurgisnacht* is radically influenced by Jung's doctrine of "the rendition of the animal influences of the id,"[65] as Mr. Kane believes to be the case, it can be plausibly pled that Spenser was an artist of psycho-analytic propensity. Like his later contemporary Robert Burton, the first famous English humanist to make a medical approach to moral problems, Spenser thought that one of the most useful truths that poets have "shadowed in their witty fictions" was the fact that "a man given over to his lust, *is no better than a beast.*"[66] In saying this Burton was thinking of analytical quite as much as he was of didactic writing. In Guyon's speech to Gryll we have an instance of its didactic statement, but in the allegory of the Seven Sins' attack in animal forms on the castle of the soul we have the psychologist's understanding of the soul's weakness against them. Its final defense requires more than the help of the Knight of Temperance; it demands the intervention of Prince Arthur himself.

Arthur, rather than the Knight of Temperance, is the main measure of the difference between Joyce's ethic and Spenser's, and between Spenser's and that of his socially-motivated critics. In the Letter to Raleigh Spenser said that he intended Arthur to represent the virtues of magnificence and perhaps of magnanimity as "Aristotle and the rest" had taught. In the *Nicoma-*

---

[63] *F. Q.:* I, iv, 18–35.
[64] *F. Q.:* II, xi, 6–14.
[65] *Fabulous Voyager.* P. 137.
[66] Robert Burton. *The Anatomy of Melancholy.* III, iii, 1. The italics are Burton's.

chaean Ethics, in a passage that Pico knew well, Aristotle discussed magnanimity as the sum of all the virtues and as divine because it was most remote from all brutishness. The systematic writers on ethics in the Renaissance, however, usually treated magnanimity as a royal virtue closely allied to magnificence, or glorious deeds in war and peace. Between magnanimity as a divine antithesis to the feral aspects of human nature and magnificence as the pursuit of glory there was a gap which Spenser tried and perhaps failed to close. He tried to bridge it by making Arthur the lover of the Fairy Queen, whom he identified with pure glory. In her service Arthur rescued St. George from Orgoglio—a deed above reproach in the moral allegory, but perhaps tainted in the historical allegory by the selfishness of the political compromises of the Elizabethan settlement of the Church of England. In the ecclesiastical allegory of Book I, and still more in the allegory of Arthur's intervention in Book V[67] in behalf of Belgé (the Netherlands) against Geryoneo (Philip II of Spain) Arthur's love of Gloriana is exposed to the devastating observation of Mr. Bronowski that, "Whatever we may think are the social virtues, glory is not one of them."[68]

If Spenser could read Mr. Bronowski, he would follow him with difficulty. Though he knew very well that there was more than one way of thinking about the Queen's ecclesiastical and foreign policies, he could not understand how by its very nature "the last infirmity of noble mind" could be dangerous to society. To grasp that dogma he would need a course in modern history taught with dialectical confidence. In defense of his own view of the matter he might plead that Arthur is not, like St. George and Artegall, the embodiment or servant of the state. Arthur is the wind of the spirit that blows where it lists but is always—as Guyon observes—first of all in love with glory and at war with Fortune.

So are St. George and Guyon in their special ways at war with Fortune, and the former is brought to the verge of suicide by contemplating her denial of human freedom by

> "Feare, sicknesse, age, losse, labour, sorrow, strife,
> Payne, hunger, cold, that makes the hart to quake."[69]

The supreme danger to human freedom, however, as Guyon knows, is within. For modern readers it was put into classic form by Joyce when he wrote in *Ulysses:* "What went forth to the ends of the world to traverse not itself? God, the sun, Shake-

[67] *F. Q.:* V, xi, 1–34.
[68] J. Bronowski. *The Poet's Defense.* Cambridge, 1939. Pp. 47–48.
[69] *F. Q.:* II, ix, 44, 6–7.

speare, a commercial traveller, having itself traversed in reality itself, becomes that self . . . Self which itself was ineluctably preconditioned to become."[70] In contrast with Joyce's summation of the substance of his novel we may recall Spenser's statement in the final canto of his Second Book of a realization of a higher self that occasionally comes to the aid of the ordinary self as Arthur does to the other knights of *The Faerie Queene* at need. The idea of a higher self—

> "our Selfe, whom though we do not see,
> Yet each doth in himselfe it well perceive to be."[71]

—is stated by the divinity of life itself, the mysterious deity Genius, who is identified by the commentators with the Daimon of Socrates, the male and female generator of life Agdistes, or the ultimate forces of virtue in nature. On the level of ordinary experience the transcendent self is the reality implied in the thought of a man's "coming to himself." Spenser thought of it in terms of freedom from anything ineluctably preconditioned as well as from the bestiality that Aristotle contrasted with the divinity of his magnanimous man. To this conviction or sense of a super-self in Spenser is owing that rush of his verse "to some pre-ordained thought," which Yeats admired. To it also is owing whatever subservience of the autonomous imagination to the will the modern reader may find in *The Faerie Queene* and blame for the weaknesses that he sees in its rhythms, imagery, or construction.

---

[70] James Joyce. *Ulysses*. London, 1936. P. 479.
[71] *F. Q.:* II, xii, 47, 8–9.

BEGINNINGS OF CHEMICAL EDUCATION IN BELOIT, LAWRENCE AND RIPON COLLEGES

ROBERT SIEGFRIED[1] AND AARON J. IHDE
Department of Chemistry, University of Wisconsin

The liberal arts colleges located in Beloit, Appleton and Ripon were founded within a few years of one another when Wisconsin was achieving statehood and establishing its state university. The early development of chemistry in the University was reviewed recently by Ihde and Schuette.[2] It is the purpose of the present paper to review the parallel rise of the subject in three of the state's liberal arts colleges.

BELOIT COLLEGE

The Fourth Convention of the Presbyterian and Congregational Churches of Illinois and Wisconsin was the active group which secured from the Wisconsin Territorial Legislature in 1846 the charter for the school to be founded near the border of the two states. The founding fathers of the institution included Yale graduates, and the plans for the college reflected the ideas and ideals of the venerable institution at New Haven.

Instruction in college subjects was offered to several students in the fall of 1847. There was as yet no building and no faculty. The teaching was entirely in the hands of Mr. Sereno T. Merrill who was director of the Beloit Seminary which had been founded earlier to prepare students for college entrance. This arrangement continued until the following spring when Joseph Emerson (B.A. Yale '41) arrived to take over the professorship of languages and Jackson J. Bushnell (B.A. Yale '41) became professor of mathematics and natural philosophy.[3]

The chair of chemistry and natural sciences went unfilled until the fall of 1849 when Stephen Pearl Lathrop arrived in Beloit. Lathrop was a graduate of Middlebury College (B.A. '39) and the Medical College of Vermont at Woodstock (M.D. '43). The years prior to his coming to Beloit were spent as a science teacher at Middlebury College, Assistant Geologist for the State Geological Survey, and principal of the Female Seminary at Middlebury.[4]

The first college catalog stated that "Arrangements have been made for providing apparatus illustrating the departments of Chemistry and Natural Philosophy which will be ready for use at the beginning of the coming collegiate year."[5] One term of chemistry was offered during the junior or senior year, Silliman's book being used as a text.

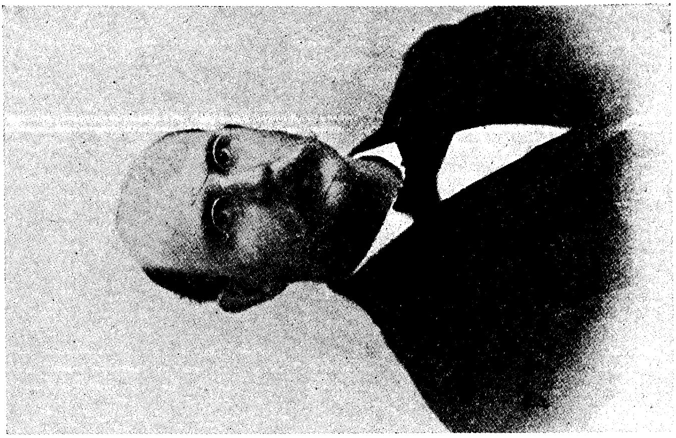
Lathrop was lured away from Beloit in 1854 to become the first occupant of the chair of Chemistry and Natural History at the University of Wisconsin. In order to make demonstrations before the students of the state institution it was necessary for him to borrow apparatus from the older college downstate. It was four years before the Lathrop vacancy was filled by a qualified chemist. Chemistry and natural science were not taught during the first three of these years. In 1857–58 William Hayes Ward (B.A. Amherst '56) served as tutor in these subjects. He left at the end of the term to prepare for the ministry at Andover Theological Seminary.[6]

Henry Bradford Nason (B.A. Amherst '55), who had just completed his doctorate in chemistry under Friedrich Wöhler at Göttingen, arrived in 1858 to take over the courses in chemistry, physiology, geology, and mineralogy. The offerings in chemistry were still limited to one term per year since Nason held a similar chair in Rensselaer Polytechnic Institute at Troy, N. Y., to which he commuted semi-annually. Scientific apparatus was further improved during this period when Nason made purchases during trips to Europe. Of particular interest is the Chemical Society of Beloit College sponsored by Nason. This society was one of the earliest college societies of its type. Thomas C. Chamberlain, who later became one of the world's leading geologists and was for some years president of the University of Wisconsin, was one of the members.[7]

Nason decided in 1866 to devote his full time to the post in Rensselaer Polytechnic Institute. He filled this position with distinction for many years. A measure of the respect which he attained was shown in 1890 when he was elected president of the American Chemical Society. He was succeeded at Beloit by Elijah Paddock Harris, (B.A. Amherst '55, Ph.D. Göttingen '59) who had been teaching at Victoria College in Canada during the previous six years. Harris added a term of organic chemistry to the offerings at Beloit. His stay was terminated after two years when he returned to Amherst College to become Professor of Chemistry, a post which he held there until his retirement in 1907.

A third Amherst graduate with a Göttingen Ph.D. under Wöhler then appeared upon the scene at Beloit. James H. Eaton soon discontinued the course in organic chemistry but expanded the general course to a full year. Laboratory work was intro-

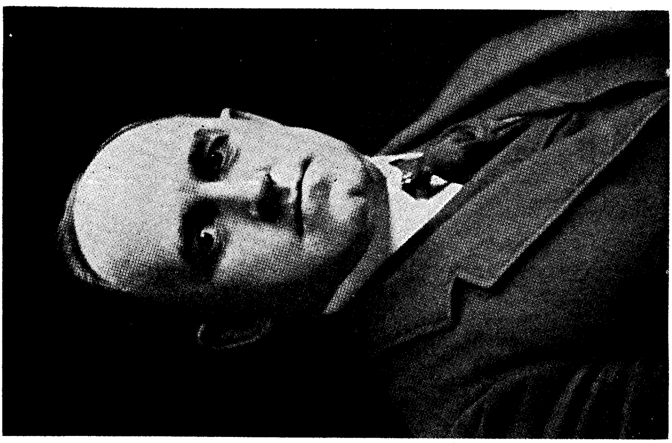
ELIJAH P. HARRIS, Beloit
1866–1868



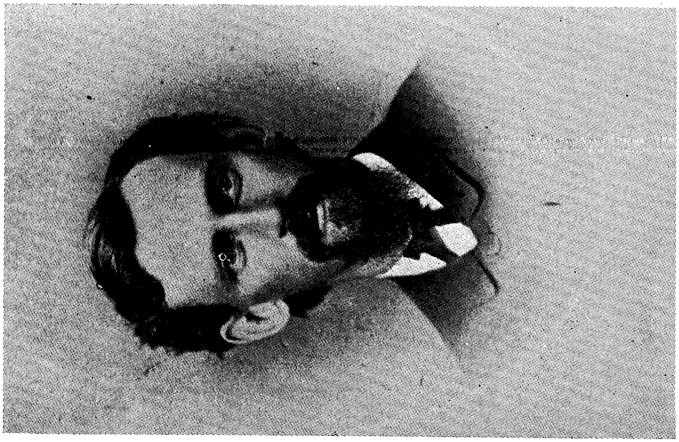
ERASTUS G. SMITH, Beloit
1881–1921

RUSSELL Z. MASON, Lawrence
1854–1865

JAMES C. FOYE, Lawrence
1867–1892



CHARLES W. TREAT, Lawrence
1892–1918



LYMAN B. SPERRY, Ripon
1869–1873

duced for the first time in 1869. A third term of chemistry was soon added and the students were now receiving instruction in qualitative and quantitative analysis and in spectrum analysis.

When Eaton died suddenly in 1876 his chair remained unfilled for five years. His courses in chemistry were offered by other faculty members until 1880. During that year C. Gilbert Wheeler, a Harvard graduate who had studied at Heidelberg and Berlin, divided his time between Beloit and Chicago Medical College. Wheeler offered two courses in inorganic chemistry using Norton's text and two courses in organic chemistry using his own text.

The following year saw the appointment of Erastus Gilbert Smith (B.A. Amherst '77, Ph.D. Göttingen '83) to the Professorship of Chemistry and Mineralogy. He was the fourth chemistry appointee at Beloit to have graduated from Amherst College and studied at Göttingen during the days when chemical instruction in that German university was under the influence of Friedrich Wöhler. Smith's stay at Beloit was a long and significant one. By the time of his retirement as Emeritus Professor of Chemistry in 1921, chemistry instruction at Beloit had evolved to modern form. The department had greatly expanded both with respect to variety of courses offered and the facilities for instruction.

In 1892 the department moved into the new Pearsons Hall of Science, designed by D. H. Burnham, famous Chicago architect. Completion of the building greatly stimulated the work in chemistry and saw the department offering one-term courses in general chemistry, qualitative analysis, and organic chemistry before the end of the century. Quantitative analysis was a two-term course. Physical chemistry was added in 1905. Other courses, such as sanitary chemistry, applied chemistry, chemistry for teachers, and electrochemistry, were offered at various times.

By 1906 the instructional load was sufficient to require a second staff member. Howard Dexter Smith (B.S. Rhode Island College '01, Ph.D. Tufts '06) served as Instructor in Chemistry for three years. When he left to take a position at the Lowell Textile Institute he was succeeded by Ben L. Glascock (B.A. Texas '07, Ph.D. Pennsylvania '09). Glascock remained only one year and was followed by Andrew F. McLeod (Ph.D. Chicago '06). McLeod had taught soils at Wisconsin, and organic and biochemistry at Chicago before coming to Beloit. When he left Beloit in 1919 he had attained the rank of Associate Professor.

Paul Winslow Boutwell, a Beloit graduate of 1910, received his Ph.D. in agricultural chemistry at the University of Wisconsin in 1916. He joined the department at Beloit in 1920 and became head of the department the following year upon the retirement of Professor Smith. He was joined in that year by the late William J. Trautmann who had just received his doctorate at Wisconsin.

The rise of the present era of chemistry at Beloit followed a strong tradition of chemical education from the days the college opened its doors. The first occupant of the chair was a graduate of a recognized medical school. From then until 1921, the subject was taught, except for two short interludes, by American graduates of Amherst College who took their doctoral degrees in chemistry at Göttingen during the days when the influence of Wöhler was profound.

LAWRENCE COLLEGE

Territorial Governor Henry Dodge, early in 1847, signed the charter establishing Lawrence Institute of Wisconsin. The circumstances surrounding the founding of this college were associated with the activities of Eleazir Williams, claimant to the title of the "Last Dauphin." Williams, an Episcopal missionary among the Wisconsin Indians, was financing his activities with money borrowed from Amos Lawrence, a Massachusetts merchant. In order to avoid foreclosure on the 5,000 acres of Wisconsin land which Williams had pledged as security, Lawrence purchased the land. Since his own health was poor the land was deeded to his son, Amos Adams Lawrence.

The idea of establishing a denominational college on the Fox River Valley land was soon germinating in the mind of the younger Lawrence. The lack of Episcopal strength in Territorial Wisconsin caused him to turn to the vigorous Methodist sect. In 1846 he proposed to Reverend William H. Sampson, presiding elder of the Fond du Lac District of the Rock River Conference, that he would give $10,000 for the founding of a college on the Lawrence lands provided that the sum would be equalled in the territory. The money was raised, the charter was granted, and a site was chosen on the banks of the Fox River. The site, to the disappointment of Lawrence, was not on his lands but near Lake Winnebago. The village which grew up in the vicinity was incorporated in 1857 as Appleton, being named for Samuel Appleton of Boston, a distant relative of Mrs. Lawrence. Work was begun on the first college building in the fall of 1848 and instruction began a year later.

The first classes were offered at the preparatory level under Principal William Sampson. James M. Phinney, A.M., a graduate of Wesleyan University of Middleton, Connecticut, served as teacher of mathematics and natural science until 1852. The first catalog lists one quarter of chemistry offered in the first year of the college preparatory course. Johnston's text was used. In the second catalog, chemistry had been moved to the last two quarters of the first year, Gray's text being used. Second-year ladies were now included in the course.

The College Department was opened in 1853 when Edward Cooke began his six-year presidency. Reverend Cooke (A.M. Wesleyan '38) had been teaching and serving as principal in several Eastern seminaries before his call to Lawrence. During his first year the professorships of Mathematics and Astronomy and of Natural Science and Experimental Philosophy were unfilled, so the president taught these subjects. According to the catalog, one term of chemistry was offered to fourth-year students—of whom there were none as yet.

The Reverend Russell Zelotes Mason (A.M. Wesleyan '44) became Professor of Mathematics and Experimental Philosophy in the next year. He had been teaching mathematics and science at McKendree College at Lebanon, Illinois, the institution which had given President Cooke a D.D. the previous spring. The catalog now listed two terms of chemistry for the junior year. These two terms continued without change through 1863. Mason's title changed repeatedly, becoming Professor of Natural Science and General Physics by 1858. A year later he became acting president when Cooke resigned to take the pastorate of a Milwaukee church. Mason became president the following year, holding the position until 1865, when he resigned "on account of supposed religious heresies."[9] He remained in Appleton in the mercantile and manufacturing business until 1879, when he moved to Silver Cliff, Colorado, to establish an assayer's office. He received an honorary LL.D. from the state university in 1866.

Mason's title became Professor of Ethics and Civil Polity in 1861, though he continued to teach the courses in science for two more years. Mathematics had been dropped from his shoulders with the coming in 1860 of Henry Pomeroy (B.S. Rensselaer '41, A.M. Union College '43) as Professor of Mathematics and Civil Engineering. Two terms of chemistry were still being offered, using Silliman or Gregory as alternative texts.

Reverend Samuel Fallows (B.A. Wisconsin '59, A.M. Wesleyan) became Professor of Natural Science and General Physics in 1863 but his time and efforts were largely devoted to recruiting the Fortieth Wisconsin Regiment which went to the front on June 14, 1864. Fallows accompanied the group, composed of professors and students from Wisconsin colleges, as lieutenant colonel. He never resumed his teaching duties at Lawrence though he became well known in religious and educational circles. His position was filled in 1865 by Welsh-born John Eugene Davies (B.A. Lawrence '62) who had just served in the Union Army for three years. Davies was doing work toward a medical degree at Chicago Medical College and in 1867 he left to take a faculty position at that institution. He received his M.D. a year later and became Professor of Natural History and Chemistry at the University of Wisconsin. At this institution his activities were gradually diverted from chemistry so that by 1874 he was confining his activities to physics and astronomy and soon thereafter solely to physics. He remained at Wisconsin until his death in 1900.

Chemistry became part of the professorial title in 1867, when James C. Foye became Professor of Chemistry and Physics. He had been teaching science and carrying out administrative work in several female academies since receiving his A.M. from Williams College in 1863. He remained at Lawrence twenty-six years. Chemistry was reduced to one term in the senior year during Foye's early years. Youman's book was used as a text.

Two terms of chemistry were not again offered until 1874. At that time Wilbur Fisk Yocum (B.A. Lawrence '60) changed from the professorship of Mathematics and Astronomy which he had held for four years to Professor of Natural History and Geology. When Yocum left two years later his chair went unfilled until 1886. During this time it was necessary for Foye to teach the courses in natural history and geology as well as those in chemistry and physics.

Laboratory work in analytical chemistry and mineralogy was introduced in 1882. Two years later a third term was added as a senior elective. Eight hours per week during this term were devoted to instruction in qualitative analysis. Clarke's "Chemistry" and Foye's "Chemical Problems" were now used as texts. Experimental demonstrations were given daily in the lectures. Foye's instruction, if we are to trust reminiscences of alumni, was not particularly inspiring. One alumna later said, "In 1885, when I was a Freshman, there was hardly any such thing as science as it is now understood. Professor Foy (sic) held up to our admiring gaze certain things which he looked at and declared them to be red or white, and we stood in a circle to receive shocks from an electric machine. But it was not until Professor Cramer came back in '86 that the modern era began."[10]

Professor Frank Cramer, to whom she refers, became Professor of Natural History and Geology in 1886. He had just received his baccalaureate degree at Lawrence the previous spring. Since he had been close to graduation a year earlier he had been able to spend a year at Yale in special scientific study. He proved to be a popular and inspiring teacher at Lawrence but was forced to resign in five years on account of ill health. He went to California where he was active in establishing the Preparatory School for Boys at Stanford University.

The thirty-year presidency of Samuel Plantz, beginning in 1894, saw great changes in Lawrence University. The six presidents preceding Plantz had all been Methodist ministers, four of them being graduates of Wesleyan University. Academic emphasis had been on Greek and Latin, with little thought being given to the place of the natural and social sciences in the contemporary world. Plantz, a graduate of Lawrence in 1880, went on to the ministry but brought back to his alma mater a new enthusiasm to give the institution a real place in the life of Wisconsin. A vigorous campaign for endowments was initiated and faculty members with more extensive and specialized training were added to the staff. Only a few Ph.D's were on the faculty when Plantz became president, and their degrees were most often of the honorary variety; *i.e.*, Foye had received a doctorate from Asbury University (later De Pauw) in 1882. After the coming of Plantz, there was a concerted effort to add German and American Ph.D.'s to the faculty.

When Foye left in 1892 to take charge of the chemistry instruction at Armour Institute his chair was filled by Earle D. Shepard, A.B. After only two years he was replaced by Charles Watson Treat (Ph.B. De Pauw '90, A.M. '93). Treat had also done summer work at the Lick Observatory, at Stanford, and continued to do summer work at Chicago. President Plantz's activities soon led to the endowment of Treat's chair of physics and chemistry by Philetus Sawyer, prominent Oshkosh lumberman and politician. By 1901 the two subjects had achieved sufficient importance to bring about a separation. Treat continued giving the instruction in physics until 1918. Lewis Addison Youtz (Ph.B. Simpson '90, Ph.D. Columbia '02) came in 1901 to direct the instruction in chemistry until his retirement in 1934.

The construction of the Stephenson Hall of Science in 1898 gave added emphasis to the sciences. Isaac Stephenson, well known in Wisconsin political circles on account of his purchase of a Senate seat, was the chief donor toward the project.

The catalog of 1904 reveals courses in general inorganic, qualitative and quantitative analysis, organic—including eight hours of laboratory work per week, physical chemistry and industrial chemistry. Student assistants were now helping with laboratory instruction.

Youtz continued as the sole chemistry professor until Florence Stouder (B.A. Denver '19, Ph.D. Illinois '25) was added to the staff in 1924. Upon her marriage in 1929 to Archie D. Power, Professor of Physics, she was succeeded by Stephen Foster Darling (B.S. Minnesota '22, Ph.D. Harvard '28).

Ripon College

The citizens of Ripon were ambitious, in 1851, to have an institution of learning in their small community. A charter was secured from the state legislature and construction was begun on a stone building for Brockway College. Financial difficulties soon stopped progress. The Winnebago District of the Convention of Presbyterian and Congregational Ministers and Churches turned deaf ears to appeals for aid, but Reverend J. W. Walcott of Menasha took over administration upon payment of $400. Instruction at the preparatory level began in the spring of 1853.

The College continued an uncertain existence and even built another stone building, again largely by local efforts. The financial crisis of 1857 and the coming of the Civil War, however, forced the Convention to consider abandoning this educational venture. The school was closed during the year 1861–62 and the campus and building were leased to the government as a training place for the First Regiment of Wisconsin Cavalry. However, local loyalty again came to the rescue and sufficient funds were raised by subscription in 1862 for the Convention to recognize the college. Under the name of Ripon College, the school was rechartered in 1864. In 1868 the Convention relinquished all ecclesiastical control and the sole governing powers were vested in the trustees.

The first catalog was published for the year 1864–65. Two terms of chemistry were offered, one in general chemistry and one in organic and agricultural chemistry, both in the junior year. These courses were taught by Reverend William H. Ward, Professor of Latin, Natural Sciences and Physical Training. This was the same William Ward who had served as tutor at Beloit College in 1857–58 and who later became well known as the editor of the *New York Independent*. After two years, Professor Ward's chemical efforts were replaced by those of Daniel

Merriman, A.M., whose official title was simply Professor of Natural Sciences.

The catalog of 1868–69 first includes the word "chemistry" in a professorial title but the Professorship of Chemistry and Natural History was unfilled that year. From 1869 to 1873 Lyman Beecher Sperry (A.M. Oberlin, M.D. Michigan '67) filled the chair of Chemistry and Natural Science. The catalog of 1870–71 stated that "The Chemistry Department is provided with Laboratory and Lecture Room and there is considerable apparatus for the illustration of other Physical Sciences." Under Sperry's tutelege, two terms of inorganic and one of organic chemistry were offered.

Sperry's chair was filled by Dr. Moses Barrett who died two months after coming to Ripon. William Gay Ballantine (A.M. Marietta '68) came in February 1874 but stayed less than two years. Alvah H. Sabin (B.S. Bowdoin '76, M.S. '79) took the position in 1876. In 1877 a new building housing the Chemistry and Astronomy Departments was completed. Three terms of chemistry were offered during the sophomore year. Sabin left in 1880, becoming a specialist in paints and varnishes. He did considerable lecturing at various schools in the East and Middle West, including the University of Wisconsin in 1901–02.

During the years from 1880 to 1889 there was no permanent teacher of chemistry employed, but chemistry never lost its place in the curriculum. No matter what the special field of the man who taught the chemistry courses, chemistry was always included in his title. For example, two of the other faculty members who taught chemistry during this interval were Charles H. Chandler (B.A. Dartmouth '68, M.A. '71), Professor of Chemistry and Physics, and C. Dwight Marsh (B.A. Amherst '77, M.A. '80), Professor of Chemistry and Biology. As many as four terms of chemistry were offered during this time, but consisting only of general and analytical. Laboratory work was included as a regular part of the curriculum and the analytical courses consisted almost entirely of that type of instruction, ten hours a week being required.

With the coming of William Stowell Leavenworth (B.S. Hamilton '89, M.S. '92) in 1889, Ripon again had its chemistry and physics instruction on a more permanent basis. During his fourteen-year stay, the chemistry department expanded into something like its present organization. More and varied types of courses were offered and it became possible to major in the subject. A significant influence on this expansion was the building of Ingram Hall of Science, completed in 1900. The chemistry department occupied the third floor. The facilities available were a lecture room adequate for fifty students, a general laboratory for thirty-five students, a quantitative laboratory for sixteen, and a qualitative laboratory for twenty. In addition there was a private laboratory for advanced students, and a private laboratory for the incumbent professor. All laboratories were equipped with hoods and other standard equipment.

The catalog for 1900–01 listed the following courses in chemistry: general; two courses in qualitative analysis; quantitative analysis; organic; medical chemistry consisting of urinalysis and toxicology. In the next few years various other courses were offered intermittently; mineralogy, for example, and a second semester of organic especially for premedical students.

George F. Weida (B.S. Kansas '90, Ph.D. Johns Hopkins '94) was the first Ph.D. to hold the post of Professor of Chemistry at Ripon. His arrival in 1903 followed Professor Leavenworth's acceptance of a position at Olivet College in Michigan. Dr. Weida's short stay from 1903 to 1907 did not cause any significant change in the offerings or organization of the chemistry department except the introduction of a course in the history of chemistry. In 1907 Weida took a position as Professor of Chemistry at Kenyon College in Ohio.

A further expansion in the course offerings came under Albert Franklin Gilman (B.S. Amherst '97, Ph.D. Denver '13), whose name first appears in the catalog of 1906–07. By the end of his first year at Ripon, Gilman was offering, in addition to the courses previously given, a term of physical chemistry and another term of organic.

In 1909 Burrell O. Raulston (A.B. Marysville '09) was employed as Instructor in Chemistry to relieve Gilman of a part of his rather extensive load. Raulston had been a student of Gilman at Maryville before the latter came to Ripon. Raulston was at Ripon only three years, and upon his departure a part of the teaching burden was taken by successive seniors who were majoring in chemistry. The first senior to hold this position of Laboratory Assistant in Chemistry was E. L. Krause who, after taking his M.A. at the University of Wisconsin, became Professor of Chemistry at Marietta College in Ohio. In 1917 Gilman left Ripon to accept a post at Huron College. In 1920 he became Professor of Chemistry at Carroll College.

Augustus Lawrence Barker (B.S. Alabama '10, M.S. '11, Ph.D. Wisconsin '22) became Professor of Chemistry at Ripon in 1917 upon the departure of Gilman.

GENERAL TRENDS

This review of chemistry instruction in three Wisconsin colleges reveals certain similarities as well as differences. Similarity is apparent in the manner in which teaching programs evolved. The teaching programs rather clearly fall into three periods: 1) the natural science, 2) the physical science, and 3) the chemical. This same trend was apparent in the development of chemical instruction at the University of Wisconsin.[2]

The *natural science period* occurred in the early years in each college. During this period the science courses, and often even the mathematics courses, were taught by one professor. He might be an M.D. but was as likely to be a minister. In alternating terms he was likely to teach physics and chemistry, botany and zoology, geology and mineralogy, mathematics and astronomy.

With growth of the colleges there was a transition to the *physical science period* where chemistry was taught along with physics and perhaps geology and mineralogy. Biology and mathematics were no longer part of the chemistry teacher's repertory. The professor of chemistry and physics could no longer be called "Reverend" and was likely to have some graduate training in the sciences, possibly even a doctor's degree. The offerings in chemistry were increased somewhat to include the organic and analytical aspects of the subject. Laboratory instruction was introduced during this period.

The *chemical period* began when a full-time professorship of chemistry was established. The occupant of the chair carried a Ph.D. in the subject, or acquired one during his period of tenure. Laboratory instruction was expanded and student assistants were added to the staff. Later an additional staff member of professorial rank would be added. The curriculum was enriched by courses such as physical chemistry, food analysis, and industrial chemistry.

The duration of each of the periods varied greatly in the different institutions. Beloit passed almost at once from the first to the second. The State University required almost two decades to make the same step, while Lawrence and Ripon failed to complete the transition before 1890. The State University, however, made the second transition rather quickly, while the other three colleges failed to complete the step before the beginning of the twentieth century.

Laboratory work was inaugurated at Beloit in 1869, at Ripon in 1880, and at Lawrence in 1882. Beloit was the first to acquire a separate building for the sciences (1892). The science buildings at Lawrence and Ripon were not constructed until 1898 and 1900, respectively. Separate professorships of chemistry were created at Beloit in 1898, Lawrence in 1901, and Ripon in 1904.

The parallelism in the development of chemical instruction in these three colleges is particularly striking when the different organizational and economic circumstances of these schools is considered. The causes of these parallel trends must lie outside the immediate environment of the schools themselves. The increased importance attached to science in general and chemistry in particular at the turn of the century seems to be a factor in these trends. The Census Committee of the American Chemical Society reported at the Twenty-Fifth Anniversary Meeting in 1901 that since 1876 "accommodations for students and teachers have increased as one to twenty-five."[11] The expanding facilities for chemical education within these Wisconsin colleges can be interpreted as the manifestation of this more general trend.

ACKNOWLEDGMENT

We wish to express our appreciation for the help given to us by Professors H. A. Brubaker, W. P. Gilbert, and W. F. Raney of Lawrence College; Paul W. Boutwell, Robert H. Irrmann, and the late R. K. Richardson of Beloit College; A. L. Barker and E. A. Tenney of Ripon College; and H. A. Schuette of the University of Wisconsin.

NOTES AND LITERATURE

1. Present Address: Boston University, Boston 15, Massachusetts.
2. IHDE, A. J., and H. A. SCHUETTE. "Early days of chemistry at the University of Wisconsin," *J. Chem. Educ.*, 29, 65–72 (1952).
3. EATON, EDWARD DWIGHT. *Historical Sketches of Beloit College*, A. S. Barnes and Co., New York, 1928, p. 30.
4. BOUTWELL, PAUL W. "Stephen Pearl Lathrop. A Pioneer Chemist in Wisconsin." *Trans. Wis. Acad. Sciences, Arts, Letters*, 41, 95–116 (1952).
5. *Catalogue of the Officers and Students of Beloit College and Beloit Seminary for the Year 1849–50.* Beloit, 1850, p. 18.
6. SMITH, ERASTUS G. in Eaton *op. cit.*, p. 212.
7. BOUTWELL, PAUL W. "The Chemical Society of Beloit College, 1863–66." *Trans. Wis. Acad. Sciences, Arts, Letters*, 41, 83–94 (1952).
8. VAN KLOOSTER, H. S. "Friedrich Wöhler and His American Pupils." *J. Chem. Educ.*, 21, 158–170 (1944).
9. *Alumni Record of Lawrence University.* Appleton, 1881, p. 17.
10. *Alumni Record* (Lawrence) 1857–1905. Appleton, 1905, p. 30.
11. BASKERVILLE, C., L. KAHLENBERG, C. E. MUNROE, W. A. NOYES and E. F. SMITH. "Report of the Census Committee." Twenty-fifth Anniversary of the American Chemical Society, New York City, April 12 and 13, 1901. Supplement to the *Journal of the American Chemical Society*, p. 101, 1902.

THE ABBÉ PRÉVOST AND THE MODERN READER

BERENICE COOPER
State College, Superior, Wisconsin

Within the present century, there has been a revival of interest in the work of a number of writers, because new significances have been discovered in what they have been saying to us. Perhaps this re-evaluation may be explained by our having become aware of problems and meanings which their contemporaries only faintly realized.

The influence of Freudian psychology and the emphasis upon symbolism in the interpretation of literature have contributed to making Melville a more important figure than he was before 1919. During this generation, Hawthorne's reputation has been increasing while Irving's has declined. Henry James is being read with an enthusiasm due partly to the insights of modern psychology and to the present interest in matters of literary form. John Donne and the metaphysical poets are more admired than they were a hundred years ago, and the method of the so-called "new criticism" is one of the causes for the twentieth-century revival of interest in these poets.

Such re-evaluations may do late justice to a man who was ahead of his times or who wrote in symbolic terms carrying a meaning that sometimes even he may have comprehended only imperfectly; again the revival of interest may be due to the universality of the problem with which the earlier writer was concerned, to the work's being contemporary in the Spengler sense, our age having reached a stage of culture (or civilization, alas!) which parallels that of the writer's epoch.

It is high time to re-evaluate the work of the Abbé Prévost and to direct attention from the sentimental novel of his emotionally unstable early career to the philosophical novel of his maturity, for the later work changes entirely the interpretation that has been given of his contribution to literature and to the history of ideas.

If the Abbé Prévost is to be known only through the story of Manon Lescaut and her faithful lover, the Chevalier des Grieux, the abbé becomes only a minor figure in the history of a literary form which is quite out of fashion. Even those readers who insist upon sentimentality in their fiction prefer it today in the modern dress of the slicks and the pulps and think the melancholy hero, romantically devoted to his amoral sweetheart, rather silly and find her final regeneration unconvincing. Those who read for something more than escape from reality, cherish from the past many books more vitally relevant to their lives than such a sentimental romance as *Manon Lescaut.*

It is not necessary, however, to belittle *Manon Lescaut* in order to show that it is totally unfair to a true evaluation of Prévost as a literary man that he should be remembered only for this earlier work[1] and that students of literature should ignore his more mature work, *Le Philosophe anglais,* the story of Cleveland, the English philosopher.

Rather than belittling *Manon Lescaut,* it is necessary only to show that the later novel, while sharing with Prévost's other romances the characteristic defects of early eighteenth-century fiction, has a theme that concerns the premises of twentieth-century philosophical and religious thought and that even at some of its subordinate plot levels, it treats of matters of greater interest to the modern reader than the sorrows of Des Grieux's unrequited love and Manon's fatally delayed regeneration.

In presenting *Le Philosophe anglais* as a book that requires a re-evaluation of Prévost and that deserves discovery by the modern reader, one might borrow a term popular in modern criticism and call attention to its three "levels of reference." On the lowest level, there is the popular eighteenth-century tale. All the stereotyped melodrama of the period is there: adventures in escaping from persecution, subsequent hazards of sea voyage and hardships of the American wilderness with both friendly and cannibal tribes of Indians;[2] loss of and reunion with loved ones;[3] sentimental love and melancholy;[4] repentance of the chief villain and defeat of other persecutors;[5] restoration to happiness and to fortune.[6]

One may go so far as to claim that at this level there is something for the modern lover of escape fiction in magazines, radio

---

[1] Although *Manon Lescaut* was published in 1731 as the last volume of *Memoires et avantures d'un homme de qualité* and the first four volumes of *Le Philosophe anglais* were also published in 1731, the last four volumes were published 1738–39, after the author's reconciliation with the church and return from exile, and these volumes have a distinctly different tone. They concern the mature reflections of the English philosopher Cleveland and resolve for him the conflict between rational philosophy and religion.

[2] *Le Philosophe anglais* (Rouen: Racine, 1785), III, 65–192.

[3] *Ibid.,* IV, 115–40; V, 161–216.

[4] *Ibid.,* IV, 116–23.

[5] *Ibid.,* 124–31.

[6] *Ibid.,* VII, 142–43, 176–80; VII, 188, 209–15.

serials, and movies. If the writers of movie scenarios ever discover the wealth of exotic setting and melodramatic plot buried in this only partly translated French novel, technicolor and proper advertising can do wonders with the story of the colony on St. Helena. Here was a Utopia except for the lack of enough husbands for the very marriageable young women. The failure of the attempt at eugenic, committee-directed marriages between the lovely virgins and the young men imported by the government contains truly dramatic moments that would lend themselves to a typical movie spectacle.[7]

Cleveland's early life in Rumney Caverns where he and his mother hide away from the vengeance of Cromwell, who is determined to kill his former mistress and her illegitimate son, would provide Orson Welles with the kind of dimmed light and shadow he loves, and Cleveland's meeting with his future wife and her father in these same caverns, his discovery of the inscription telling the story of another of Cromwell's victims, the escape of Cleveland, Fanny, and Axminister to France would provide fresh content for the stereotyped movie melodrama.[8]

One further illustration of movie sources hidden at this lower "level of reference" is the story in the later volumes of Cleveland's falling in love with Ceçile, who is finally proved to be his daughter. The incest motif is treated in so genteel a manner that it would pass the standards of Hollywood censorship; yet it carries sufficient suggestion of the tabooed subject to furnish material for the sort of advertising that stimulates box office receipts.[9]

On the second level, *Le Philosophe anglais* may be enjoyed for its incisive satire of political and religious institutions. There is satire upon dictatorship in the story of Cleveland's government of the Abaquis, an Indian tribe.[10] Organized religion, whether Catholic or Protestant, is unmercifully satirized wherever it is intolerant, dogmatic, superficial, or gloomy in its teachings.[11]

The Jesuits are perhaps more thoroughly satirized than the Jansenists, but there are a few attractive Jesuits in the novel while no redeeming traits relieve the portraits of the Jansenists. Both Protestant ministers, one in the story of the colony on St. Helena and one who tries to convert Cleveland, are narrow bigots. Sometimes the satire is subtle; sometimes it is a kind of

[7] *Ibid.*, II, 33–170.
[8] *Ibid.*, I, 11.
[9] *Ibid.*, V, 69–160; VIII, 156–57.
[10] *Ibid.*, III, 115–73.
[11] *Ibid.*, V, 7–15, 19–33, 48–85.

mildly irreverent humor as when Cleveland makes fun of ecclesiastical robes.[12]

The satirical treatment is not merely destructive in its purpose, nor does it exist merely for the sake of exposing the faults of social institutions. It prepares the way for the climax of the novel and is perfectly integrated with the theme of Cleveland's search for a philosophy of life that will satisfy the demands of his reason and endue his soul with strength to bear the tragedy of living. The failure of his early views, which he designates as natural philosophy, to sustain him in time of crisis, his futile examination of Protestant, Jansenist, and Jesuit interpretations of religion, his disillusionment with the materialistic philosophy of the French *philosophes*,[13] are stages in his evolution toward the "true religion" to which he is at last converted.

It is the third "level of reference," however, that gives the book its claim to recognition as a serious contribution to the universal problem of the meaning of life and of suffering. On this third level, Cleveland is the English philosopher, not the hero of a melodramatic romance; he is man faced with the confusing problems of all time. The incidents of the novel become part of an extended metaphor of the stages of thought through which a thoughtful man evolves a triumphant faith and an eclectic philosophy of life that preserve for him that which his intellect accepts and respects and that add to rational belief what du Noüy has characterized as "the inspired traditions represented by the Christian religion."[14] Cleveland, like many twentieth-century men discards superstition and outgrown dogma and narrow sectarianism disguised as religion, but he reaches the conclusion that man is more than a reasoning animal and that his aspiration toward something in the uncharted infinite has meaning. Philosophy anticipates, says Cleveland, what religion realizes.[15]

That the modern reader is concerned with such a theme as this is evident from the interest in such recent books as Lecomte du Noüy's *Human Destiny*, Max Otto's *Science and the Moral Life*, and the continuing interest in Alfred Whitehead's Lowell Lectures of 1925, published as *Science and the Modern World*.

---

[12] The irreverent clause, "et que je crus d'abord en chemise," is deleted in the Rouen edition of 1785, as it was from a number of editions between 1757 and 1783. For an account of censored editions, see my paper, "Variations in the Text of Eighteenth Century Editions of *Le Philosophe Anglais*," *Transactions of the Wisconsin Academy*, XXXII (1940), 287–98.

[13] *Le Philosophe anglais*, VIII, 53–69.

[14] Lecomte du Noüy, *Human Destiny* (New York: Longmans Green, 1947), p. 257.

[15] *Le Philosophe anglais*, VIII, 215.

The Abbé Prévost, writing in the early eighteenth century, did not state the conflict between rationalism and religion in exactly the same terms as do twentieth-century philosophers. He wrote of natural philosophy, which was the name he gave to a Neo-Stoic ethics and to the study of natural law. He lived before Comte gave us the term Positivism, but he wrote of the materialism of the French *philosophes* influenced by Hobbes.[16]

Apparently the abbé rejects institutionalized religion altogether for in the story of Cleveland's conversion there is no mention of church or priest or sacraments. "True religion" is presented by Lord Clarendon after Cleveland has examined and found wanting both Protestantism and Catholicism. In Cleveland's summary of this "true religion" there is no mention of Christ as a vicarious savior or even as an ideal for the good life, although the follower of "true religion" is called a Christian. Faith in God and in immortality are mentioned as important beliefs. Religious duties include ethical living and reading the Bible and the lives of saints.[17]

Asceticism plays no part in this "true religion"; the wise use of pleasures of the senses is a part of the good life. No principles of natural philosophy are rejected as false; they are merely insufficient because they fail to take account of the needs of the human heart, which only religion can satisfy. Natural law needs to be supplemented by supernatural law.[18]

I realize that in my enthusiasm for *Le Philosophe anglais,* I am tempted to exaggerate its claims upon the interest of the modern reader, but with allowance for this enthusiasm, I believe that analysis of the contents supports the argument that this philosophical novel presents a far different Prévost than we have known through *Manon Lescaut.*

Prévost tells us in the preface to *Le Philosophe anglais* that his views agree with Cleveland's.[19] Upon that declaration, I base a revised interpretation of his character. He was far more than a romanticist. He took seriously the conflicts in the dominant ideas of his period, and while writing a melodramatic novel that would be a best-seller of his day, he took pleasure in placing beneath the surface of adventure, love, and intrigue the theme of the search of man for the answer to the most important questions in life.

---

[16] *Ibid.,* 53–69.
[17] *Ibid.,* 213.
[18] *Ibid.,* 211.
[19] *Ibid.,* "Preface," ii.

The author of *Le Philosophe anglais* has raised and answered in his own way a series of questions that have been raised again and again in the history of thought, questions which still concern twentieth-century philosophers.

Can man find through his knowledge of natural law a strength of spirit that will enable him to meet the tragedy of living? To this Prévost's answer is that the study of natural law is the beginning of wisdom but that it must lead into the study of the higher law.

Is it possible to find a philosophy that gives meaning to life with all its suffering and tragedy and brings to man peace of mind and soul? To this question his answer is that there is a supernatural world beyond the natural world and toward this uncharted infinite man reaches. Only through recognition of the realm beyond the reach of natural law can man find the spiritual strength to go on with the struggle for existence.

What part shall institutionalized religion play in the life of a man whose ideal it is to live with his fellowmen in a spirit of justice and love? The answer here seems to be that the church need play no part at all. At least it is not mentioned as a necessary element in the religious life.

In the three twentieth-century books which I have mentioned above, we find conclusions remarkably similar to Prévost's.

Max Otto writes:

> We might then indeed speak of science and religion without equivocation or confusion, as inseparable and complementary endeavors in man's attempt to make himself at home on this planet.[20]

Alfred Whitehead says:

> Religion is the vision of something that stands beyond, behind, and within the passing flux of immediate things; something which is real, and yet waiting to be realized; . . . . something that gives meaning to all that passes and yet eludes apprehension; something whose possession is the final good, and yet is beyond all reach; something which is the ultimate ideal, and the hopeless quest.[21]

Lecomte du Noüy says:

> The extraordinary strides made in the conquest of nature will not bring man the happiness he has the right to expect, unless there is a corresponding moral development. This development can only be based, in our actual society, on a

---

[20] Max Otto, *Science and the Moral Life* (Mentor Book 43), p. 180.
[21] A. N. Whitehead, *Science and the Modern World* (Mentor Book 28), p. 191.

> unification, a reconciliation of the rational—science—with the irrational—faith; of the ponderable with the imponderable; on an explanation of the relation between matter and spirit . . .[22]

It has been my purpose in previous papers read before the Wisconsin Academy[23] to present the contributions made to the history of ideas by the Abbé Prévost's *Le Philosophe anglais.* In this paper I have argued that this novel represents a more significant and mature work than *Manon Lescaut* and entitles the abbé to be associated in the mind of the modern reader with all those who are dissatisfied with a completely rationalistic materialism.

For those modern readers who are interested in the evolution of a personal philosophy that gives life meaning, the Abbé Prévost is a contemporary, provided they will make themselves acquainted with *Le Philosophe anglais.*

---

[22] du Noüy, p. 256.

PRELIMINARY REPORTS ON THE FLORA OF WISCONSIN. XXXVII. CYPERACEAE

PART I.—CYPERUS, DULICHIUM, ELEOCHARIS, BULBOSTYLIS, FIMBRISTYLIS, ERIOPHORUM, SCIRPUS, HEMICARPHA, RYNCHOSPORA, PSILOCARYA, CLADIUM, SCLERIA

H. C. GREENE

Carex, by far the largest and most complex genus of the Cyperaceae, is being presented separately as Part II in this treatment of Wisconsin sedges. The maps showing distribution of species are based on the collections in the herbaria of the University of Wisconsin and the Milwaukee Public Museum. For most species the collections are fairly numerous and representative and it is felt that the maps based on them are, in most cases, more than ordinarily useful in giving a picture of the true distribution of the species concerned.

Key to the Genera of Cyperaceae in Wisconsin

1. Flowers all perfect, i.e., stamens and pistil in the same flower
  2. Basal empty scales of spikelets none, or rarely 2 (sometimes 3 in *Eleocharis smallii*)
    3. Scales of spikelets 2-ranked, and keeled
      4. Flowers without bristles (perianth); achenes beakless; inflorescence terminal; spikelets few—many-flowered, usually elongated or slender .... *Cyperus*
      4. Flowers with bristles; achenes beaked, inflorescence axillary; stem hollow, round in cross-section; leaves many, with a conspicuous sheath .... *Dulichium*
    3. Scales of spikelets spirally imbricated (overlapping)
      4. Base of style persistent on the achene as a tubercle
        5. Spikelet solitary; leaves reduced to sheaths; bristles usually present on achenes; plants primarily of moist to wet habitats .... *Eleocharis*
        5. Spikelets several or numerous; leaves with blades; achenes lacking bristles; plants of dry sandy habitats .... *Bulbostylis*
      4. Base of style not persistent on the achene as a tubercle
        5. Flowers without any inner scales
          6. Base of style enlarged (but readily detachable from the achene); bristles none .... *Fimbristylis*
          6. Base of style not enlarged; bristles usually present
            7. Bristles 6, but each 4–6-cleft to near the base, making them appear numerous, silky, usually white, all much exserted (projecting) .... *Eriophorum*

7. Bristles 0–8, short, not silky (a single exception, whitish and exserted in S. hudsonianus) .... *Scirpus*
5. Flowers characteristically with an inconspicuous inner scale (plants resembling a very small and delicate *Scirpus*) .... *Hemicarpha*
2. Basal empty scales of the spikelets 3 or more
3. Styles 2-cleft; enlarged base of style persistent on the achene as a tubercle
4. Spikelets few-flowered; bristles usually present..... *Rynchospora*
4. Spikelets many-flowered; bristles none .... *Psilocarya*
3. Styles 3-cleft; enlarged base of style not persistent on the achene; bristles none; only the uppermost scale of spikelet bearing flower and fruit .... *Cladium*
1. Flowers all imperfect, i.e., stamens and pistils not in the same flower
2. Pistillate flower subtended by a flat scale; achene naked, bony, and usually white .... *Scleria*
2. Pistillate flower wholly enclosed by a sac (perigynium), the style protruding through the opening at the top .... *Carex*

The key to genera of the Cyperaceae has been adapted from that used by Mr. C. C. Deam in his "Flora of Indiana", as has also the following key to the species of Cyperus found in Wisconsin.

Key to the Wisconsin species of CYPERUS

1. Stigmas 2; achenes flattened, not 3-angled; spikelets flat; scales falling from the rachis at maturity
2. Exserted style branches many, conspicuous, long, projecting up to 4 mm.; scales dull .... *C. diandrus*
2. Exserted style branches few, inconspicuous, short, not projecting more than 2 mm.; scales shining, deep brown.......... *C. rivularis*
1. Stigmas 3; achenes 3-angled
2. Spikelets in globose heads, or in short clusters, the rachis (axis) not more than 1 cm. long
3. Involucral bracts recurved or widely spreading at maturity; leaves linear, mostly less than 2 mm. wide
4. Scales of spikelets tapering to a long recurved point; spikelets in clusters, but not in markedly compact globose heads; spikelets frequently more than 8-flowered; plants of wet sandy shores .... *C. inflexus*
4. Scales of spikelets not with recurved points; spikelets in compact terminal, globose or ovoid-globose heads; spikelets all less than 8-flowered, or only a few with 8 or more flowers; plants of dry, sterile, usually sandy habitats .... *C. filiculmis* var. *macilentus*
3. Involucral bracts erect or ascending
4. Scales of spikelets tapering to a long, recurved point; leaves less than 2 mm. wide; dwarf annuals of wet sandy shores .... *C. inflexus*
4. Scales of spikelets not tapering to a long recurved point; leaves linear but usually wider than in *C. inflexus;* perennials of dry, sterile, usually sandy habitats

5. Scales 2–2.5 mm. long, the mucro (pointed tip of scale) less than 0.5 mm. long; achenes 1.5–2 mm. long; spikelets 5–9-flowered .... *C. Houghtonii*
5. Scales mostly 3–4.5 mm. long, the mucro 0.5–1 mm. long; achenes 2.5–3 mm. long; spikelets 4–16-flowered. . *C. Schweinitzii*

2. Spikelets on an elongated rachis (axis) 1–3 cm. long
3. Flowers remote, the successive scales not reaching the bases of the ones above on the same side of the rachis. . . . . *C. Engelmanni*
3. Flowers close together, the successive scales overlapping the bases of the ones above
4. Scales mostly 2.7–4 mm. long; culms with corm-like bases
5. Spikelets erect or ascending, more than 2 5 mm. wide; achenes ellipsoid, about 2.5 mm. long and half as wide .... *C. Schweinitzii*
5. Spikelets widely spreading or reflexed, less than 2.5 mm. wide; achenes linear-oblong, mostly 1.5–2 mm. long and about 0.3 mm. wide .... *C. strigosus*
4. Scales less than 2.7 mm. long; culms without corm-like bases
5. Scales 1–1.5 mm. long; flowers very closely imbricated, the scales overlapping more than half their length; wings of rachis white, extending to and fused with the base of the scale next above; achenes about 0.8 mm. long .... *C. erythrorhizos*
5. Scales mostly 2–2.5 mm. long; flowers not very closely imbricated, the scales usually overlapping less than half their length; achenes 1–1.5 mm. long
6. Plants with numerous fibrous roots, annual; culms with 1–4 leaves; longest rays of umbel generally less than 5 cm. long; spikelets usually dense, reddish-brown, at maturity easily broken into segments below the flowers .... *C. ferruginescens*
6. Plants with numerous scaly stolons that at length bear a tuber, perennial; culms very leafy, leaves usually more than 4; rays of umbels usually 4–13 cm. long; spikelets usually straw-colored, sometimes light reddish-brown; at maturity not separating into segments below the flowers .... *C. esculentus*

CYPERUS DIANDRUS Torr. (Fig. 1). Wet soil on the borders of streams and lakes. Often confused with the next species.

C. RIVULARIS Kunth. (Fig. 2). Wet soil on the borders of streams and lakes. In Wisconsin more abundant than *C. diandrus.*

C. INFLEXUS Muhl. (Fig. 3). On the sandy shores of lakes and along streams. According to Deam, dried specimens of this plant have a pleasing odor, similar to that of dried slippery elm leaves.

C. FILICULMIS Vahl. var. MACILENTUS Fern. (Fig. 4). On dry sterile, mostly sandy soil.

C. HOUGHTONII Torr. (Fig. 5). On sandy soil. Grading into the next species, but usually macroscopically distinguishable by the smaller, more compact inflorescence.

C. SCHWEINITZII Torr. (Fig. 6). On dry sandy shores, banks and cuts. Common.

C. ENGELMANNI Steud. (Fig. 7). Low, moist ground on the borders of lakes and ponds.

C. STRIGOSUS L. (Fig. 8). Common in many situations, except dry sand.

C. ERYTHRORHIZOS Muhl. (Fig. 9). Moist situations, sometimes abundant in beds of dried-up ponds and sloughs.

C. FERRUGINESCENS Boeckl. (Fig. 10). Moist soil, along lakes and rivers. Except for its more reddish color, quite similar to the following species in its above-ground parts.

C. ESCULENTUS L. Chufa. (Fig. 11). On the borders of ponds and lakes, and along streams. This species tends to be weedy and may spread extensively by means of its small, edible, nut-like tubers.

DULICHIUM ARUNDINACEUM (L.) Britton. (Fig. 12). Bog margins, wet swamps, and borders of lakes and ponds. A striking species, with its pointed, stiffly projecting, grass-like leaves with conspicuous sheaths. By its hollow stems at once distinct from any other sedge. This plant prefers acid waters and, due to hard water, is hence rare along the Wisconsin and Mississippi Rivers. (The collection at Trempeleau was made in a wet depression in the sand terrace there and is not from the river bottoms).

Key to the Wisconsin species of ELEOCHARIS

1. Stem nearly as thick as the spikelet; scales persistent
   2. Stem jointed, stout, 0.5–1 m. high .... *E. equisetoides*
   2. Stem not jointed
      3. Plants stout, tall, stem sharply 4-angled .... *E. quadrangulata*
      3. Stems slender, 1–2 mm. thick, bluntly 3-angled .... *E. Robbinsii*
1. Stem decidedly more slender than the spikelet; scales readily deciduous at maturity
   2. Plants from a rootstock 2 mm. or more thick
      3. Stigmas 2; achenes 2-angled
         4. A solitary sterile scale at the base of and encircling the spikelet .... *E. calva*
         4. 2–3 sterile scales at the base of the spikelet, the lowest not encircling the base of the spikelet; tubercle depressed-deltoid; stems from slender and wiry to stout and rather soft .... *E. Smallii*
      3. Stigmas 3; achenes 3-angled
         4. Stems flattened, 0.5–7 dm. high; scales sharp-pointed, dark chestnut brown; achene dull yellow or brownish; tubercle broadly conical .... *E. compressa*
         4. Stems angled
            5. Stems capillary, 4-angled, striate, 2–8 cm. high; tip of upper sheath whitened; scales elliptic-oblong with rounded tips; achenes pale straw-colored, 0.7–1 mm. long; tubercle narrow, flattened, with a short point in the middle.... *E. nitida*

5. Stems slender, 6–8-angled, up to 4 dm. high; tip of upper sheath dark-margined; achenes wax-yellow to golden-yellow, noticeably pitted, 0.9–1.5 mm. long; tubercle broadly conical (as in E. compressa with which this species may be confused) .... *E. elliptica*

2. Plants without rootstocks or with thread-like rootstocks
3. Spikelets 3–9-flowered, rarely as much as 15-flowered; usually dwarf plants not over 5 cm. high
4. Bunches of stems not connected by rootstocks; some stems usually very short; achenes finely pitted in longitudinal lines; tubercle slender conical-awl-shaped.......... *E. intermedia*
4. Bunches of stems connected by slender rootstocks; all stems about the same length, capillary and angled
5. Stems often forming a turf; tubercle distinct from the body of the achene; achenes small, pale-brownish, with 3-ribbed angles and 2–3 times as many smaller intermediate ribs, also transversely striate .... *E. acicularis*
5. Stems only a few together, or solitary; tubercle confluent with body of achene and differentiated from it only by its darker color; achenes transversely striate .... *E. pauciflora* var. *Fernaldii*
3. Spikelets many-flowered
4. Stigmas 2; achenes 2-angled
5. Sheaths white and loose toward the tip; stems 2–15 cm. high; achenes olive-green to blackish; obovoid, 1 mm. or more long; tubercle conical .... *E. olivacea*
5. Sheaths close and often dark-margined at the tip
6. Plants with rootstocks; base of tubercle much narrowed. Slender and depauperate members of the E. *Smallii* group may key out here
6. Plants without rootstocks; tubercle broadest at base
7. Tubercle nearly or quite as broad as the achene
8. Tubercle a third to half as high as the body of the achene; spikelet ovoid; plants highly variable in size .... *E. obtusa*
8. Tubercle flattened, not more than a fourth as high as the body of the achene; spikelet cylindrical, 5–16 mm. long; achenes lacking bristles .... *E. Engelmanni f. detonsa*
7. Tubercle less than two-thirds as broad as the achene, higher than broad; spikelet globose-ovoid to ovoid-cylindric; plants highly variable in size.......... *E. ovata*
4. Stigmas 3; achenes 3-angled
5. Summit of upper sheaths loose, of very delicate texture, cut at an oblique angle
6. Achene with longitudinal ridges; tubercle distinct from body of achene, broader than high, with flange-like base .... *E. Wolfii*
6. Achene without longitudinal ridges; tubercle not distinct from body of achene, 2–3 times as high as broad, slender, awl-shaped .... *E. intermedia*

5. Summit of upper sheaths close, firm, green- or dark-margined, cut nearly square across the top; the pyramidal tubercle much smaller than the body of the achene and not sharply differentiated from it; the spikelets spindle-shaped; stems flattened and striate-grooved, wiry, erect, 3–12 dm. long, often arching and rooting at the tip ....*E. rostellata*

ELEOCHARIS EQUISETOIDES (Ell.) Torr. Jointed Spike Rush. (Fig. 13). Shallow water. The only Wisconsin collections were made in 1893 at Lake Wingra, Madison, where the species is now extinct.

E. QUADRANGULATA (Michx.) R. & S. Square-stem Spike Rush. (Fig. 13). Shallow water of lakes and ponds. So far collected at but two stations in Wisconsin.

E. ROBBINSII Oakes. Triangle Spike Rush. (Fig. 13). Shallow water and wet shores. When growing in water this species may produce tufts of floating capillary abortive stems or fine leaves.

E. CALVA Torr. (Fig. 14). Wet bogs and shores throughout the state.

E. SMALLII Britt. (Fig. 15). Muddy and sandy shores and shallow water. *E. palustris* (L.) R. & S., the name formerly applied to most Wisconsin specimens having this general morphology is here discarded, following H. K. Svenson[1] who considers the European *E. palustris* to be distinct from the American plants.

E. COMPRESSA Sull. (Fig. 16). Wet places along rivers and lakes.

E. NITIDA Fernald. (Fig. 16). On wet red clay of alkaline reaction. Perhaps a post-glacial relic. Collected at a single station within the city limits of Superior, Douglas Co.

E. ELLIPTICA Kunth. (Fig. 17). Wet sandy shores of Lakes Superior and Michigan; also swamps and sedge meadows.

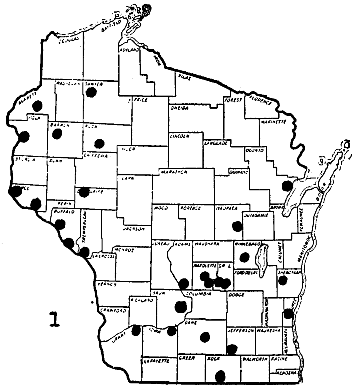
E. INTERMEDIA (Muhl.) Schultes. (Fig. 18). Marshy and springy areas, and muddy or sandy shores of lakes and ponds.

E. PAUCIFLORA (Lightf.) Link var. FERNALDII Svenson. (Fig. 19). Marl bogs and the Lake Michigan shore.

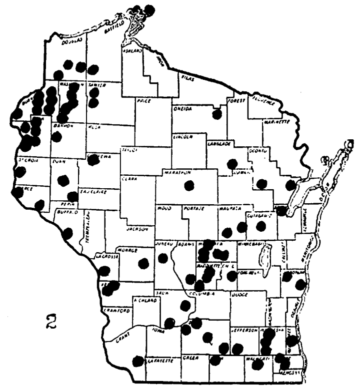
E. ACICULARIS (L.) R. & S. Needle Spike Rush. (Fig. 20). Common on wet shores and in shallow water. The grass-like submerged f. *inundata* Svenson is occasionally collected in Wisconsin. (This species has been supposed to lack tubers, whereas *E. parvula* (R. & S.) Link, otherwise resembling *E. acicularis*, has been supposed to have tubers. Sterile tuber-bearing plants from Devils Lake, Sauk Co., were determined as *E. parvula*, but later similar plants were found fruiting and proved to be *E. aci-*

---

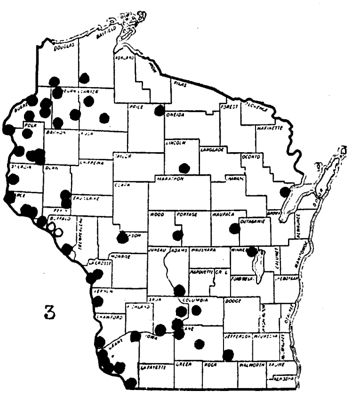
[1] Rhodora 49: 61. 1947.


1

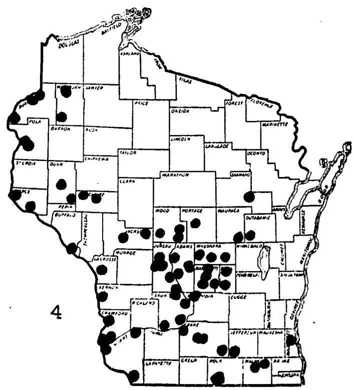
Cyperus diandrus


2

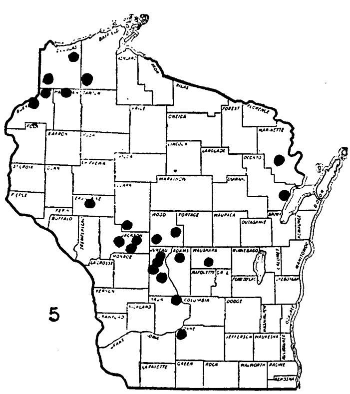
Cyperus rivularis


3

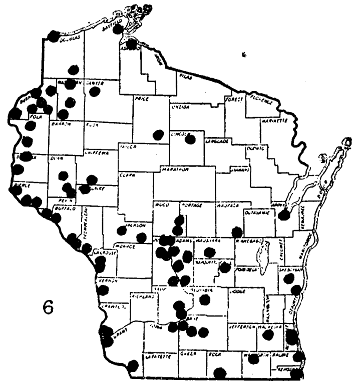
Cyperus inflexus


4

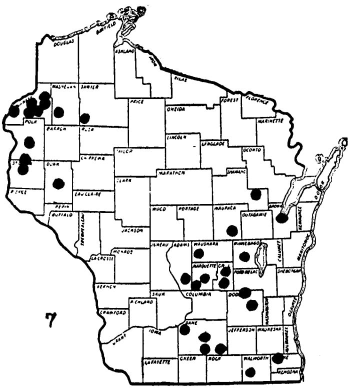
Cyperus filiculmis
var. macilentus


5

Cyperus Houghtonii

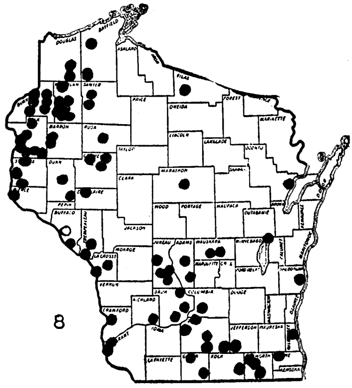

6

Cyperus Schweinitzii



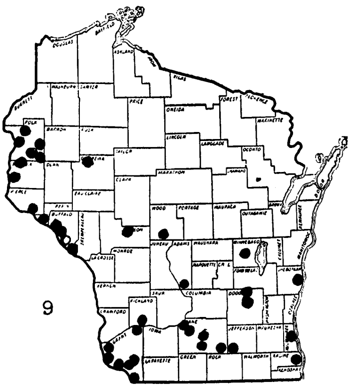
7

Cyperus Engelmanni



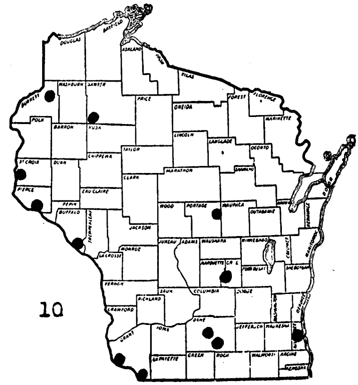
8

Cyperus strigosus



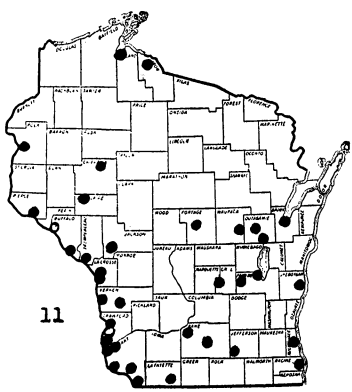
9

Cyperus erythrorhizos



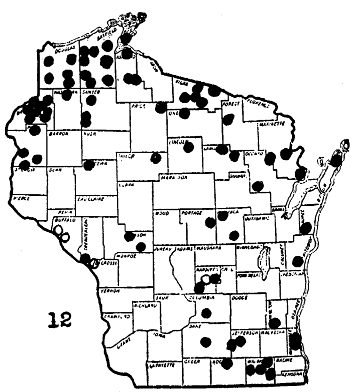
10

Cyperus ferruginescens



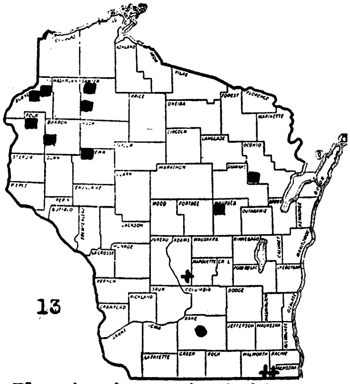
11

Cyperus esculentus



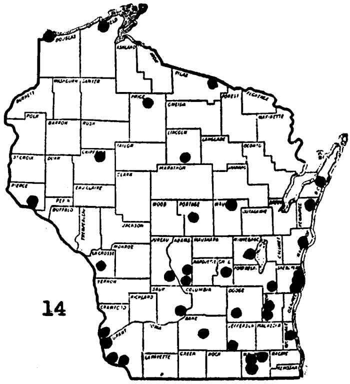
12

Dulichium arundinaceum



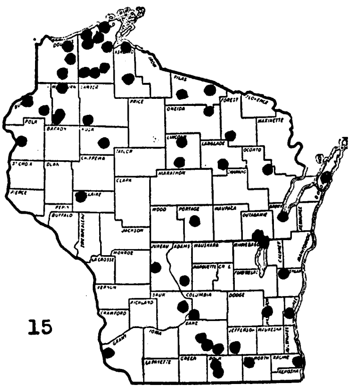
13

● Eleocharis equisetoides
✚ Eleocharis quadrangulata
■ Eleocharis Robbinsii



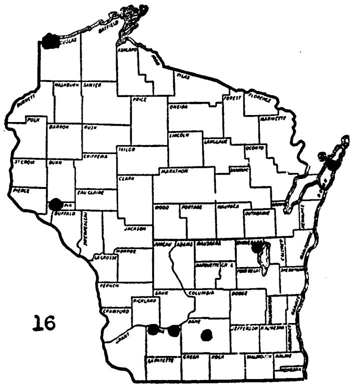
14

Eleocharis calva



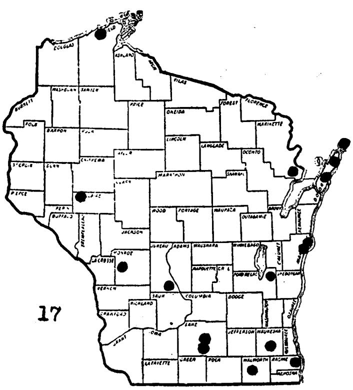
15

Eleocharis Smallii



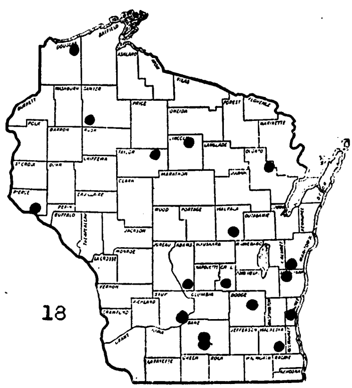
16

● Eleocharis compressa
■ Eleocharis nitida



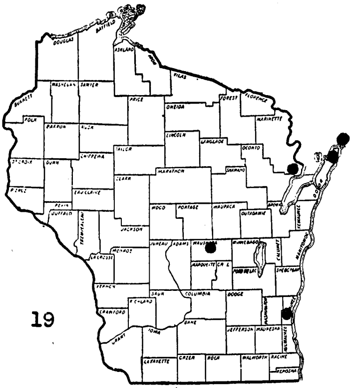
17

Eleocharis elliptica

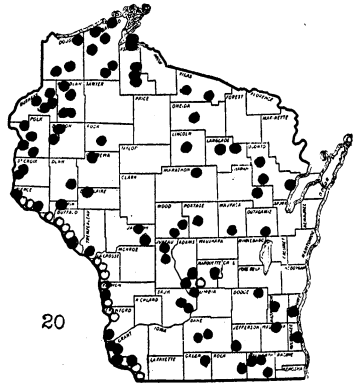


18

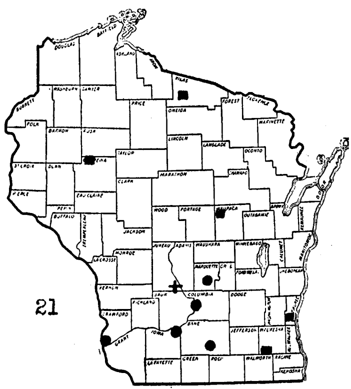
Eleocharis intermedia



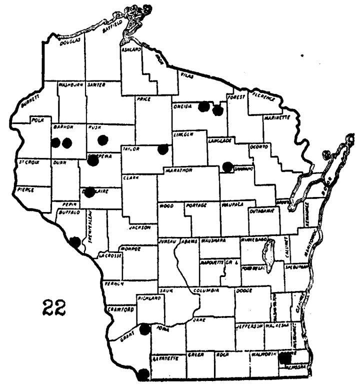
Eleocharis pauciflora var. Fernaldii



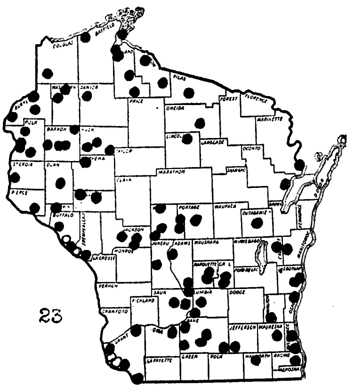
Eleocharis acicularis



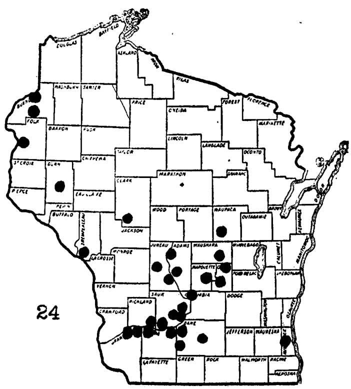
+ Eleocharis Wolfii
■ Eleocharis olivacea
● E. Engelmanni f. detonsa



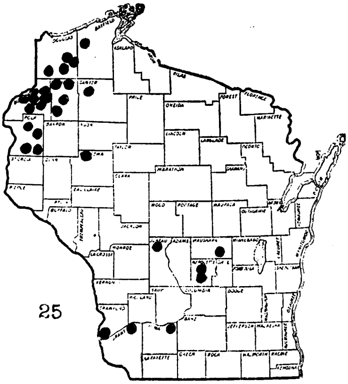
● Eleocharis ovata
■ Eleocharis rostellata



Eleocharis obtusa

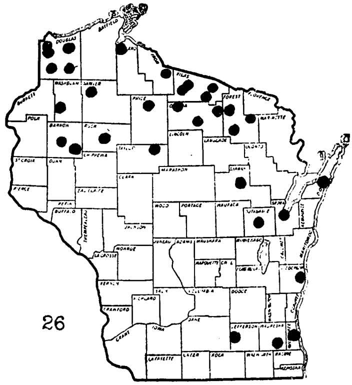


Bulbostylis capillaris



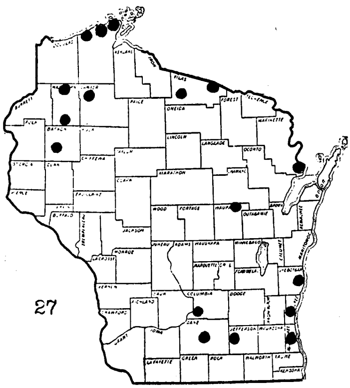
25

Fimbristylis autumnalis



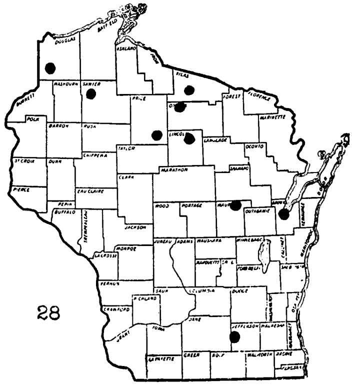
26

Eriophorum spissum



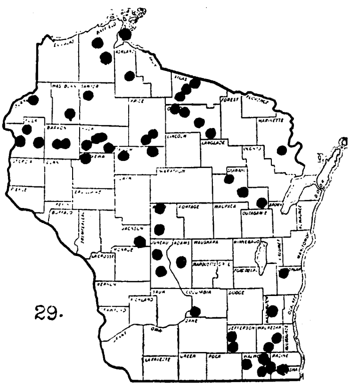
27

Eriophorum gracile



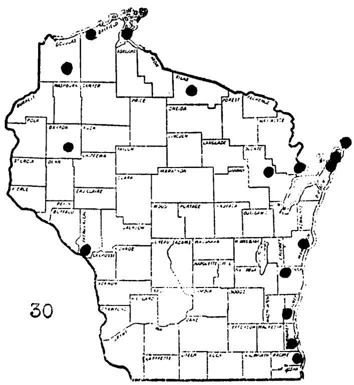
28

Eriophorum tenellum



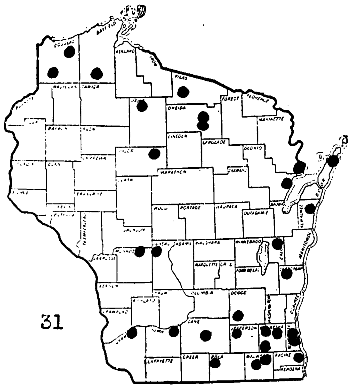
29.

Eriophorum virginicum



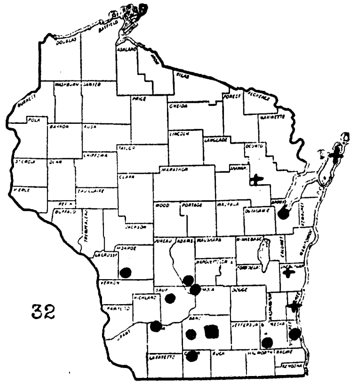
30

Eriophorum viridi-carinatum



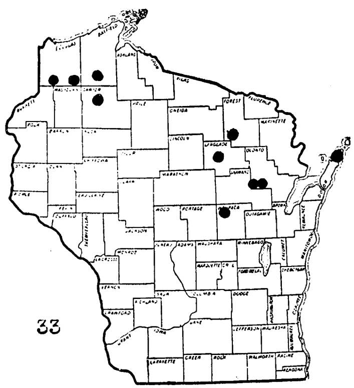
31

Eriophorum angustifolium



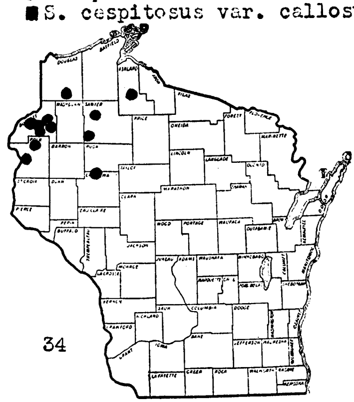
32

● Scirpus Clintonii
✚ Scirpus hudsonianus
■ S. cespitosus var. callosus



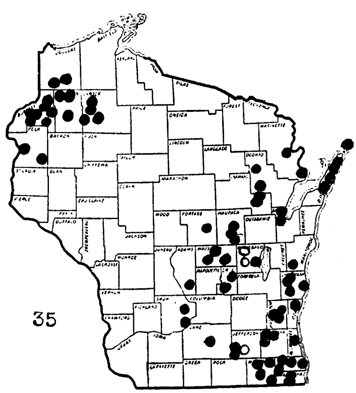
33

Scirpus subterminalis



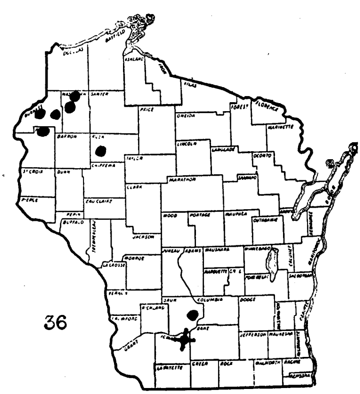
34

Scirpus Torreyi



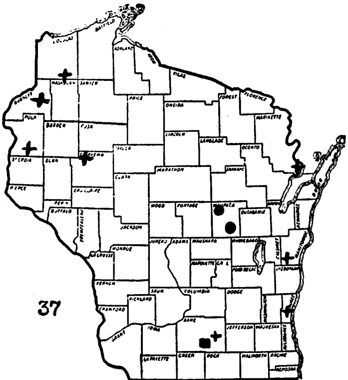
35

Scirpus americanus



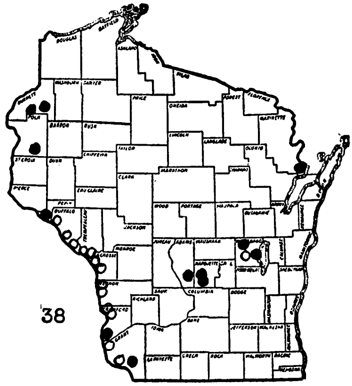
36

● Scirpus debilis
✚ S. debilis var. Williamsii



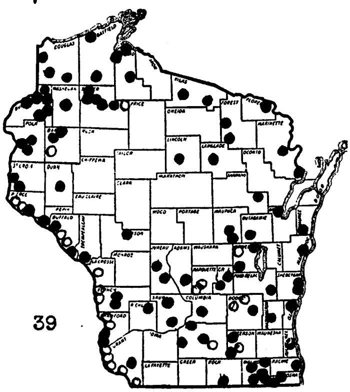
37

■ Scirpus Hallii
● Scirpus Smithii
✚ S. Smithii var. setosus



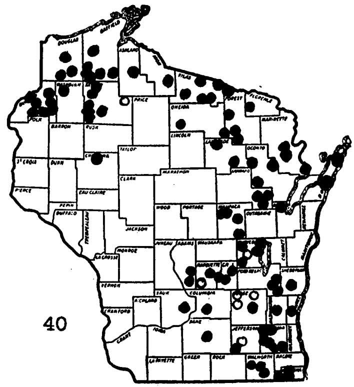
38

Scirpus heterochaetus



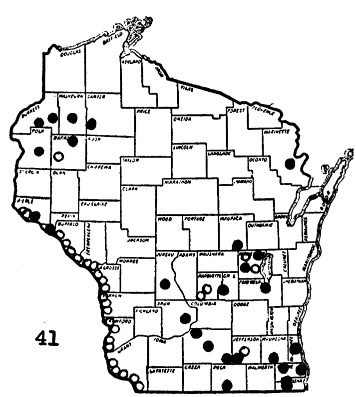
39

Scirpus validus



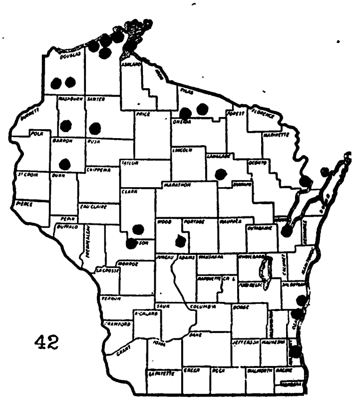
40

Scirpus acutus



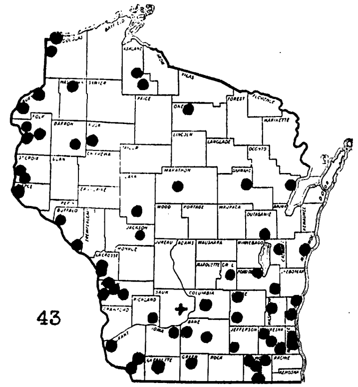
41

Scirpus fluviatilis



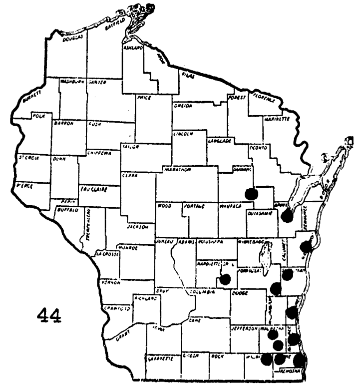
42

Scirpus rubrotinctus



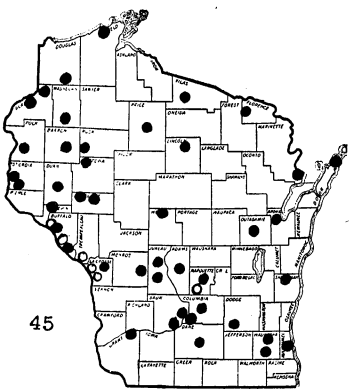
43

● Scirpus atrovirens
+S. atrovirens var. georgianus



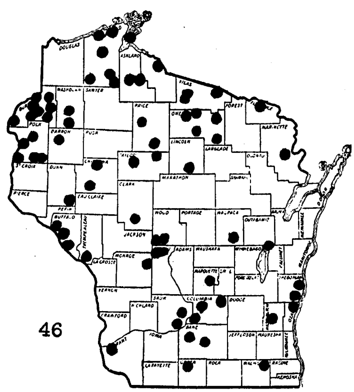
44

Scirpus lineatus



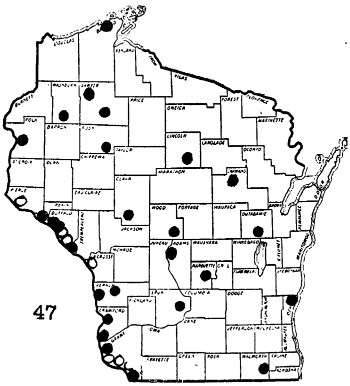
45

Scirpus cyperinus



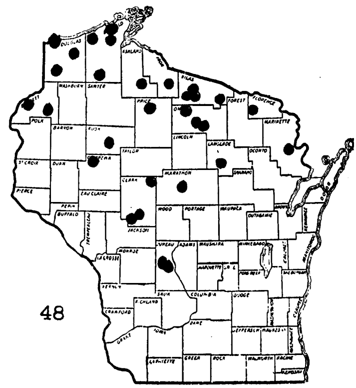
46

Scirpus cyperinus var. pelius



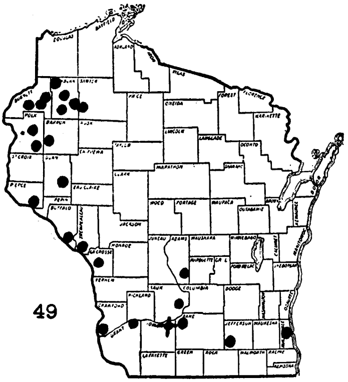
47

Scirpus pedicellatus



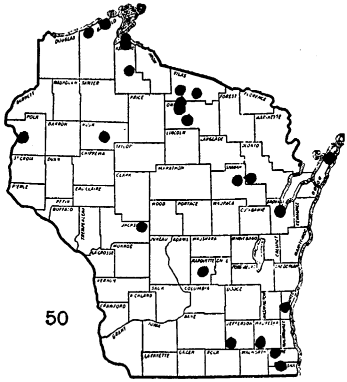
48

Scirpus atrocinctus



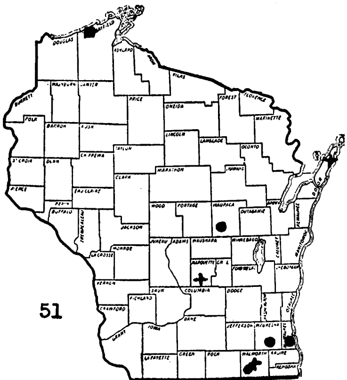
49

+ Hemicarpha micrantha var. Drummondii
● H. micrantha var. minor



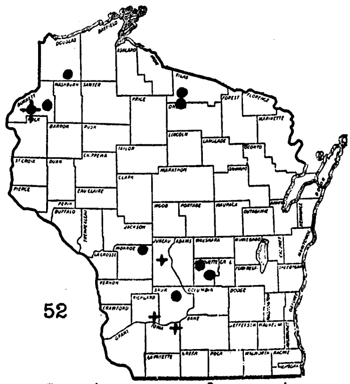
50

Rynchospora alba



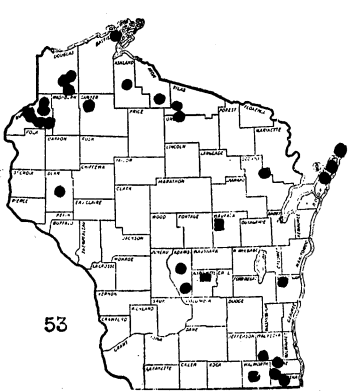
51

● Rynchospora capillacea
+ R. capillacea f. leviseta
■ Rynchospora fusca



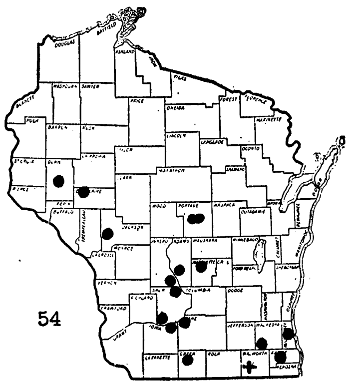
52

● Rynchospora glomerata var. minor
+ R. glomerata var. minor f. discutiens



53

■ Psilocarya scirpoides
● Cladium mariscoides



54

● Scleria triglomerata
+ Scleria verticillata

cularis, so until its presence is otherwise demonstrated *E. parvula* cannot be considered to occur in Wisconsin).[1]

E. WOLFII Gray. (Fig. 21). On wet, acid sand.

E. ENGELMANNI Steud. f. DETONSA (Gray) Svenson. (Fig. 21). Damp sand and drying pond bottoms.

E. OLIVACEA Torr. (Fig. 21). Bogs and wet shores.

E. OVATA (Roth) R. & S. (Fig. 22). Distinguished with difficulty from, and grading into, *E. obtusa* (Willd.) Schultes. (Fig. 23).

E. ROSTELLATA Torr. Beaked Spike Rush. Walking Sedge. (Fig. 22). Wet marl borders of lakes. A single collection from Long Lake, Racine Co.

E. OBTUSA (Willd.) Schultes. (Fig. 25). Muddy places, common.

BULBOSTYLIS CAPILLARIS (L.) C. B. Clarke (*Stenophyllus capillaris* (L.) Britton). (Fig. 24). Frequent in dry, sandy, fallow fields and other dry sandy situations. (*B. capillaris* var. *crebra* Fernald, characterized by having the pedicels longer than the spikelets and lacking sessile spikelets at the bases of the leaves, apparently does not occur in Wisconsin. The species proper, with sessile spikelets at the bases of the leaves and with the normal spikelets longer than their pedicels is well represented, but much of the Wisconsin material is depauperate, or collected early in the season, and hence lacks the sessile spikelets at the leaf bases).

FIMBRISTYLIS AUTUMNALIS (L.) R. & S. (Fig. 25). Wet shores of lakes, streams and sloughs. Absent, or at least not up to the present collected, over wide areas in the northern, central westerns and southeastern parts of the state.

The following key to *Eriophorum* has been adapted from the key used by Mr. C. C. Deam in his "Flora of Indiana".

Key to the species of ERIOPHORUM in Wisconsin

1. Spikelets solitary; involucre none; scales lead color.........*E. spissum*
1. Spikelets 2-several; involucre of 1-several leafy bracts
  2. Leaves 1–2 mm. wide, channeled their entire length; 1 primary involucral bract
    3. Upper leaf blade shorter than its sheath................*E. gracile*
    3. Upper leaf blade longer than its sheath..............*E. tenellum*
  2. Leaves 1.5–6 mm. wide, flat at least below the middle; the involucral bracts more than 1
    3. Scales of spikelets with only one prominent rib; stamens 3; plants of May and June

[1] Svenson, H. K.—Rhodora 36: 388. 1934.

4. Upper leaf sheaths dark-girdled at summit; midrib of scales not extending to the apex, the upper part of scale hyaline, rib prominent below apex........................*E. angustifolium*
4. Upper leaf sheaths not dark-girdled at summit; midrib of scales extending to apex........................*E. viridi-carinatum*
3. Scales of spikelets with several prominent ribs; stamen 1; bristles varying from tawny to white; plants of August and September ....*E. virginicum*

ERIOPHORUM SPISSUM Fernald. (Fig. 26). Bogs in northern Wisconsin and similar situations near the Lake Michigan shore.

E. GRACILE Koch. (Fig. 27). Bogs and swamps.

E. TENELLUM Nutt. (Fig. 28). Occurring in situations similar to those in which E. GRACILE is found.

E. VIRGINICUM L. (Fig. 29). Marshes and tamarack bogs throughout the state, except in the southwestern portion where such habitats are rare.

E. VIRIDI-CARINATUM (Englem.) Fern. (Fig. 30). Bogs and sedge marshes.

E. ANGUSTIFOLIUM Roth. (Fig. 31). Sloughs, marshes and bogs. The species of *Eriophorum* are collectively known as the Cotton Grasses because of the cottony appearance produced by the whitish, long-projecting and much divided bristles.

Key to the species and varieties of SCIRPUS in Wisconsin

1. Involucre none, or merely the modified outer scale of the solitary terminal small spikelet
2. Bristles of achene rounded, setulose; involucre very short, equalling or only slightly exceeding the solitary spikelet; sheaths at base bearing a slender almost bristle-shaped leaf; a plant of dry habitats ....*S. Clintonii*
2. Bristles of the achene flat and strap-like, without barbs
3. Bristles about twice length of achene.....*S. cespitosus* var. *callosus*
3. Bristles white, long, far exceeding achene and scales. (Similar in appearance to *Eriophorum*); culms slender, many in a row from a running rootstock ....*S. hudsonianus*
1. Involucre of one or more leaves, appearing as if a continuation of the stem, or foliaceous
2. Involucre of a single leaf, appearing as if a continuation of the stem
3. Spikelets not stalked; stems rarely more than 1 m. tall
4. Spikelet solitary; stems weak, usually supported by the water, often with tufts of hair-like leaves........*S. subterminalis*
4. Spikelets usually 2 or more; stems erect
5. Stems sharply 3-angled, 2–5 mm. thick, from a rootstock; side of stem nearly flat; involucral leaf 4–15 cm. long
6. Scales of spikelet red-brown; achene with an abrupt short point...............................*S. americanus*
6. Scales of spikelet yellow-brown; achene with an abrupt long point....................................*S. Torreyi*

5. Stems bluntly 3-angled, 1–1.5 mm. thick, from tufted roots
   6. Scales about 0.5 mm. long .... see *Hemicarpha*
   6. Scales about 2 mm. long
      7. Achene strongly cross-wrinkled .... *S. Hallii*
      7. Achene smooth, or very lightly wrinkled
         8. Achene convex on both sides
            9. Bristles present .... *S. debilis*
            9. Bristles absent .... *S. debilis* var. *Williamsii*
         8. Achene flat on one side and convex on the other
            9. Bristles absent .... *S. Smithii*
            9. Bristles present .... *S. Smithii* var. *setosus*

3. Spikelets on stalks or long rays, or sometimes spikelets crowded; stems 1–2 m. tall
   4. Achene 3-angled, plump, pale grayish-brown, with 2–4 bristles less than or scarcely equalling the achene, 1.7–2 mm. broad; conspicuous whitish, flattened stamen filaments commonly present; spikelets usually solitary, ellipsoid, 8–14 mm. long, grayish-brown on rather long pedicels. . *S. heterochaetus*
   4. Achene 2-angled
      5. Spikelets ovoid, 5–10 mm. long, distinctly reddish-brown, loosely clustered; achenes 1.3–1.5 mm. broad, somewhat flattened on one side; stems in fresh specimens soft and spongy, light green, usually more than 1 cm. thick at base .... *S. validus*
      5. Spikelets long-ellipsoid or subcylindric, drab, grayish-brown, 1–2 cm. long; achenes 1.7–1.9 mm. broad, convex on both sides; stems in fresh specimens firm in texture, dark olive-green, 3 mm.–1 cm. thick at base .... *S. acutus*

2. Involucre of 2 or more leaves
   3. Largest involucral leaves 1 mm. or less wide at base; style swollen at base, but not persisting as a tubercle. . . . see *Fimbristylis*
   3. Largest involucral leaves 2–10 mm. wide at base; style not swollen at base
      4. Spikelets 5–10 mm. thick; stems sharply triangular, thick, from stout tuber-bearing rootstocks .... *S. fluviatilis*
      4. Spikelets 1–5 mm. thick; stems mostly bluntly triangular, 2–5 mm. thick; inflorescence characteristically wide and much branched
         5. Upright stems solitary from rootstocks; achene bristles barbed downward, or rarely absent
            6. At least the lower sheaths red, bristles barbed nearly to the base .... *S. rubrotinctus*
            6. All the sheaths green; bristles barbed only above the middle
               7. Bristles about equalling the achene; the lower sheaths superficially nodulose-septate .... *S. atrovirens*
               7. Bristles shorter than the achene, or absent; sheaths smooth, not nodulose-septate. . *S. atrovirens* var. *georgianus*
         5. Upright stems in large clumps, without rootstocks; bristles smooth
            6. Bristles scarcely longer than the scales; spikelets nearly all long-stalked; scales golden-brown with a broad green midrib; leaves linear, flat, pale green, rather broad, 0.5–1 cm. wide, or rarely wider...... *S. lineatus*

6. Bristles much longer than the scales, giving the inflorescence a wooly appearance
   7. Spikelets mostly without stalks, in clusters of 2–15
      8. Involucels (secondary involucres, e.g., at bases of spikelet clusters) reddish-brown
         9. Spikelets 3–6 mm. long.................*S. cyperinus*
         9. Spikelets 7–10 mm. long...*S. cyperinus* var. *Andrewsii*
      8. Involucels black; rays of inflorescence very unequal; scales of spikelets greenish-black; leaves bright green, rather soft, 2–5 mm. broad...*S. atrocinctus*

SCIRPUS CLINTONII Gray. (Fig. 32). Drying marl bogs, and marshes.

S. CESPITOSUS L. var. CALLOSUS Bigel. (Fig. 32). Sedge meadows.

S. HUDSONIANUS (Michx.) Fernald (Fig. 32). Cold bogs and wet shores. Close to *Eriophorum,* under which it is sometimes treated.

S. SUBTERMINALIS Torr. (Fig. 33). Shallow water, ponds, and streams.

S. TORREYI Olney. (Fig. 34). On wet sandy shores of soft to medium hard water lakes in northwestern Wisconsin.

S. AMERICANUS Pers. (Fig. 35). Wet sandy shores of hard water lakes.

S. DEBILIS Pursh. (Fig. 36). Sandy lake shores.

S. DEBILIS var. WILLIAMSII Fernald (Fig. 36). Same habitat as for the species.

S. HALLII Gray. (Fig. 37). Wet, muddy shores.

S. SMITHII Gray. (Fig. 37). Sandy lake shores.

S. SMITHII var. SETOSUS Fernald. (Fig. 37). Same habitat as for the species.

S. HETEROCHAETUS Chase. (Fig. 38). Hard water lakes, and sloughs along rivers.

S. VALIDUS Vahl. (Fig. 39). Wet situations in medium hard water.

S. ACUTUS Muhl. (Fig. 40). In both hard and soft water.

S. FLUVIATILIS (Torr.) Gray. (Fig. 41). On borders of hard water lakes.

S. RUBROTINCTUS Fernald. (Fig. 42). Swales in northern and eastern Wisconsin.

S. ATROVIRENS Muhl. (Fig. 43). Swales and marshes. *S. atrovirens* var. *georgianus* (Harper) Fernald is very rare in Wisconsin but intermediate forms, characterized by lower sheaths superficially nodulose-septate as in the species and the bristles (perianth) imperfectly developed as in the variety, are not uncommon.

S. LINEATUS Michx. (Fig. 44). Swales and marshes in the eastern part of the state.

S. CYPERINUS (L.) Kunth. (Fig. 45). Wet shores, swales and marshes.

S. CYPERINUS var. PELIUS Fernald. (Fig. 46). In situations similar to those in which S. cyperinus occurs.

S. PEDICELLATUS Fernald. (Fig. 47). Swales, lake and stream shores.

S. ATROCINCTUS Fernald. (Fig. 48). Swales, marshes and wet shores of lakes.

Key to the varieties of HEMICARPHA MICRANTHA in Wisconsin (after Friedland, Amer. J. Bot. *28:* 860, 1941)

1. Perianth-scale equal to or exceeding the achene, neither deeply excised nor vestigial
   2. Scale with no definite vascular tissue; mucro (pointed tip) of the glume longer than the body........................var. *aristulata*
   2. Scale with 3–5 vascular strands; mucro of the glume shorter than or subequal to the body........................var. *Drummondii*
1. Perianth-scale shorter than the achene, deeply excised, sometimes 2-cleft, vestigial or even absent..............................var. *minor*

The var. *aristulata,* included to complete the key, has a more western range and has not so far been found in Wisconsin.

HEMICARPHA MICRANTHA (Vahl.) Pax. var. DRUMMONDII (Nees) S. Friedland (Fig. 49). Damp sand. A single collection from Arena, Iowa Co. This species has the plants growing in loose clumps, the culms erect or ascending.

H. MICRANTHA var. MINOR (Schrad.) S. Friedland. (Fig. 49). Sandy borders of ponds and rivers. In this species the plants grow in dense dwarfed clumps, with the outer culms recurved-spreading.

The following key to Rynchospora has been adapted, with additions and omissions, from that used by Mr. C. C. Deam in the "Flora of Indiana".

Key to the species and varieties of RYNCHOSPORA in Wisconsin

1. Scales of spikelets white or nearly so, becoming tawny with age; spikelets in terminal and axillary corymbose heads; perfecting only one flower; stamens 2; bristles 9–12........................*R. alba*
1. Scales of spikelets chestnut color; spikelets perfecting more than one flower; stamens 3; bristles 6, rarely more
   2. Bristles long and conspicuous (3 times as long as the achene), extending straight upward from the achene................*R. fusca*

2. Bristles not long and conspicuous
   3. Leaves all filiform; spikelets 3–6, in terminal clusters
      4. Bristles barbed.................................*R. capillacea*
      4. Bristles smooth..........................*R. capillacea* f. *leviseta*
   3. Leaves wider, flat; spikelets numerous, in clusters or heads
      4. Bristles downwardly barbed..............*R. glomerata* var. *minor*
      4. Bristles smooth.............*R. glomerata* var. *minor* f. *discutiens*

RYNCHOSPORA ALBA (L.) Vahl. (Fig. 50). Bogs. A distinctive and easily recognized species.

R. FUSCA (L.) Ait. f. (Fig. 51). Bogs. A single collection, made more than 50 years ago at Port Wing, Bayfield Co., where it should be sought again.

R. CAPILLACEA Torr. and R. CAPILLACEA f. LEVISETA (Hill) Fernald. (Fig. 51). Bogs, borders of marly, spring-fed pools, and damp sandy-clay soil on the Lake Michigan bluffs.

R. GLOMERATA (L.) Vahl. var. MINOR Britton and R. GLOMERATA var. MINOR f. DISCUTIENS (Clarke) Fernald. (Fig. 52). Low places and wet sandy shores.

PSILOCARYA SCIRPOIDES Torr. (Fig. 53). Drying shores of lakes.

CLADIUM MARISCOIDES (Muhl.) Torr. (Fig. 53). Swales, marshes and lake shores.

Key to the species of SCLERIA in Wisconsin

1. Achenes smooth, ovoid, about 3 mm. long, including the basal disk (hypogynium); disk covered with a whitish foam-like crust; culms 0.5–1 m. high, roughish; leaves broadly linear, 3.5–9 mm. wide, roughened ....*S. triglomerata*
1. Achenes not smooth, globose, rough-wrinkled with short elevated ridges, about 1 mm. long; disk almost obsolete; culms simple, slender, smooth, 1–9 dm. high; leaves narrowly linear, glabrous ....*S. verticillata*

SCLERIA TRIGLOMERATA Michx. (Fig. 54). Moist, sandy soil or marshes.

S. VERTICILLATA Muhl. (Fig. 54). A single collection made by Mr. S. C. Wadmond at Delavan, Walworth Co., on an open boggy slope descending to a creek.

In the maps which indicate the distribution of species of Cyperaceae an open circle, (O), indicates a sight record by a reliable observer. All other figures are based on actual herbarium specimens.

I am indebted to Mr. A. M. Fuller of the Milwaukee Public Museum for his prompt cooperation in submitting the Museum collections of Cyperaceae for inspection, and to Professor N. C. Fassett for advice and guidance in the course of the study.

NOTES ON WISCONSIN PARASITIC FUNGI. XVIII

H. C. GREENE
Department of Botany, University of Wisconsin, Madison

The collections on which this series of notes is based were, unless stated otherwise, made during the season of 1952.

LEPTOSPHAERIA sp. on *Phalaris arundinacea* var. *picta* (cult.) occurs on elongate dead areas on leaves that were, in the main, still living. Coll. August 23 at Madison. The scattered to subseriate perithecia are on lesions on both green and chlorotic areas of this variegated ornamental and are in good maturity. It seems likely that the fungus is weakly parasitic. A rather large and confusing assemblage of species of *Leptosphaeria* have been described on Gramineae, mostly on culms, and any further formal descriptions do not seem justified at present. Notes on this collection are as follows: Perithecia black, globose, 100–115μ diam.; asci broadly clavate, 60–65 x 13–14μ; ascospores olivaceous, 3-septate, the penultimate cell slightly enlarged, falcate, 21–23 x5–6μ.

CYTOSPORA EVONYMI Cooke was associated with a destructive twig blight of *Evonymus fortunei (E. radicans)* at Madison, but it is not certain that it was the primary agent.

PHYLLOSTICTA, which seems not to correspond with any of the considerable number of species reported on that host, was collected on *Rhus radicans* at Madison, August 14. The black, subglobose pycnidia, approx. 150–175μ diam., which are somewhat imperfect below, are scattered and epiphyllous on large, dead, yellow-brown, wedge-shaped lesions involving the tips of the leaves. The conidia are hyaline, cylindric, 5–7 x 2–2.5μ.

PHYLLOSTICTA sp. on *Rhamnus cathartica,* collected at Madison, August 3, while technically seemingly referable to this genus, is scarcely the ordinarily encountered representative. The dark-olivaceous pycnidia are strongly erumpent, almost superficial, on dead areas near the leaf tips. They are subglobose and the walls are lined with a conspicuous layer of closely ranked conidiophores, about 20 x 2μ. In some pycnidia there is a basal, olivaceous, pseudoparenchymatous cushion over which the phores are ranged. The pycnidia measured run from 200–330μ in the largest diam. The fusoid conidia are hyaline, 4–6 x 2–2.5μ.

PHYLLOSTICTA sp. occurred on small cinereous spots on the leaves of *Stachys palustris* at Madison, September 2. The pycnidia are black, pseudoparenchymatous, small, about 65μ diam., globose, with a dark ostiolar ring. The conidia are hyaline, bacilliform, 3–4 x 1μ. Possibly the precursor of a perfect stage.

PHYLLOSTICTA (or *Phoma*?) on *Castilleja sessiliflora* at Gibraltar Bluff, Columbia Co., July 30. The capsules are thickly studded with the pycnidia which are black, flattened, pseudoparenchymatous, variable in size, the largest up to 175μ diam. The conidia are short-cylindric, hyaline, 5–6 x 2–2.5μ. Possibly parasitic.

PHYLLOSTICTA on *Plantago rugelii,* collected in small quantity at Madison, July 27, differs from other species described on *Plantago,* as indicated in the key given by Tehon and Daniels (Mycologia 19: 118. 1927). The spots are orbicular, about 1.5 cm. diam., with wide brown margins and cinereous centers. The pycnidia are black, subglobose, 150–175μ diam., while the conidia are hyaline and rod-shaped, 4–5 x 1.5μ.

PHOMA sp. was conspicuously and consistently present on dead leaders of the previous season's growth on plants of *Spiraea alba* at Madison. Profuse development of healthy lateral branches had occurred below the dead terminal portion. It seems likely, but is not certain that the fungus is secondary. The pycnidia are in the epidermal tissue, gregarious, black, subglobose, about 75–100μ diam., with accompanying weakly radiating strands of dark, thick-walled, mostly isodiametric cells, producing a vaguely dendritic effect. The conidia are hyaline, mostly ovoid, rather variable, 4–6.5 x 3–3.5μ.

CONIOTHYRIUM sp., possibly parasitic, occurred on narrow, dead marginal strips of otherwise still green leaves of *Carex aquatilis* at Madison, July 17. The black, shining, seriate pycnidia are 75–100μ diam. The elliptic or fusoid conidia are a clear purplish-brown, 8–11 x 4–4.5μ.

ASCOCHYTA sp. on *Napaea dioica,* collected near New Glarus, Green Co., August 9, bears the pycnidia, mostly epiphyllous, on large, mottled, brown and white, wedge-shaped areas. This was compared with *Ascochyta althaeina* Sacc. & Bizz., but the latter is confined to rounded, small, sharply defined spots and has smaller conidia than the specimen on *Napaea,* where they run from 8–15 x 3.5–4.5μ, without a noticeable constriction at the septum. The pale brown pycnidia are subglobose, thin-walled, about 125μ diam.

ASCOCHYTA sp., which seems quite distinct and well-marked, was collected on leaves of *Verbena urticaefolia* at Madison, July 2. The spores are within the size range of those of an *Ascochyta*-

Stagonospora complex encountered in previous years in the same vicinity on *Verbena stricta* so, in the expectation that further collections may clarify relationships, formal description is deferred. The lesions are large, brown or purplish-brown, wedge-shaped areas, which originate at the leaf tips and become progressively larger with the spread of the infection, until ultimately the entire leaf dies back. The lower stem leaves are usually those affected. The pycnidia, which are scattered over the lesions, are of the usual *Ascochyta* type, rather large, pale brown and thin-walled. The hyaline, uniseptate conidia are about 7–13 x 3–4μ, and may or may not guttulate, depending on the pycnidium in which they are borne. Many of the more heavily infected leaves bore numerous, rather prominent, almost superficial, immature, black perithecia, interspersed among the *Ascochyta* pycnidia. Some of these leaves were placed in a wire cage which was set out in the field in the vicinity of the original collection. About a month later the leaves were examined again and it was found, rather surprisingly, that some of the perithecia had matured, producing large hyaline, uniseptate ascospores. They seem closest to *Melanopsamma* and it seems highly probable that this is the perfect stage of the *Ascochyta.*

ASCOCHYTA sp. on *Kuhnia eupatorioides,* collected August 27, in LaFollette Memorial Park on the east shore of Lake Kegonsa in Dane Co., is borne on small, scattered, angled, cinereous spots. The black pycnidia are epiphyllous, subglobose, about 115–125μ diam. The hyaline conidia are cylindric, 7–11 x 2–3μ. Coll. only in small quantity.

STAGONOSPORA sp. on *Cyperus filiculmis* var. *macilentus.* Dane Co., Madison, July 29. The host plants were brown and dead at the time of collection, but are studded from top to bottom with the black, somewhat elongate pycnidia and it seems very likely that this fungus was the cause of the necrosis. The pycnidia are approx. 125–175μ in long diam. The spores, which are not very numerous, are hyaline, granular, 17–26 x 5.5–6.5μ, 1–2-septate. *Stagonospora cyperi* Ell. & Tracy, the only other species of which I find a report on *Cyperus,* has spores which are much smaller and out of the range of the Wisconsin specimen.

STAGONOSPORA on *Carex lanuginosa,* collected at Madison, July 13, is so far undetermined as to species. The medium-sized pycnidia are on straw-colored spots on the narrow leaves. The conidia are hyaline, 2-septate, subcylindric, straight or slightly curved, cell contents granular, many cells with one or two oil droplets, 35–55 x 10–13μ. The *Stagonosporae* seem to have an affinity for *Carex* and a considerable array of species have been listed thereon. A critical study would probably reduce the numbers of species significantly.

STAGONOSPORA sp. on *Juncus tenuis,* Madison, June 25, has spores whose dimensions correspond to those of *Stagonospora trimera* (Cooke) Sacc., but the original description is too meager to allow of satisfactory determination. North American Fungi No. 341, issued as this species, was examined, but spores were not found. The Madison material is on plants of the current season, but as they had been completely killed back when observed, it is a question whether or not the fungus was the primary agent.

SEPTORIA LEPACHYDIS Ell. & Ev. was extremely destructive to leaves of *Brauneria purpurea* at Madison. Large areas or entire leaves had become brown or blackish, and bore many hundreds, if not thousands, of the tiny pycnidia. Ordinarily this vigorous host is free of extensive fungus infection of any sort, although a small earlier specimen of *S. lepachydis* on it was reported in my Notes III.

SEPTORIA on *Solidago rigida,* collected August 1, 1951, near Marshall, Dane Co., has not been determined. The rather large black pycnidia are amphigenous on large, indefinite, brown, dead areas. The leaves bear numerous small purplish spots but, so far as examined, they are sterile. The slightly flexuous spores are filiform-acicular, mostly about 50–60 x 1.5μ. Perhaps close to *S. fumosa* Peck, but dissimilar from other collections assigned to that species.

LEPTOTHYRIUM sp. occurred in profusion on the flower stalks and capsules of *Wulfenia (Besseya) bullii,* near Brodhead, Green Co., August 9. A metamorphosis of at least the surface layers of the host had taken place and stalks and capsules were a conspicuous, shining black. The black, flattened fruiting bodies, mostly on, but not confined to the capsules, are about 150–175μ diam., or rarely more. They are firmly seated within the carbonized host tissues, yet withal erumpent. The conidiophores are bottle-shaped and in a rather compact basal layer. Most of the hyaline conidia are fusoid and straight, occasionally moderately curved, about 10–16 x 2–3μ. A few of the conidia are almost allantoid. There had evidently been no seed set, so the fungus is perhaps parasitic. However, *Wulfenia bullii* is one of our earliest blooming spring plants, so it may be that the flowering stems were languishing or dead before being attacked.

COLLETOTRICHUM sp. occurs in questionable relationship to the host on the terminal portions of living leaves of *Carex cephalophora* in two collections from the vicinity of Madison in July and August. This is a large, coarsely setose fungus, with falcate conidia well over 20μ in length. The fungus has fruited in greatest profusion on dead or dying tissue which is closely adjacent to the still green portion of the leaf. Possibly weakly parasitic.

CLADOSPORIUM sp., parasitic on *Achillea millefolium,* Madison, July 31, is extremely interesting in the host-parasitic relationship in that it is confined, or nearly so, to the trichomes which have been invaded to the degree that at many points they are literally packed with light brown, short-septate mycelium. The trichomes of *Achillea* have a short, inflated, cellular basal portion and many of those which are infected have broken off at this point, at which there is usually produced a tuft of spreading conidiophores. On the distal portions of the trichomes the phores are usually not in definite tufts, but in series radiating from the substratum. They are highly variable in length, and hence in septation, but all are clear, dark brown, tortuous, occasionally branched, and several times closely geniculate at the somewhat paler tips. The conidia are catenulate, pale olivaceous-gray, usually with a distinct spore scar at each end, fusoid, subfusoid, or subcylindric, 7–14 x 3–5μ, continuous or 1-septate. *Achillea millefolium,* with its very hairy surface, serves as a trap for air-borne spores, and the spore situation is not entirely clear. A good many *Alternaria* spores are found in mounts from this material, but it is not thought that they were formed here. As shown by allergy counts, they are present in the air in great numbers in mid- and late summer. At various points on the mycelium in some mounts there have been noted muriform, almost sessile, *Stemphylium*-like structures, and their relation is also obscure.

Liatris ligulistylis leaves, collected at Madison, August 11, bear on large (1–1.5 cm.) rounded, dull brown lesions, a fungus which appears probably parasitic, but which I have been unable to place satisfactorily even as to genus. The conidia are 17–23 x 3–3.5μ, faintly olivaceous, subcylindric to subfusoid, 1-septate and occasionally somewhat constricted at the septum. There is a prominent truncate spore scar. The conidiophores are in small tufts of not more than 6 or 7, from a small, dark, substomatal tubercle. They are clear brown, continuous, 12–22 x 4–4.5μ, many of them with a strongly curved tip which is once or twice geniculate. Suggestive of a depauperate *Cercospora.* The spores are not of the type usually associated with *Cladosporium, Scolecotrichum,* or *Fusicladium.*

Carex crinita var. *gynandra,* growing in deep shade around the border of a woodland pool in the Town of Primrose, Dane Co., July 12, 1951, is heavily infected by an interesting, but so far undetermined fungus in the *Heterosporium-Helmintho-*

sporium category. The dead, brown, distal portions of the leaves have scattered over them on their upper sides an organism which, under hand lens inspection, appeared to be a *Colletotrichum*. However, the supposed setae are small tufts (3–6 in a tuft) of erect-spreading, brown, 5–8-septate conidiophores, 130–200 x 6–7μ, slightly paler at the tip which may have a few closely spaced geniculations. These phores arise from a small, dark, compact, rounded, pseudoparenchymatous, stromatoid base, about 50–65μ diam. The few conidia which were observed are about 30–35 x 6–7μ, 3-septate, pale yellowish-gray and appearing smooth, or almost so. This fungus might perhaps be referred to the genus *Cercosporidium* Earle, which Chupp considers to be doubtfully distinct from *Cercospora*.

HELMINTHOSPORIUM spp. (?) have been found, both at Madison, on *Scirpus acutus* and on *Juncus tenuis* in what may be a parasitic relationship. While the dimensions are entirely different, the spores are of a similar type, and are not of the sort encountered in graminicolous species of *Helminthosporium*. In both cases there is a strongly tapered, attenuate apex, which is hyaline, or subhyaline, and non-septate. The enlarged basal portion is septate and shows the cell lumen condition usually found in old, mature *Helminthosporium* spores. On *Scirpus acutus* the spores run from about 100–130 x 12–15μ, and are 6–9-septate, with the appendage not accounting for more than a quarter or a third of the overall length. On *Juncus tenuis,* however, in the case of a spore 165 x 11μ and 8-septate, the non-septate, hyaline apical portion is 100μ or three-fifths of the entire length.

CERCOSPORA sp. (?) on stems of *Juncus balticus* var. *littoralis* was collected at Madison, July 2. The short conidiophores are in spreading tufts of approx. 3–6, protruding from stomatal openings, and arising from a small substomatal tubercle. They are continuous, brown below, with pallid tips, closely geniculate at the tip with very prominent spore scars, 15–22 x 4–4.5μ. The spores are clavate, truncate below with large scar, straight or almost so, with only a slight taper to the obtuse tip, rather thick-walled and pale olivaceous, mostly indistinctly 2-septate, about 50–60 x 4–4.5μ.

ADDITIONAL HOSTS

The following hosts have not been previously recorded as bearing the fungi mentioned in Wisconsin.

MICROSPHAERA EUPHORBIAE (Peck) B. & C. on *Euphorbia preslii*. Dane Co., Madison, September 20.

ACANTHOSTIGMA OCCIDENTALE (Ell. & Ev.) Sacc. Conidial stage on *Cirsium altissimum*. Green Co., New Glarus Woods, September 4.

CLAVICEPS PURPUREA (Fr.) Tul. Sclerotia on *Festuca elatior*. Green Co., New Glarus, August 9.

PHYLLACHORA PUNCTA (Schw.) Orton on *Panicum subvillosum*. Vilas Co., Sayner, September 1940. Coll. L. H. Shinners.

PHRAGMIDIUM AMERICANUM (Peck) Diet. II, III on *Rosa setigera* (cult.). Dane Co., Madison, August 14.

PUCCINIA RUBIGO-VERA (DC.) Wint. I on *Anemone cylindrica*. Columbia Co., Gibraltar Bluff near Okee, June 8. II, III on *Agropyron smithii*. Columbia Co., Portage, September 15.

PUCCINIA SILPHII Schw. on *Silphium terebinthinaceum* X *laciniatum*. Dane Co., Morrisonville, August 22. This was with the parent species which were likewise infected. I assume that this hybrid is var. *pinnatifidum* of *S. terebinthinaceum*, as of Gray's Manual where it is based on leaf characters. However, not only leaves, but flowers are intermediate.

PELLICULARIA FILAMENTOSA (Pat.) Rogers on *Solanum dulcamara*. Dane Co., Madison, July 21. Strictly hypophyllous, and appearing strongly parasitic.

PHYLLOSTICTA GROSSULARIAE Sacc. on *Ribes alpinum* (cult.). Dane Co., Madison, August 24.

PHYLLOSTICTA CACALIAE H. C. Greene on *Solidago rigida*. Dane Co., Morrisonville, August 22. Reported hitherto in Wisconsin on *Cacalia tuberosa, Senecio aureus, Silphium perfoliatum,* and *Silphium terebinthinaceum*. Admittedly, the specific name was an unfortunate choice, in view of the host range. On *S. rigida* the spots are orbicular, about .5–.7 cm. diam., cinereous with a narrow brown or yellow-brown border.

ASTEROMELLA ANDREWSII Petr. was highly destructive to the following cultivated species of *Gentiana* at Madison: *G. setigera, G. clausa, G. kisselringii, G. purdomi,* and *G. lagodechiana*. Grown and coll. by J. T. Curtis.

ASCOCHYTA SYRINGAE Bres. on *Syringa josikaea* (cult.). Dane Co., Madison, August 18.

DARLUCA FILUM (Biv.) Cast. on *Puccinia gentianae* III on *Gentiana puberula*. Columbia Co., near Portage, Septemebr 17. Rarely found on telia.

SEPTORIA ANDROPOGONIS J. J. Davis on *Andropogon scoparius*. Sauk Co., Cactus Bluff, Town of Prairie du Sac, July 11. The spores are slightly wider, and the pycnidia slightly larger, than in typical material on *A. furcatus*, but the specimen falls well within Sprague's expanded conception of *S. andropogonis*, as set forth in his "Diseases of Cereals and Grasses in North America", where he reports a collection on *A. scoparius* from Nebraska. Also on *Sorghastrum nutans,* Columbia Co., near Lodi, July 23. This specimen shows spores as described for the type on *Andropogon furcatus,* as well as some larger spores of the sort found in *S. andropogonis* var. *sorghastri* Greene & Sprague (Farlowia 1: 576. 1944) showing intergrading, as might be expected.

SEPTORIA SOLIDAGINICOLA Peck on *Solidago rigida.* Dane Co., Morrisonville, August 22. The spots are irregularly angled or rounded, mostly rather large and not very clean-cut. The pycnidia are gregarious on the cinereous central portion.

HAINESIA LYTHRI (Desm.) Hohn. *(Pezizella)* on *Rosa blanda.* Dane Co., Madison, August 19. On *Rhus copallina.* Dane Co., Madison, August 21. On *Potentilla arguta.* Dane Co., Belleville, September 13.

OVULARIA SPHAEROIDEA Sacc. on *Vicia villosa.* Dane Co., Madison, September 20. Coll. L. Weathers.

HETEROSPORIUM GRACILE (Wallr.) Sacc. on *Belamcanda chinensis.* Iowa Co., along County Trunk C, 3 miles southeast of Lone Rock, August 12. The host plants had persisted and were spreading in a long-abandoned farm garden.

CERCOSPORA CARICIS Oud. (*C. caricina* Ell. & Dearn.) on *Carex pubescens.* Sauk Co., Devils Lake, September 10.

CERCOSPORA GRANULIFORMIS Ell. & Holw. on *Viola pedata.* Richland Co., near Lone Rock, August 12. Det. Chas. Chupp.

ADDITIONAL SPECIES

The fungi mentioned have not been previously reported as occurring in Wisconsin.

MYCOSPHAERELLA ALTERA (Pass.) House on *Equisetum arvense.* Dane Co., Madison, July 15. On the dead tips of living branches.

CINTRACTIA PSILOCARYAE (Tracy & Earle) Clint. on *Psilocarya scirpoides.* Marquette Co., Westfield, September 18, 1934. Coll. N. C. Fassett. On a phanerogamic specimen only recently mounted and filed in the Wisconsin Herbarium. As reported in the "North American Flora", Massachusetts and Rhode Island are the only other localities for the smut on this host.

HERPOBASIDIUM DEFORMANS Gould is the name applied to the fungus reported in Wisconsin lists as *Glomerularia lonicerae* Peck. Martin, in his "Revision of the North Central Tremellales" (Univ. Iowa Studies in Nat. Hist. 19(3): 1952) states that the so-called conidia are really resting spores produced after the basidia.

Phomopsis pimpinellae (Ell.) comb. nov.

Septoria pimpinellae Ell. (Jour. Mycol. 7: 277. 1894.)

Abundant material on leaves of *Taenidia integerrima,* at Madison, August 2, 1952, shows both scolecospores and *Phoma*-type spores borne regularly in the same pycnidium. The latter are subfusoid to fusoid, ca. 11–14 x 2.5–3.5μ, while the scolecospores are mostly 20–25 x 1.5μ, strongly curved, tapered to a point at one end and subobtuse at the other. A small specimen collected at Madison in 1949 (Amer. Midl. Nat. 44: 640. 1950) did not show the fusoid spores, but as noted at the time the fungus seemed suggestive of *Phomopsis.*

ASCOCHYTA SONCHI (P. Henn.) Syd. on *Sonchus asper.* Columbia Co., two miles south of Rio, July 26. This was originally described as *Diplodina sonchi* P. Henn. Sydow's Mycotheca germanica No. 2387, issued as *A. sonchi* on leaves of *Sonchus oleraceus* proves, upon examination to be quite worthless for purposes of microscopic comparison, as is the case with so many numbers of this over-issued series. However, the Wisconsin material approximates the description fairly closely, although the conidia, instead of being 8–13 x 3–3.5μ as described, run 10–15 x 3.5–4μ. The conspicuous spots are orbicular with pale brown centers, somewhat sunken, 2–7 mm. diam., and with a moderately wide, elevated purplish margin. Occasional lesions occur on the stems.

STAGONOSPORA GLYCERICOLA R. Sprague on *Glyceria grandis.* Dane Co., Madison, July 5. Sprague states that, on the basis of the material he studied, he regards this species as a saprophyte. The Wisconsin collection, however, appeared to be parasitic, insofar as could be judged from the newer lesions. Where infection had been heaviest the leaves were killed back.

Urohendersonia stipae sp. nov.

Maculis pallidis, elongatis, fuscis varie; pycnidiis olivaceis, subglobosis, muris tenuibus, ostiolatis, gregariis vel sparsis; conidiis olivaceis, cylindraceis vel fusoideis late, distincte 3-septatis, 25–30 x 8.5–10μ, pedicellatis, pedicellis affixis constanter, hyalinis, curvis in spiris laxis, filiformibus, 19–28 x 1–1.5μ.

Spots pallid, elongate, with fuscous mottling; pycnidia olivaceous, subglobose, thin-walled, ostiolate, gregarious or scattered; conidia olivaceous, cylindric or broadly fusoid, distinctly 3-septate, 25–30 x 8.5–10μ, pedicellate, pedicels remaining attached to spores, hyaline, curved in a lax spiral, filiform, 19–28 x 1–1.5μ.

On living leaves of *Stipa spartea.* Madison, Dane County, Wisconsin, U. S. A., July 29, 1952.

The areas on which the pycnidia occur are dead, but were surrounded by living tissue, and the fungus is considered to have functioned as a parasite. A highly interesting and unusual form, differing from *Hendersonia* in the persistent pedicels which, in the spores lying free in a mount, appear as caudate appendages.

SEPTORIA QUINQUESEPTATA R. Sprague on *Koeleria cristata*. Sauk Co., Cactus Bluff, Town of Prairie du Sac, July 7, 1945. In this specimen the pycnidia, which are about 175μ diam., are clustered on small ashen spots. The spores are 5–7-septate and closely resemble Sprague's figure of them. It seems possible that, as Sprague suggests in his "Diseases of Cereals and Grasses in North America", p. 253, this is but a variant of *Septoria andropogonis*, J. J. Davis.

Colletotrichum madisonensis sp. nov.

Maculis cinereis vel pallido-brunneis, elongatis varie; acervulis sparsis irregulariter, epiphyllis, subcuticularibus, planis, fuscis, amplitudinibus formisque variis, prope circulis vel elongatis, 100–450μ in mensuris longis; setis in marginibus plerumque, sparsis vel gregariis, plerumque brevibus, pote robustis, rectis vel curvis, vel sinuosis nonnihil, subacuminatis, continuis vel 1-septatis raro, fuscis, 25–60 x 4–4.5μ; conidiis hyalinis, subfusoideis vel subfalcatis, 17–23 x 3.5–4μ; conidiophoris brevibus, ampulliformibus, in ordinibus planis compactis.

Spots cinereous to pale brown, variously elongate; acervuli irregularly scattered, epiphyllous, subcuticular in origin, applanate, dark brown, variable in size and shape, from almost round to elongate, 100–450μ in long dimension; setae mostly marginal, scattered or in loose clusters, mostly short, rather stout, straight or curved, or somewhat sinuous, subacuminate, continuous, or rarely 1-septate, dark brown, 25–60 x 4–4.5μ; conidia hyaline, subfusoid or subfalcate, 17–23 x 3.5–4μ; conidiophores short, flask-shaped, in a compact, flat layer.

On living leaves of *Carex lacustris*. Madison, Dane County, Wisconsin, U. S. A., June 25, 1952.

The pale spots in which the acervuli occur are themselves usually surrounded by brown tissue, the whole often forming a central stripe toward the distal end of the long leaf. The extreme tip of an infected leaf is usually brown and dead. The cuticle above an acervulus is frequently ruptured, but often remains attached, forming a little flap which follows the outline of the acervulus. Also collected on *Carex stricta* at Madison, August 8, 1952.

Cylindrosporium interstitialis sp. nov.

Maculis nullis; acervulis elongatis varie, 65–80μ latis, in interstitiis mesophyllis foliis, hypophyllis, saepe in seriebus; conidiophoris inconspicuis, fere obsoletis; conidiis robustis, rectis vel flexuosis vel curvis, hyalinis, 20–36 x 3–4μ, 2–3-septatis.

Spots none; acervuli variously elongate, 65–80μ wide, in mesophyll between the leaf ribs, hypophyllous, often in series; conidiophores inconspicuous, almost obsolete; conidia stout, straight, flexuous, or curved, hyaline, 20–36 x 3–4μ, 2–3-septate.

On living leaves of *Spartina pectinata*. Madison, Dane County, Wisconsin, U. S. A., July 27, 1952.

Sprague in his "Diseases of Cereals and Grasses in North America" lists only two other species of *Cylindrosporium* on native Gramineae, both based on Wisconsin material. These are *C. calamagrostidis* Ell. & Ev. and *C. glyceriae* Ell. & Ev., neither of which resembles *C. interstitialis*. The infected leaves show an obscure yellowing and speckling, but there are no definite spots. In *Spartina* the only accessible mesophyll tissue abuts on the spaces between the heavily sclerified ribs, and this accounts for the restricted placement of the acervuli.

Cercoseptoria scirpi sp. nov.

Maculis areis immarginatis pallidis, in caulibus supra; conidiophoris nullis vel rudibus; tuberibus compactis, olivaceis, subglobosis, infra stomatibus, 20–25μ diam.; conidiis in fasciis ex tuberibus, hyalinis, flexuosis, apicibus obtusis vel subobtusis, 40–55 x 3.5–4μ, obscure 3-septatis.

Spots immarginate pallid areas on the upper stems; conidiophores none or rudimentary; tubercles compact, olivaceous, subglobose, substomatal, 20–25μ diam.; conidia borne in small tufts on the tubercles, hyaline, flexuous, ends obtuse or subobtuse, 40–55 x 3.5–4μ, obscurely 3-septate.

On living stems of *Scirpus acutus*. Madison, Dane County, Wisconsin, U. S. A., August 8, 1952.

Most of the conidia are somewhat more obtuse at one end than at the other. This is another of those borderline forms that are neither *Cylindrosporium* nor yet *Cercosporella*. Although the conidia are in small tufts, this is not apparent from a hand lens examination, which shows only a sordid-whitish, appressed-farinose surface, without revealing the presence of the fungus. Infection was restricted to the upper stem.

Cercoseptoria iridis (Ell. & Halst.) comb. nov.

Cylindrosporium iridis Ell. & Halst. (Jour. Mycol. 6: 34. 1890).

Although I have not seen the specimen on which Ellis and Halsted based their description, I am quite confident that material collected on *Iris virginica* var. *shrevei* in southern Wisconsin in 1952 is but a somewhat better development of the same thing. I consider this fungus to belong properly in the Moniliaceae, although indeed it verges even on the tuberculariaceous. In the Wisconsin specimens the spores are up to 35 x 2μ, although most are shorter and more slender, while the conidiophores are about as the authors described them, approx. 8 x 2μ. Despite the nondescript phores I am transferring this to *Cercoseptoria,* as each tuft is borne on a small tubercle.

CERCOSPORA SIMULANS Ell. & Kell. on *Amphicarpa bracteata.* Green Co., New Glarus Woods, July 5, 1951. Chupp has examined this specimen and states that it is atypical in the almost complete lack of color in the conidiophores, but otherwise is characteristic. He informs me that, depending on conditions of development, certain Cercosporae exhibit considerable variability in depth of coloration of the conidiophores.

CERCOSPORA CANESCENS Ell. & Mart. on *Phaseolus vulgaris.* Dane Co., Madison, August 25.

Alternaria araliae sp. nov.

Maculis obscuro-brunneis, zonatis infirme, conspicuis, orbicularibus, saepe magnis, .5–3 cm. diam.; conidiophoris unis vel in fasciis parvis non plus quam 3, intrastomatibus, epiphyllis, robustis, prope rectis vel curvis leviter, non-geniculatis, apicibus truncatis, cicatricibus prominentibus, claris, pallido-brunneis, 40–65 x 6–9μ, 2–4-septatis, cellis basibus fere amplis distincte; conidiis acrogenis, longo-attentuatis, claro-olivaceis infra, apicibus fere hyalinis, basibus obtusis, cicatricibus prominentibus, non-muriformis vel restricte tantum, 70–180μ longis x 10–17μ infra, 125–170 x 15–17μ plerumque, 3–10- (6–10- plerumque) septatis.

Spots dull brown, faintly zonate, conspicuous, orbicular, often large, .5–3 cm. diam.; conidiophores arising singly or in small tufts of not more than 3, intrastomatal, epiphyllous, stout, almost straight or slightly curved, non-geniculate, tip truncate, with prominent spore scar, clear pale brown, 40–65 x 6–9μ, 2–4-septate, the basal cell usually noticeably enlarged; conidia acrogenous, long-tapering, clear olivaceous at base to almost hyaline at the narrow tip, base obtuse with prominent scar, non-muriform or only sparingly so, 70–180μ long x 10–17μ at the base, mostly 125–170 x 15–17, 3–10– (mostly 6–10–) horizontal septations.

On living leaves of *Aralia racemosa.* Madison, Dane County, Wisconsin, U. S. A., September 19, 1952.

This is plainly not *Alternaria panax (panacis)* Whetzel. Authentic material of *A. panax* from the Herbarium of the Department of Plant Pathology at Cornell University differs markedly from the fungus on *Aralia* in characteristics of both conidia and conidiophores. A typical conidium of *A. araliae* shows the following measurements: 128μ overall length, 15μ wide at base, 4μ at tip, the septate, olivaceous basal portion 63μ long, the strongly tapered, subhyaline, non-septate apical portion 65μ long.

ALTERNARIA FASCICULATA (C. & E.) Jones and Grout on *Callistephus chinensis* (cult.). Kenosha Co., Kenosha, September 20. Coll. A. O. Paulus, Referred here with some doubt. A number of specimens in the Wisconsin Herbarium, labeled as *A. fasciculata,* were examined and found to be quite variable, especially as regards conidiophores. The spores of the current collection show good correspondence with the description, and the fungus appears to have been definitely parasitic.

PARASITES OF NORTHWEST WISCONSIN FISHES IV. SUMMARY AND LIMNOLOGICAL RELATIONSHIPS*

JACOB H. FISCHTHAL

The 1944–1946 studies on the parasites of northwest Wisconsin fishes, reported by Fischthal (1947, 1950b, 1952) for the Fish Management Division of the Wisconsin Conservation Department in its desire for more knowledge on the distribution, incidence, and intensity of parasitism in fishes from the many lakes and streams of the state, are, in the present paper, summarized and limnological factors relating to parasitism considered. In an abstract of a paper read at the 24th annual meeting of the American Society of Parasitologists, Fischthal (1949c) presented a preliminary discussion of these topics.

SUMMARY

Over the 3-year period a total of 4,532 fishes, representing 61 different species and subspecies distributed in 17 families and collected from 124 different lakes and streams, were examined for parasites and 4,186 or 92.4 per cent were infected with at least one species (Table 1). Of these 4,532 fishes examined, 34.4 per cent were from streams. The fishes from streams were 85.3 per cent parasitized, while the remainder from lakes and flowages were 96.1 per cent infected. Bangham (1948), also working in Wisconsin, found 91 per cent of 13,855 fishes harboring parasites. These fishes were collected during the summers of 1943 through 1948 and the college year of 1947 to 1948.

The 92.4 per cent total infection for northwest Wisconsin is, for the most part, relatively high in comparison with surveys conducted elsewhere in the United States and Canada. In a study of the Upper Snake River drainage and Yellowstone Lake, Wyoming, Bangham (1951) indicated that 92.3 per cent of 2,535 fishes contained at least one species of parasite. Freshwater fishes from southern Florida studied by Bangham (1940) showed 88 per cent of 1,380 fishes parasitized. Bangham (1941) found 84.3 per cent of 560 fishes from Algonquin Park (Ontario) lakes infected. In a further study of the Algonquin Park region Bangham and Venard (1946) showed 75.8 per cent of 676 fishes to harbor at least one species of parasite. Hunter (1941) found

* Contribution No. 3 from the Department of Biological Sciences, Harpur College, State University of New York, Endicott, New York.

parasites in 72.5 per cent of 598 Connecticut fishes. In a survey of Lake Erie, Bangham and Hunter (1939) found 58.3 per cent of 2,158 fishes infected with parasites. Essex and Hunter (1926) obtained parasites from 39 per cent of 652 fishes from lakes and streams of the central states. A comparison of the per cent infection of families of northwest Wisconsin fishes with fishes of other surveys is shown in Table 2. Essex and Hunter (1926), in the central states, and Holl (1932), in North Carolina, found that stream fishes were less parasitized than lake fishes.

More than 121 species of parasites were found during the course of the surveys. Of these more than 106 were helminths; these include at least 51 species of trematodes, 26 cestodes, 21 nematodes, and 9 acanthocephalans. In addition there were encountered 5 species of copepods, 1 virus, and an undetermined number of species of protozoans, glochidia, and leeches. A composite check list of the forms taken is presented in Table 3. Pearse (1924) in a study of fish parasites in 5 Wisconsin lakes found 90 species of parasites, 72 of which were helminths. Van Cleave and Mueller (1934) found 68 species of worms in Oneida Lake, New York, fishes. In Lake Erie fishes Bangham and Hunter (1939) listed 114 species of parasites, 97 of which were helminths. Bangham (1940) found 75 species of parasites (60 helminths) in southern Florida freshwater fishes. Hunter (1941) listed 61 species of parasites from Connecticut fishes; 47 species were worms. Bangham and Venard (1942) in Reelfoot Lake, Tennessee, fishes found 71 species of helminths out of a total of 83 parasite species. In northern Wisconsin Bangham (1946) found 82 species of parasites, 67 of which were worms. Bangham and Venard (1946) listed 71 of the 75 species of fish parasites from Algonquin Park, Ontario, lakes as helminths. Bangham (1951), in Wyoming fishes, found 49 species of parasites, 39 being helminths.

The larval parasites occurred most frequently and in more hosts than did any other of the developmental stages. Next in line were the immature forms, most of which would not reach sexual maturity in the hosts in which they were encountered. These were present because the hosts happened to have taken food containing the larval stage in the life cycle. Host-specificity played an important role in regard to the distribution of the various species of adult parasites.

Among the trematodes the metacercarial stage of some occurred as follows: in 7 of the 8 hosts listed as harboring *Bucephalus elegans; Clinostomum marginatum* in all 27; in 4 of the 8 hosts with *Cryptogonimus chyli; Diplostomulum scheuringi* in all 20; *Diplostomulum* spp. in all 35; *Neascus* spp. in all 43; *Posthodiplostomum minimum* in all 25; and *Tetracotyle* spp. in all 19. Although immature stages of trematodes were taken from a variety of hosts, it is known that in almost all cases these would reach sexual maturity wherever encountered. Only a very few species of adult trematodes showed a great lack of host-specificity. These were *Allocreadium lobatum* with 6 hosts, *Alloglossidium corti* with 6 (all ameiurids), *Azygia augusticauda* with 15, *Crepidostomum cooperi* with 14, and *C. cornutum* with 7. Most all the other adult trematodes had 1, 2 or 3 hosts. An undetermined number of species of monogenetic trematodes in the superfamily Gyrodactyloidea were recovered from the gills of 30 hosts.

Among the cestodes *Proteocephalus* spp., represented by a variety of unidentified larval and immature worms, was the most widely distributed with 26 hosts listed. *Proteocephalus pearsei* was found in 17 hosts, but was sexually mature only in the perch *(Perca flavescens)*; it probably would not reach maturity in the other 16 hosts. *Proteocephalus ambloplitis,* perhaps the most detrimental of fish cestodes because of its relation to sterility in the black basses, was taken in the larval stage from 16 hosts; in 3 of these 16 also occurred the sexually mature adult *(Amia calva, Micropterus d. dolomieu, M. salmoides)*. *Triaenophorus nodulosus* occurred in 9 hosts, reaching sexual maturity only in members of the Esocidae; they were found encysted in the majority of hosts. *Bothriocephalus cuspidatus* was seen in 8 hosts, but as immature forms which apparently only matured in one, *Stizostedion v. vitreum. Proteocephalus stizosthethi* occurred in 5 hosts as immature individuals, but matured in only 1 of these *(Stizostedion v. vitreum)*. The remainder of adult cestodes occurred in only 1, 2 or 3 hosts.

Among the nematodes immature *Camallanus oxycephalus* was found in 22 hosts; sexually mature worms occurred in only 9 of these 22. Adults of *Capillaria catenata* inhabited 7 hosts, *Contracaecum brachyurum* 5, and *Dichelyne cotylophora* 7. A wide variety of hosts were inhabited by adult *Rhabdochona cascadilla, Spinitectus carolini,* and *S. gracilis* with 14, 15, and 17, respectively. Encysted larval *Spiroxys* sp. occurred in 22 different hosts. Larval and immature *Contracaecum* spp. (probably *C. brachyurum* of fishes and *C. spiculigerum* of birds) occurred in 40 hosts. All the other adult nematodes were found only in 1, 2 or 3 hosts.

Among the acanthocephalans *Leptorhynchoides thecatus* had the most numerous hosts, occurring as encysted or adult forms in 37 fishes. Lincicome and Van Cleave (1949), from personal observations and the published literature, reported *L. thecatus* from 79 fish hosts. Fischthal (1950a), from data based on the 1945 and 1946 northwest Wisconsin fish parasite surveys, added 7 new hosts to their list. *Pomphorhynchus bulbocolli* was encountered as encysted and adult worms in 31 hosts; *Neoechinorhynchus cylindratus* in 12 hosts.

Among the protozoans a variety of unidentified species of Myxosporidia were recovered from 29 hosts, while *Trichodina* spp. was observed on 21. The copepods were not too numerous, *Ergasilus caeruleus* being the most common with 6 hosts. Various species of larval clams, glochidia, were taken from 34 hosts. Leeches occurred on 10 hosts. One readily recognized virus, the cause of lymphocystis in *Stizostedion v. vitreum,* was present.

Due to the appearance in the literature of papers pertaining to parasites listed in these 1944–1946 parasite surveys, certain additional information should be given here in order to bring the data up to date. In the 1944 survey (Fischthal, 1947) Table 5 on *Salmo gairdnerii irideus* lists *Phyllodistomum* sp. This form is *P. lachancei* described by Choquette (1947). Choquette (1948) declared *Cystidicoloides harwoodi* (Chandler, 1931) a synonym of *Metabronema salvelini* (Fujita, 1920), the latter receiving priority. Therefore, this designation should be applied to *C. harwoodi* listed in the 1944 survey in Tables 4 *(Salmo trutta fario),* 5 *(S. gairdnerii irideus),* and 6 *(Salvelinus f. fontinalis),* and in the check list of parasites. For the same survey, in Table 15 *(Nocomis biguttatus)* and in the check list of parasites, the designation Cestodaria is incorrect and should be changed to Caryophyllaeidae. In Table 38 on *Micropterus d. dolomieu* and 39 on *Micropterus (=Huro) salmoides* of the 1944 survey the form *Sanguinicola* sp. has been described as a new species, *S. huronis,* by Fischthal (1949b); it is already listed under this new name in the 1945 survey (Fischthal, 1950b). Fischthal (1951) described a new genus and species of cestode, *Pliovitellaria wisconsinensis,* based in part on specimens listed as Caryophyllaeidae under *Notemigonus crysoleucas auratus* and *Hyborhynchus notatus* in the 1945 survey; the new designation is used in the 1946 survey (Fischthal, 1952) for the specimens from *N. crysoleucas auratus.*

Because printer's proof on the 1944 survey (Fischthal, 1947) was not read by the author, certain similar omissions were made in the published account which should now be inserted. In portions of Tables 28, 30, 42, and 43 the number of fishes examined for each water and the number infected were omitted. In adding this data the water will be listed first, followed by two figures; the first figure is the number examined, the second is the number infected. For Table 28 *(Esox lucius)* on p. 185: Namekagon River 3–3, Rocky Ridge Lake 5–5, Silver Lake 9–9, Spooner Lake 4–4, Staples Lake 17–17, Upper Turtle Lake 20–20, Vermillion Lake 5–5, Vermillion River 1–1, Whalen Creek 2–2, Windigo Lake 5–5, and Yellow River (W.) 11–11. For Table 30 *(Perca flavescens)* on p. 190: Ellsworth Lake 5–4, Lost Land Lake 2–2, Marshmiller Pond 2–2, Meadow Creek 1–1, Namekagon River 15–15, Red Cedar River 1–1, Spooner Lake 3–3, Staples Lake 10–10, Teal Lake 11–11, Upper Turtle Lake 15–15, Windigo Lake 4–4, and Yellow River (W.) 12–12. For Table 42 *(Lepomis m. macrochirus)* on p. 210: Devils Lake 15–15, Lost Land Lake 15–15, Namekagon River 16–16, Round Lake 12–12, Silver Lake 14–14, Spooner Lake 10–10, Staples Lake 15–15, Teal Lake 16–16, Tozer Lake 6–6, and Windigo Lake 13–13. For Table 43 *(Ambloplites r. rupestris)* on p. 212: Namekagon River 5–5, Red Cedar River 1–1, Silver Lake 11–11, Spooner Lake 1–1, Staples Lake 2–2, Teal Lake 18–18, Tozer Lake 1–1, Upper Turtle Lake 15–15, Vermillion River 2–2, Windigo Lake 13–13, and Yellow River (W.) 11–11.

RELATIONSHIP OF LIMNOLOGICAL FACTORS IN LAKES TO PARASITISM IN FISHES

Lakes vary widely in physical, chemical and biological characteristics, and these factors appear to have some effect upon the distribution of fishes and their parasites. Cross (1938) came to the same general conclusion. Pearse (1924) stated that, "Before all the factors which influence parasitism in fishes are known, if they ever are, parasitologists and ecologists will have to labor for several generations." Van Cleave and Mueller (1934) fully concurred with Pearse. As a result of my experiences in the studies on northwest Wisconsin fish parasites, I wish at this time to re-emphasize the need for several more generations of study.

Ward (1910) stated that the parasitic fauna of any animal is primarily a function of its habitat. Pearse (1924) noted that the habitats of fishes are important in their relation to parasitic infection. Welch (1935) pointed out that "these (physical and chemical conditions) and other possible conditions, in their various combinations and intensities, make up the fundamental environmental structure upon which the occurrence, distribution, and success of aquatic organisms depend. Each of these inorganic conditions functions in one or more ways in exerting influence upon organisms, and, in addition, the organisms exert influences upon each other; . . . Conditions within an environment are, to a great extent, mutually dependent, and in nature, factors are always operating in the presence of others." Bangham (1946) stated that the chemical, biological and physical characteristics of the habitat of the host appear to have a rather marked effect on distributions of the parasites.

A consideration of the principal limnological factors in relation to parasitism in lake fishes will be undertaken. It must be kept in mind that any consideration of the influence of a single factor on the organism is merely a necessary method of approach.

PHYSICAL FACTORS

Form of basin: It is well known that greater biological productivity is favored in a lake when there is a close superposition of the photosynthetic zone over the decomposition zone. The closer and more permanent the association of these zones the greater the productivity. In contrast, the steeper the slope of the basin the greater the removal of the decomposition zone to the hypolimnion with the result that much of the essential decomposition materials become inaccessible. High productivity tends to favor a high incidence and intensity of parasitism in fishes. Trematodes require a molluscan intermediate host in their life cycles. Many further require a second intermediate host, utilizing such forms as turbellarians, mollusks, aquatic annelids, and various aquatic insects and crustaceans. The cestodes frequently make use of copepods for their transfer hosts. Acanthocephalans are known to require amphipods as intermediate hosts. Most all those organisms associated with the parasite life cycles prefer dwelling in the littoral zone of a lake where the greatest extent of superposition of plants and decomposition materials usually occur. Thus, in a productive area, parasitism is enhanced by this close association of fish host, intermediate host, and the larval stages of the various species of parasites.

Shore line and changes in water level: Welch (1935) stated that under strictly comparable conditions, the greater the length of shore line the greater the biological productivity. An increased irregularity of the shore line tends to produce more protected bays and coves, usually more shallow water with a resultant increase of superposition of photosynthetic and decomposition zones, and a greater diversity of bottom and margin conditions. All these produce a more desirable habitat for aquatic plants and animals. The end result is a close superposition of the parasitized and unparasitized fish populations, invertebrate and vertebrate intermediate hosts, and the various larval stages seeking necessary hosts. Bangham and Hunter (1939) and Hare (1943) noted higher fish parasitism in shallow waters.

Changes in water level, if sharp, decrease the littoral zone and, therefore, the effective superposition of the fish population and the stages in the life cycles of the various parasites and their intermediate hosts. The result would be a decrease in biological productivity with a resultant decrease of parasitism. Snails, insects, plankton, and fishes, with their parasites, may be trapped in small pools, and die as a result of oxygen depletion, high temperatures, or the complete drying of these pools. These animals, therefore, would no longer be available as hosts. Conditions such as these are constantly at work in Moose Lake and the Chippewa Flowage, the water level changes being effected in the spring (rising) and in the fall and winter (lowering) for hydroelectric purposes.

Water movements: Movements of water within a lake are produced by inlets and outlets, by underground seepage and springs, and by wind action. These movements would help to distribute floating or suspended free-living larval stages of fish parasites as well as plankters harboring larval parasites. In this way parasites may be brought into contact with hosts within other parts of a lake or the drainage system in order to complete the life cycle. Water movements may affect fish parasitism adversely by moving free-living larval parasites or parasitized plankters out of reach of the next necessary host in the life cycle. This would decrease the incidence and intensity of parasitism by breaking up the superposition of aquatic organisms.

Wave action: The action of waves on exposed shores leave them almost barren of aquatic life and, therefore, sources of parasitism as only burrowing forms can withstand the molar action of waves. Pearse (1924) stated that the small fishes living in shallow waters (exposed) have fewest parasites.

Temperature: The influence of temperature on aquatic organisms is important. The thermal stratification of lakes affects the vertical and horizontal distribution of organisms. The colder waters of the hypolimnion are not conducive to a high productivity and, therefore, concentrates much of the fauna of a lake in the epilimnion and thermocline. This limiting factor may serve to increase the superposition of hosts and parasites, resulting in a higher incidence and intensity of parasitism in fishes. Temperature affects seriously the metabolic rate of poikilothermic invertebrate and vertebrate hosts. As examples, sporocyst and cercarial development in the trematode life cycle is almost entirely arrested in snails due to cold, and conversely, is greatly enhanced by high temperatures. Fishes are known generally to harbor more parasites in the summer and fall than in the colder seasons. This may be accounted for in part by the seasonal variation of infected aquatic organisms, they being abundant in warm seasons and scarce in cold. Warm waters in all seasons have a higher productivity than cold waters, these conditions affecting parasitism of fishes. Some parasites are known to be considerably reduced in numbers or to disappear entirely from their aquatic hosts during the winter season. Temperature changes also affect the feeding rate of fishes. In the cold winter months some fishes feed very little; some such as the carp and gizzard shad, are known to sink into a stupor without feeding at all during some such periods. Since parasitism of fishes with adults is of necessity a result of their feeding on infected intermediate hosts, conditions lowering the rate of feeding would result in a lowered incidence and intensity of infection. Conversely, high summer temperatures increase the rate of food-getting with the resultant increase in the degree and variety of parasitism. Pratt (1919), Essex and Hunter (1926), and Bangham and Hunter (1939) noted a greater variety and higher parasitism in fishes during warm months.

Light: The influences of light on parasitism in fishes may be directly concerned with the organisms in the parasite life cycle or may be related to the photosynthetic process. Light is known to affect the emergence of cercariae from snails, some preferring darkness, others light, and still other coinciding with the rising or setting sun. The movements of some plankters and other aquatic organisms, including fishes, are affected by light. Diurnal movements of various invertebrates and fishes are well known. These must coincide as closely as possible with events in the parasite life cycle in order to effect the necessary steps for continued development and propagation of the parasitic species concerned. Light is essential to photosynthesis in aquatic plants, both rooted and planktonic, resulting in increased productivity of lakes. Again, parasitism in fishes may be favored. A prolonged shutting out of light from the lake during the winter, when heavy snow cover on the ice prevents light penetration, results in the inability of plants to produce its photosynthetic by-product oxygen. The effect may be a winter-kill which would affect the parasites by killing any free-swimming larval stages or the hosts harboring parasites in various stages of the life cycles. Even if the winter-kill is not complete, it would immeasurably cut down on fish parasitism due to the availability of fewer hosts essential in the life cycles.

Chemical Factors

Dissolved oxygen: In lakes there is a stratification of oxygen closely correlated with the thermal stratification. The hypolimnion is usually deficient in oxygen and, therefore, can only be invaded temporarily by most aquatic organism. These must get out of the hypolimnion or perish. No doubt many plankters bearing larval parasites or capable of serving as intermediate hosts for parasites do perish in this manner. As mentioned in connection with thermal stratification the concentration of hosts and parasites above the hypolimnion produces a greater possibility of completion of parasite life cycles. As also mentioned above a light winter-kill in lakes, resulting from a depletion of oxygen under the ice cover, decreases fish parasitism. During the summer there have occurred instances of oxygen exhaustion at night and oxygen replacement during the day in plant-choked ponds and lakes, resulting in a partial kill of fishes, plankton, and benthos. Thus it is seen that parasitism is increased or decreased by the presence or absence of a sufficient quantity of oxygen as it affects location and distribution of fishes, plankton, bottom organisms, insects and snails in relation to the parasites in their various developmental stages. An insufficient supply of oxygen can weaken a fish so that it may be more susceptible to attack by various parasites. Welch (1935) mentioned that various investigators have pointed out definite evidences of a close relation between insufficient dissolved oxygen and parasitic diseases of fishes. Elliott and Russert (1949) raised the question as to whether an infection with *Clinostomum marginatum* may disturb the oxygen demand of perch so as to make them more susceptible to oxygen deficiencies under the winter ice cover.

Carbonates: Soft waters (seepage lakes) possess very little carbonates and as a result are usually unproductive. Hard waters (drainage lakes) are usually very productive. When carbonates are scarce, then the mollusk population so necessary for trematode life cycles is absent or very much reduced because of the lack of shell building materials. Many crustaceans also seem to be reduced or lacking when carbonates are scarce, producing a noticeable lack of intermediate hosts for acanthocephalans. Both Bangham (1946, 1948) and Fischthal (1949c) have pointed out these conditions as prevalent in soft water lakes. They also mentioned that as the hardness of the water increased the incidence and intensity of parasitism increased accordingly.

Hydrogen-ion concentration (pH): Acid lakes (in part soft water and bog lakes) have little or no mollusks because the acid either dissolves or corrodes the carbonate shells, reducing trematode parasites in fishes. Plankton too is much reduced in acid waters, and cestodes and acanthocephalans are seriously reduced due to lack of necessary intermediate hosts. As neutrality and alkalinity are reached there is an increase in the biological productivity of lakes, and along with this an increase in fish parasitism is noted. Bangham (1946) noted this in northeast Wisconsin lakes in relation to largemouth bass.

Pollution: Pollution of waters with certain organic wastes, especially manures, may aid in the development of certain aquatic organisms. It is common fish management policy for small farm ponds and fish hatchery ponds to fertilize these waters with either manure or commercially prepared fertilizers in order to increase the biological productivity. Therefore, the natural drainage of manures into lakes increases their productivity, especially algae, plankton, and bottom organisms. This condition favors an increased parasitism in fishes because of the greater element of certainty for stages in the parasite life cycle finding the next hosts. Pollution with excessive creamery wastes or sewage, and with most industrial or mining wastes are usually detrimental to aquatic organisms of all kinds. These effects are brought about through the altering of the physical and especially the chemical nature of the environment. Certain essential hosts in the parasite life cycle may be eliminated. If the biochemical oxygen demand is great enough, most of the aquatic organisms, including those bearing the various stages of the parasite life cycle, would be killed. Thus parasitism certainly is reduced or entirely eliminated along with their hosts.

BIOLOGICAL FACTORS

Plankton: As has already been pointed out in the discussion of physical and chemical conditions the plankton plays an important role in the parasitism of fishes, particularly regarding the cestodes and acanthocephalans.

Benthos: The benthos (bottom fauna) of lakes is significant in the parasite life cycle. Trematodes especially make much use of this group of aquatic organisms. Snails or clams serve as the first intermediate hosts for all digenetic trematodes. In addition aquatic insects, various annelids, turbellarians, and crustaceans serve as second intermediate hosts.

Aquatic plants: As previously noted the greater the superposition of the photosynthetic zone over the decomposition zone, the greater the biological productivity of a lake. Weedy bays and shore lines produce a high incidence and intensity of parasitism, especially of trematodes in fishes, because of the greater superposition of hosts and stages in the parasite life cycles. Snails, insects, various plankters and many species of fish prefer weedy habitats. Pearse (1924), Van Cleave and Mueller (1934), and Bangham and Hunter (1933) also point out this effect on parasitism.

Food chain: Van Cleave and Mueller (1934) have stated, "When they first begin to take food, the fry of many fishes start to accumulate a parasitic population within their bodies. The food habits of a fish, and many of the conditions of its environment, influence the number and nature of the parasites which it will carry." Marshall and Gilbert (1905), Bangham and Hunter (1939), Hunter (1941) and Hare (1943) made similar observations. Van Cleave and Mueller stated further, "Regardless of feeding habit of the adult, most fresh-water fishes for a while after birth feed on plankton. Since plankton organisms serve so commonly as hosts for larval worms the young fish feeding on plankton are peculiarly open to invasion by the larval parasites. The young of fishes not infrequently have parasitic populations unlike those of the older ones of the same species and these dissimilarities may be traced directly to differences in food habits at different ages." Hare (1943) likewise noted this condition. Fishes are most heavily parasitized at the season when they are most actively feeding. However, as pointed out by Essex and Hunter (1926), there is a considerable seasonal as well as local variation in the food available to fishes.

Many of the larval worms in fishes are present because of the food habits of carnivorous fishes and of fish-eating birds. Notable examples of the latter are *Clinostomum marginatum* and various strigeids (*Neascus* spp., *Diplostomum* spp., and *Tetracotyle* spp.) among the trematodes, *Ligula intestinalis* among the cestodes, and *Contracaecum spiculigerum* among the nematodes. Reptiles are responsible for the larval nematode, *Spiroxys* sp., occurring in fishes.

Fish population: Various interrelations between species and within a single species may affect the incidence and intensity of parasitism in fishes. Species of fishes may be in constant competition with each other for mutually preferred habitats and for similar foods. Overlapping may enhance parasitism if the parasite involved reaches maturity within the different host species or if one species of fish serves as intermediate host for the parasite of another. On the other hand, if the parasite shows host-specificity, parasitism may be reduced because one of the fish species will be removing from the food supply those intermediate hosts bearing larval parasites or leave fewer intermediate hosts available for infection. Van Cleave and Mueller (1934), working with larval *Clinostomum marginatum,* and Fischthal (1949a), with the same parasite and larval *Neascus* spp., indicated that apparently within a single species of fish there may exist separate shallow water and deep water populations; this conclusion was based on the fact that inshore perch and centrarchids harbored the above named parasites, while those from the deeper, off-shore waters were almost always uninfected. Percentages of infection with any given species of parasite for a single species of fish may be misleading unless all the groups within the species are sampled.

Movements of fish of a single species through the lake would affect their parasitism. Some species of fishes migrate either seasonably (at spawning time) or regularly, and, therefore, may show a wider variety of parasites picked up in the variety of habitats visited; examples of such fishes are the northern pike, muskellonge, and walleye. Pearse (1924) noted that the highest average infection per fish occurred in those which invaded the greatest variety of habitats. He stated further that the lake with the largest variety of habitats has the greatest variety of fishes and parasites. Holl (1932) reemphasized this viewpoint. Some other species of fishes such as the cisco show vertical diurnal movements, and parasitism in these species may be associated with feeding on plankton near the surface of the lake. Still other fishes exhibit horizontal diurnal movements, spending the day in deep water and the evening or night feeding in shallow waters where most parasitism probably is acquired.

RELATIONSHIP OF LIMNOLOGICAL FACTORS IN STREAMS TO PARASITISM IN FISHES

Many of the conditions affecting parasitism of fishes in lakes apply to the stream environment. However, a number of fundamental limnological differences of significance are present for a stream which should be discussed.

PHYSICAL FACTORS

Water movements: Current in one direction is the outstanding feature of stream environments. In general the greater the velocity of the current the greater the divergence of stream and lake populations. Current tends to carry those aquatic organisms (all plankton and some benthos) subject to water movements downstream. Depending on the circumstances, it may insure completion of steps in the parasite life cycle by bringing the various developmental stages into contact with the next host, or it may break the chain of events in the life cycle by sweeping developmental stages beyond the reach of the next host. Current rate may vary considerably within the length of a stream and within any given cross section. Such differences often determine the position of organisms, and this in turn would influence the life cycles of parasites to some extent, especially where hosts in the life cycle may seek similar positions. In streams, however, this superposition of organisms is not quite as important as in lakes because the current would tend to distribute parasites and some hosts more readily and thus assure proper contacts. Currents tend to create pools beyond riffles, logs, brush, boulders and other obstructions, and provide places for fishes and other organisms to concentrate. This would tend to increase parasitism.

Temperature: Temperature in streams tends to be uniform at all depths and to follow air temperature more closely than lakes; also, thermal stratification is absent. Therefore, the kinds of organisms tend to be restricted because of only one temperature which many others might not be able to tolerate. Seasonal variations in temperature produce seasonal changes in plankton and bottom organisms. The cold water streams, trout waters, usually have a restricted fish population as well as invertebrate fauna. Bangham (1948) and Fischthal (1949c) have mentioned that cold water trout streams have a very low incidence and intensity of parasitism when compared to warm water streams.

Turbidity: The greatest extremes of turbidity occur in streams. In some streams high turbidity is an usual condition during the year, while in others it is only temporary and caused by heavy rains or spring thaws. This turbidity is largely due to silt, detritus and other non-living substances. The general effect of turbidity is to cut down light penetration, to cover over feeding and spawning areas of fishes, and under certain circumstances to cover over and smother bottom organisms and their habitats. Especially during times of high water or flood there is a general scouring of the stream bottom and shifting of materials downstream, finally settling down over the bottom after the waters recede to completely alter the habitat that previously existed. The molar action of turbid streams, especially during high water, is extreme with a considerable detrimental effect on most all aquatic organisms. The general effects of all this on parasitism in fishes in streams is tremendous, and tends toward its reduction.

Chemical Factors

Dissolved oxygen: The mechanical actions of currents provides a high supply of dissolved oxygen at all depths. This permits all organisms access to all parts of the stream without danger of oxygenless regions as in stratified lakes. This condition coupled with the current tends to permit complete distribution throughout the stream of larval parasites and their necessary intermediate hosts.

Biological Factors

Plankton: Streams have a relatively low plankton production. Inasmuch as plankters frequently serve as intermediate hosts for fish parasites, their paucity would result in a lower incidence and intensity of fish parasitism. Headwater areas are almost entirely devoid of plankton; the middle portions usually have a maximum plankton population; plankton declines in the lower sections. Therefore, within a single stream, parasitism of fishes may be correlated with the distribution of plankton, being very low or lacking in the upper portion, and more pronounced in the middle and lower sections. Backwaters and sluggish regions of streams, with conditions more like that of a lake, tend to produce more plankton with the result that fish parasitism is usually increased.

Benthos: In streams the benthos plays a most important role in fish parasitism. Due to the current the plankton is reduced and the benthos, in the form of mollusks, annelids, insects, and crustaceans, plays an important part in transfer of larval fish parasites by serving more frequently as intermediate hosts. In swift waters and in headwaters the benthos, usually insects, is the most important of the aquatic groups regarding parasitism in fishes. The riffle bottoms usually exceed the pool bottoms in productivity. In the sluggish waters and in backwaters with a soft bottom, the benthos is usually more abundant and diversified, and with the plankton, is influential in parasitism of fishes.

Aquatic plants: Aquatic plants are usually much reduced in streams. Sometimes they may grow along the edges, but with limited success. Water mosses may be found in rapid current. Backwaters and sluggish waters may develop an extensive vegetation, more of the lake type in character than of a stream. In these sluggish-water areas the vegetation serves as support for many components of the fauna. The result is a greater biological productivity because of the superposition of the photosynthetic zone over the decomposition zone. This condition always favors a higher incidence and intensity of all forms of fish parasitism. The vast majority of streams examined in northwest Wisconsin by the author were free of aquatic plants.

Food chain: In swift streams or in swift sections of streams the fishes, insects and other benthos are predominantly bottom dwellers or inhabitants of pools. They are dependent mostly on the drifting of food down to them from upstream. Therefore, parasitism of the fishes is likewise dependent on the downstream drift of larval parasites and their necessary hosts. Microorganisms form an important part of the diet. In sluggish streams and backwaters pelagic fishes and plankton are present, and feeding is usually by actively seeking the food. In this instance parasitism is usually brought about by the active feeding habits of the fishes and some intermediate hosts.

Fish population: Many of the stream fishes are common also to lakes, however, the incidence and intensity of parasitism is usually lower in the former. Some species of fishes are almost entirely confined to a stream habitat, notably the trout, many cyprinids, mudminnow, the darters, muddler, and the sticklebacks. Fishes in streams tend to seek the pools. This provides a concentration of fishes and assures passage of larval parasites encysted in fishes to those carnivorous species in the population. Fish-eating birds play an important part in parasitizing snails and subsequently fishes with larval parasites. The larval genus *Neascus* and larval *Posthodiplostomum minimum*, both reaching maturity in birds, were the most common parasites encountered in stream fishes.

EFFECTS OF PARASITISM ON THE FISH HOST

From the author's experiences in the examination of northwest Wisconsin fishes it is apparent that the condition of most fishes is not seriously handicapped by their parasite burden. There were instances where it did appear that parasitism had an adverse effect on the condition of the host but this could not be established with certainty because of the possibility of other factors within the host or its environment paralleling this parasitism and being wholly or in part responsible for the condition of the host. In the dynamics of an aquatic environment there are many factors (physical, chemical, biological) which can influence the condition of a fish or fish population. Unless all factors in the environment are understood and taken into account in the analysis of any accumulated data or unless rigid controls are maintained, it is extremely hazardous, even after statistical treatment of the data, to claim with certainty that parasitism is the cause of poor condition. Misinterpretations may easily result without the whole of the picture. It is also possible, in certain instances, that the poor condition of fishes may be due to factors other than parasitism, and that the parasites were more readily acquired as a result of greater susceptibility because of this poor condition. Investigators finding these fishes in poor condition and heavily parasitized may conclude that the condition resulted from parasitism. Here again, erroneous conclusions would be formulated unless the entire histories of the fishes were known.

Pearse (1924) stated that most fish parasites do little harm to their hosts. Pratt (1919) and Hunter (1941) mentioned that although many parasites do little damage to the fish host, they occasionally cause serious epidemics.

General debility: Due to parasitism some fishes become sluggish in their activity and are more readily captured by the angler, by other fishes, and by fish-eating reptiles, birds and mammals. Essex and Hunter (1926) related how heavily infected (with cestode larvae) large-headed, slender-bodied rainbow trout in a Montana lake were less resistant to capture than normal trout. Bangham and Hunter (1939) pointed out the sluggish condition of fishes infected with larval *Ligula intestinalis.* Hunter (1941) cited examples of sluggishness due to heavy infections with *Clinostomum marginatum* in some fishes, with larval *Ligula intestinalis* in minnows, and with larval *Schistocephalus* in coregonid fishes. As Hunter pointed out, the examples he cited were extreme ones which "serve to illustrate the point that parasites may produce a noticeable effect upon their host. Undoubtedly, moderate infections have a definite but less readily detectable effect". Elliott and Russert (1949) suggested that older perch having a heavy infection with *Clinostomum marginatum* may be more susceptible to anaerobiosis because of an increased oxygen demand or because of a generally debilitated condition due to parasitism.

Retardation of growth: Parasites are probably capable of retarding growth in fishes, but as noted above the extent to which the former alone effect growth under natural conditions is extremely difficult to ascertain. Hubbs (1927) claimed that the cyprinid, *Platygobio gracilis,* was stunted by a heavy tapeworm infection. Cross (1935, 1938), in a study on fish-parasite relationships in the Trout lake region of Wisconsin, concluded that heavily parasitized fishes were retarded in growth. However, Elliott and Russert (1949) were dissatisfied with Cross' calculations, "which were an approximate comparison of the size, as well as the number of parasites of different kinds in a fish, to the latter's size and weight."

Loss of weight: Weight loss in fishes due to parasitism also probably occurs. As noted above, it is most difficult under natural conditions to determine the extent to which parasites alone effect this weight loss. Essex and Hunter (1926) indicated that the thin, emaciated condition of rainbow trout from a Montana lake was due to heavy parasitism with a larval tapeworm. Hunter and Hunninen (1933) reported that smallmouth bass from lakes infected with larval *Proteocephalus ambloplitis* weighed less than uninfected smallmouth bass of the same age group from rivers. Hunter and Hunter (1938) found that a group of young smallmouth bass experimentally heavily infected with the larval black grub, *Crassiphiala ambloplitis,* showed a statistically significant loss of weight when compared with the control fish. This is a scientifically sound experiment and more of this general type are needed and are necessary to find out more concerning the effects of all types and degrees of parasitism on fishes. Bangham (1938) stated that centrarchids in southern Florida, when heavily infected with larval *Posthodiplostomum minimum* and nematodes, were often thin and lacked fat about their visceral organs. Cross (1938) concluded that parasitism in fishes of the Trout Lake region of Wisconsin caused a loss in weight. Bangham and Hunter (1939) mentioned that emaciation in certain fish appeared correlated with the presence of hundreds of acanthocephalans in the intestine. Woodbury (1940) and Elliott and Russert (1949), working with *Clinostomum marginatum* infections in perch, did not find any correlation between parasitism and the coefficient of condition (length-weight relationship showing the degree of relative well-being) of these fish.

Loss of sight: That parasites cause impairment of sight or complete loss of sight is a certainty. Many of northwest Wisconsin fishes possessed larval *Diplostomulum* in the humors and lenses of the eyes. Although no definitely blind fishes were taken, many had their sight impaired by the heavy infections found. Ferguson and Hayford (1941) reported blindness or impaired vision caused by larval flukes *(Diplostomum)* in the lenses of the eyes of hatchery trout and other fishes. They concluded that blind fish cannot feed properly even in a hatchery, become emaciated and sluggish, and eventually die.

Sterility: One of the most devastating parasites of fishes is the bass tapeworm, *Proteocephalus ambloplitis.* Heavy infections of the gonads with the larval stage (plerocercoid) has resulted in sterilization of adult basses of all species. The author has found largemouth and smallmouth basses in northwest Wisconsin that were completely sterile or partially so due to this larval tapeworm. Rich (1924) was one of the first to report this condition. Since that time this parasite has been reported by many different investigators from such areas as Ohio, Wisconsin, New York, Connecticut, Lake Erie, Mississippi River, Ontario, and others.

Other pathologic conditions: Much pathologic effects on the hosts' tissues were noted in northwest Wisconsin as a result of the presence of various parasites. The larval bass tapeworm, *Proteocephalus ambloplitis,* in basses especially has caused a considerable amount of adhesions in the mesentery and connecting viscera. These adhesions were so great that the organs could be separated only with great difficulty. This has also been noted by the many investigators who have reported the larval bass tapeworm from fishes in various sections of the United States and Canada. Pearse (1924) recorded destruction of liver tissue by larval tapeworms. Bangham (1938), for southern Florida, and the present author, noted that cysts of *Posthodiplostomum minimum* riddled the liver, and caused adhesions in the mesenteries in centrarchids. Hare (1943), summarizing the effects noted by others that acanthocephalans have on their hosts, stated that the Acanthocephala are so abundant in most hosts as to cause serious damage. He noted in his own collections that when the intestinal lumen was clogged, laceration of the walls with holes was frequent, resulting in inflammation and yellowing of the tissues. Similar effects produced by acanthocephalans were frequently noticed in northwest Wisconsin fishes, even in light infections. Bangham and Venard (1946) noted that leeches which attached to the inside surface of the operculum, and the acanthocephalan, *Pomphorhynchus bulbocolli,* found with their long, spiny proboscides deeply embedded in the intestine, caused considerable damage to their hosts, *Catostomus commersonnii.* Pearse (1924) mentioned copepods which suck blood from the gills as injurious to fishes. Hunter (1941) discussed *Bacterium salmonicida,* the cause of furunculosis in trout, as causing lesions in the organs and body musculature. No doubt, Wisconsin in times past has stocked infected trout from diseased hatcheries before the disease was diagnosed. Protozoan cysts caused by Microsporidia (in the flesh) and Myxosporidia (in the flesh, gills, viscera, and mesenteries) have an adverse effect on the host and no doubt makes the latter sluggish and easy prey to other animals. Lymphocystis, a virus disease of walleyes, produced huge, ugly tumor-like growths of the flesh on the outside of the body. The effect it has on the walleye population of a lake is not known; however, from tagging experiments conducted by the author in northwest Wisconsin to study migration of this fish, it was noted that the growths may entirely disappear in one year with the previously infected areas in some clearly visible because of the newly formed, somewhat differently pigmented skin over them.

TABLE 1

SUMMARY OF PARASITE SURVEY DATA, 1944–1946

FISH	NO. EXAM.	NO. INF.	% INF.	NO. WATERS EXAM.	NO. SPP. PARASITES FOUND
Acipenseridae					
1. *Acipenser fulvescens*	1	1	100	1	4
Amiidae					
2. *Amia calva*	20	20	100	7	16
Salmonidae					
3. *Salmo trutta fario*	46	20	43	10	12
4. *Salmo gairdnerii irideus*	25	19	76	3	8
5. *Salvelinus f. fontinalis*	80	47	59	11	15
Coregonidae					
6. *Leucichthys artedi*	2	2	100	1	1
Osmeridae					
7. *Osmerus mordax*	13	13	100	1	5
Catostomidae					
8. *Catostomus c. commersonnii*	312	290	93	57	36
9. *Catostomus c. catostomus*	5	5	100	1	2
10. *Hypentelium nigricans*	29	24	83	6	13
11. *Moxostoma rubreques*	20	19	95	8	15
12. *Moxostoma aureolum*	1	1	100	1	1
13. *Moxostoma erythrurum*	8	8	100	2	3
Cyprinidae					
14. *Semotilus a. atromaculatus*	108	101	94	22	21
15. *Margariscus margarita nachtriebi*	13	13	100	1	2
16. *Nocomis biguttatus*	29	29	100	5	14
17. *Rhinichthys atratulus meleagris*	21	18	86	7	5
18. *Rhinichthys c. cataractae*	26	19	73	11	9
19. *Chrosomus eos*	10	1	10	1	1
20. *Notemigonus crysoleucas auratus*	43	37	86	8	11
21. *Notropis rubellus*	12	8	67	1	4
22. *Notropis cornutus frontalis*	132	125	95	18	24
23. *Notropis hudsonius selene*	2	2	100	1	3
24. *Notropis heterodon*	23	16	70	5	5
25. *Notropis h. heterolepis*	42	37	88	5	7
26. *Hybognathus hankinsoni*	8	8	100	1	2
27. *Pimephales p. promelas*	22	22	100	3	8
28. *Hyborhynchus notatus*	51	43	84	12	14
29. *Campostoma anomalum pullum*	52	48	92	10	11
Ameiuridae					
30. *Ameiurus m. melas*	15	14	93	6	14
31. *Ameiurus n. nebulosus*	126	114	90	25	25
32. *Ameiurus n. natalis*	80	78	98	19	23
33. *Pilodictis olivaris*	6	6	100	2	4
34. *Noturus flavus*	16	16	100	3	9
35. *Schilbeodes mollis*	10	10	100	4	8
Umbridae					
36. *Umbra limi*	63	54	86	16	16

TABLE 1—*(Continued)*

SUMMARY OF PARASITE SURVEY DATA, 1944–1946

FISH	NO. EXAM.	NO. INF.	% INF.	NO. WATERS EXAM.	NO. SPP. PARASITES FOUND
Esocidae					
37. *Esox lucius*	176	176	100	35	21
38. *Esox m. masquinongy*	18	18	100	9	21
Cyprinodontidae					
39. *Fundulus diaphanus menona*	4	4	100	1	5
Gadidae					
40. *Lota l. maculosa*	9	8	89	2	5
Percopsidae					
41. *Percopsis omiscomaycus*	2	2	100	1	5
Percidae					
42. *Perca flavescens*	321	311	97	52	39
43. *Stizostedion v. vitreum*	217	217	100	32	32
44. *Hadropterus maculatus*	4	4	100	2	3
45. *Percina caprodes semifasciata*	8	8	100	4	13
46. *Boleosoma nigrum eulepsis*	32	28	88	4	14
47. *Boleosoma n. nigrum*	91	86	95	12	23
48. *Boleosoma n. eulepsis* x *B. n. nigrum*	58	47	81	11	12
49. *Poecilichthys exilis*	42	37	88	7	15
50. *Poecilichthys c. caeruleus*	9	9	100	6	8
51. *Poecilichthys* (=*Catonotus*) *flabellaris lineolatus*	58	49	84	9	15
Centrarchidae					
52. *Micropterus d. dolomieu*	27	27	100	9	28
53. *Micropterus* (=*Huro*) *salmoides*	155	149	96	46	34
54. *Lepomis cyanellus*	8	8	100	4	12
55. *Lepomis gibbosus*	282	280	99	44	32
56. *Lepomis m. macrochirus*	508	494	97	55	32
57. *Ambloplites r. rupestris*	256	254	99	42	30
58. *Pomoxis nigro-maculatus*	513	480	94	51	26
Cottidae					
59. *Cottus b. bairdii*	74	54	73	11	16
Gasterosteidae					
60. *Eucalia inconstans*	81	41	51	14	17
61. *Pungitius pungitius*	7	7	100	1	7
TOTALS	4,532	4,186	92.4	124	121+

TABLE 2

COMPARISON OF PERCENT INFECTION OF NORTHWEST WISCONSIN FISHES WITH OTHER SURVEYS

HOST FAMILY	N.W. WISCONSIN		CENTRAL STATES (ESSEX & HUNTER, 1926)		LAKE ERIE (BANGHAM & HUNTER, 1939)		S. FLORIDA (BANGHAM, 1938, 1940)		ALGONQUIN PARK LAKES (BANGHAM, 1941)		ALGONQUIN PARK LAKES (BANGHAM & VENARD, 1946)		REELFOOT LAKE (BANGHAM & VENARD, 1942)		PORTAGE LAKES (HARE, 1943)		N. WISCONSIN (BANGHAM, 1946)		WYOMING (BANGHAM, 1951)	
	No. Exam.	% Inf.	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Acipenseridae	1	100	2	50	2	100	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Amiidae	20	100	13	77	4	100	21	100	....	....	....	....	11	100	....	....	8	100	....	....
Salmonidae	151	57	15	67	63	64	....	....	12	42	27	100	....	....	....	....	30	33	620	91
Coregonidae	2	100	....	....	108	53	....	....	36	97	25	96	....	....	....	....	12	83	23	100
Osmeridae	13	100	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Catostomidae	375	98	145	36	92	28	70	94	57	98	53	98	22	100	....	....	81	95	335	80
Cyprinidae	594	89	36	22	672	43	95	53	194	64	374	58	12	67	16	19	53	43	1519	96
Ameiuridae	253	94	127	43	75	73	89	98	65	100	11	100	100	97	5	80	54	100	....	....
Umbridae	63	86	....	....	12	50	....	....	....	....	....	....	2	50	....	....	20	70	....	....
Esocidae	194	100	8	75	13	62	10	100	....	....	....	....	....	....	1	100	54	100	....	....
Cyprinodontidae	4	100	....	....	31	42	232	83	....	....	....	....	37	94	....	....	1	100	....	....
Gadidae	9	89	....	....	10	100	....	....	14	100	15	100	....	....	....	....	2	100	....	....
Percopsidae	2	100	....	....	53	82	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Percidae	840	95	14	86	428	69	....	....	58	100	84	96	15	60	11	36	357	97	....	....
Centrarchidae	1749	96	139	60	395	74	516	99	123	100	81	100	275	97	66	90	628	99	....	....
Cottidae	74	73	....	....	7	29	....	....	....	....	....	....	....	....	....	....	2	0	50	48
Gasterosteidae	88	55	....	....	22	18	....	....	....	....	7	0	....	....	....	....	28	71	....	....

TABLE 3

CHECK LIST OF PARASITES, 1944–1946

TREMATODA

Parasite	No. Spp. Fish Infected
1. *Acolpenteron catostomi* Fischthal and Allison, 1942	1
2. *Allocreadium ictaluri* Pearse, 1924	1
3. *Allocreadium lobatum* Wallin, 1909	6
4. *Allocreadium* sp.	1
5. *Alloglossidium corti* (Lamont, 1921)	6
6. *Alloglossidium geminus* (Mueller, 1930)	3
7. *Anonchohaptor anomalum* Mueller, 1938	1
8. *Azygia augusticauda* (Stafford, 1904)	15
9. *Bucephalopsis pusilla* (Stafford, 1904)	1
10. *Bucephalus elegans* Woodhead, 1930	8
11. *Bucephalus* sp.	1
12. *Bunodera leuciopercae* (Mueller, 1776)	1
13. *Bunodera sacculata* Van Cleave and Mueller, 1932	2
14. *Bunoderina eucaliae* Miller, 1938	2
15. *Caecincola parvulus* Marshall and Gilbert, 1905	2
16. *Clinostomum marginatum* (Rudolphi, 1819)	27
17. *Crepidostomum cooperi* Hopkins, 1931	14
18. *Crepidostomum cornutum* Osborn, 1903	7
19. *Crepidostomum farionis* (Mueller, 1788)	2
20. *Crepidostomum isostomum* Hopkins, 1931	4
21. *Crepidostomum lintoni* (Pratt in Linton, 1901)	1
22. *Crepidostomum* sp.	1
23. *Cryptogonimus chyli* Osborn, 1903	8
24. *Diplostomulum scheuringi* Hughes, 1929	20
25. *Diplostomulum* spp.	35
26. Gyrodactyloidea	30
27. *Macroderoides flavus* Van Cleave and Mueller, 1932	2
28. *Macroderoides parvus* (Hunter, 1932)	1
29. *Macroderoides spiniferus* Pearse, 1924	1
30. *Neascus* spp.	43
31. *Octomacrum lanceatum* Mueller, 1934	2
32. *Phyllodistomum brevicecum* Steen, 1938	1
33. *Phyllodistomum etheostomae* Fischthal, 1942	4
34. *Phyllodistomum lachancei* Choquette, 1947	1
35. *Phyllodistomum lysteri* Miller, 1940	1
36. *Phyllodistomum nocomis* Fischthal, 1942	1
37. *Phyllodistomum notropidus* Fischthal, 1942	1
38. *Phyllodistomum pearsei* Holl, 1929	1
39. *Phyllodistomum* spp.	2
40. *Phyllodistomum staffordi* Pearse, 1924	3
41. *Phyllodistomum undulans* Steen, 1938	1
42. *Plagiocirrus primus* Van Cleave and Mueller, 1932	2
43. *Plagioporus sinitsini* Mueller, 1934	2
44. *Posthodiplostomum minimum* (MacCallum, 1921)	25
45. *Rhipidocotyle papillosum* (Woodhead, 1929)	3
46. *Sanguinicola huronis* Fischthal, 1949	2
47. *Sanguinicola occidentalis* Van Cleave and Mueller, 1932	2

TABLE 3—*(Continued)*

CHECK LIST OF PARASITES, 1944–1946

Parasite	No. Spp. Fish Infected
48. *Sanguinicola* spp.	2
49. *Tetracotyle* spp.	19
50. Trematoda—larval spp.	4
51. *Triganodistomum attenuatum* Mueller and Van Cleave, 1932	2
CESTODA	
1. *Abothrium crassum* (Block, 1779)	1
2. *Biacetabulum infrequens* Hunter, 1927	1
3. *Biacetabulum* sp.	3
4. *Bothriocephalus claviceps* (Goeze, 1782)	2
5. *Bothriocephalus cuspidatus* Cooper, 1917	8
6. *Bothriocephalus formosus* Mueller and Van Cleave, 1932	4
7. *Bothriocephalus* sp.	3
8. Caryophyllaeidae	3
9. *Corallobothrium fimbriatum* Essex, 1927	4
10. *Corallobothrium giganteum* Essex, 1927	1
11. *Glaridacris catostomi* Cooper, 1920	3
12. *Glaridacris confusus* Hunter, 1929	2
13. *Glaridacris intermedius* Lyster, 1940	1
14. *Haplobothrium globuliforme* Cooper, 1914	1
15. *Hymenolepis* sp.	2
16. *Ligula intestinalis* (Linnaeus, 1758)	2
17. *Pliovitellaria wisconsinensis* Fischthal, 1951	2
18. *Proteocephalus ambloplitis* (Leidy, 1887)	16
19. *Proteocephalus fluviatilis* Bangham, 1925	2
20. *Proteocephalus pearsei* LaRue, 1919	17
21. *Proteocephalus perplexus* LaRue, 1911	1
22. *Proteocephalus pinguis* LaRue, 1911	4
23. *Proteocephalus* spp.	26
24. *Proteocephalus stizostethi* Hunter and Bangham, 1933	5
25. *Triaenophorus nodulosus* (Pallas, 1781)	9
26. *Triaenophorus stizostedionis* Miller, 1945	2
NEMATODA	
1. *Camallanus oxycephalus* Ward and Magath, 1917	22
2. *Capillaria catenata* Van Cleave and Mueller, 1932	7
3. *Contracaecum brachyurum* (Ward and Magath, 1917)	5
4. *Contracaecum* spp.	40
5. *Cucullanus* sp.	1
6. *Cystidicola stigmatura* (Leidy, 1886)	1
7. *Dichelyne cotylophora* (Ward and Magath, 1917)	7
8. *Dichelyne robusta* (Van Cleave and Mueller, 1932)	3
9. *Dichelyne* sp.	1
10. *Hepaticola bakeri* Mueller and Van Cleave, 1932	2
11. *Metabronema salvelini* (Fujita, 1920)	3
12. Nematoda—larval sp.	1
13. *Philometra cylindracea* (Ward and Magath, 1917)	2

TABLE 3—(*Continued*)

CHECK LIST OF PARASITES, 1944–1946

PARASITE	NO. SPP. FISH INFECTED
14. *Philometra nodulosa* Thomas, 1928	2
15. *Philometra* spp.	3
16. Oxyuridae	1
17. *Rhabdochona cascadilla* Wigdor, 1918	14
18. *Rhabdochona* sp.	1
19. *Spinitectus carolini* Holl, 1928	15
20. *Spinitectus gracilis* Ward and Magath, 1917	17
21. *Spiroxys* sp.	22
ACANTHOCEPHALA	
1. *Leptorhynchoides thecatus* (Linton, 1891)	37
2. *Neoechinorhynchus crassus* Van Cleave, 1919	4
3. *Neoechinorhynchus cylindratus* (Van Cleave, 1913)	12
4. *Neoechinorhynchus rutili* (Mueller, 1780)	4
5. *Neoechinorhynchus saginatus* Van Cleave and Bangham, 1949	1
6. *Neoechinorhynchus* spp.	5
7. *Neoechinorhynchus tenellus* (Van Cleave, 1913)	3
8. *Octospinifer macilentus* Van Cleave, 1919	1
9. *Pomphorhynchus bulbocolli* Linkins, 1919	31
PROTOZOA	
1. *Chloromyxum* spp.	4
2. *Epistylis* spp.	4
3. Microsporidia	1
4. Myxosporidia	29
5. *Trichodina renicola* (Mueller, 1931)	1
6. *Trichodina* spp.	20
COPEPODA	
1. *Achtheres micropteri* Wright, 1882	4
2. *Argulus catostomi* Dana and Herrick, 1837	2
3. *Argulus versicolor* Wilson, 1902	3
4. *Ergasilus caeruleus* Wilson, 1911	6
5. *Ergasilus* sp.	2
MOLLUSCA	
1. Glochidia	34
HIRUDINEA	
1. *Illinobdella moorei* Meyer, 1940	1
2. *Illinobdella* spp.	9
VIRUS	
1. Lymphocystis	1

REFERENCES

BANGHAM, R. V. 1938. Parasites of Centrarchidae from southern Florida. Trans. Amer. Fish. Soc. 68: 263–268.

——— 1940. Parasites of fresh-water fish of southern Florida. Proc. Florida Acad. Sc. 5: 289–307.

——— 1941. Parasites of fish of Algonquin Park lakes. Trans. Amer. Fish. Soc. 70: 161–171.

——— 1946. Parasites of northern Wisconsin fish. Trans. Wisconsin Acad. Sc., Arts & Let. 36: 291–325.

——— 1948. Variation in distribution of Wisconsin fish parasites. J. Parasitol. 34(6,Sect.2): 21.

——— 1951. Parasites of fish in the Upper Snake river drainage and in Yellowstone lake, Wyoming. Zoologica 36: 213–217.

BANGHAM, R. V. and HUNTER, G. W., III. 1939. Studies on fish parasites of Lake Erie. Distribution studies. Zoologica 24: 385–448.

BANGHAM, R. V. and VENARD, C. E. 1942. Studies on parasites of Reelfoot lake fish. IV. Distribution studies and checklist. J. Tennessee Acad. Sc. 17: 22–38.

——— ——— 1946. Parasites of fish of Algonquin Park lakes. II. Distribution studies. Publ. Ontario Fish. Res. Lab. No. 65: 33–46.

CHOQUETTE, L. P. E. 1947. *Phyllodistomum lachancei* sp. nov., a trematode from the ureters of *Salvelinus fontinalis* (Mitchill), with a note on its pathogenicity. Canadian J. Res., D 25: 131–134.

——— 1948. On the species of the genus *Metabronema* Yorke and Maplestone, 1926, parasitic in trout and char. Canadian J. Res., D 26: 329–333.

CROSS, S. X. 1935. The effect of parasitism on growth of perch in the Trout lake region. J. Parasitol. 21: 267–273.

——— 1938. A study of the fish parasite relationships in the Trout lake region of Wisconsin. Trans. Wisconsin Acad. Sc., Arts & Let. 31: 439–456.

ELLIOTT, A. M. and RUSSERT, L. R. 1949. Some condition characteristics of a yellow perch population heavily parasitized by *Clinostomum marginatum*. J. Parasitol. 35: 183–190.

ESSEX, H. E. and HUNTER, G. W., III. 1926. A biological survey of fish parasites from the Central States. Trans. Illinois Acad. Sc. 19: 151–181.

FERGUSON, M. S. and HAYFORD, R. A. 1941. The life history and control of an eye fluke. Prog. Fish-Cult., Memo. I–131, No. 54: 1–13.

FISCHTHAL, J. H. 1947. Parasites of northwest Wisconsin fishes. I. The 1944 survey. Trans. Wisconsin Acad. Sc., Arts & Let. 37: 157–220.

——— 1949a. The over-wintering of black grubs and yellow grubs in fish. J. Parasitol. 35: 191–192.

——— 1949b. *Sanguinicola huronis* n. sp. (Trematoda: Sanguinicolidae) from the blood system of largemouth and smallmouth basses. J. Parasitol. 35: 566–568.

——— 1949c. Parasites of northwest Wisconsin fishes. J. Parasitol. 35 (6, Sect.2): 30.

——— 1950a. Additional hosts and geographical distribution records for the common fish acanthocephalan, *Leptorhynchoides thecatus*. J. Parasitol. 36: 88.

——— 1950b. Parasites of northwest Wisconsin fishes. II. The 1945 survey. Trans. Wisconsin Acad. Sc., Arts & Let. 40 (Pt.1): 87–113.

——— 1951. *Pliovitellaria wisconsinensis* n. g., n. sp. (Cestoda: Caryophyllaeidae) from Wisconsin cyprinid fishes. J. Parasitol. 37: 190–194.

——— 1952. Parasites of northwest Wisconsin fishes. III. The 1946 survey. Trans. Wisconsin Acad. Sc., Arts & Let. 41: 17–58.

HARE, R. C. 1943. An ecological study of the worm parasites of Portage Lakes fishes. Ohio J. Sc. 43: 201–208.

HOLL, F. J. 1932. The ecology of certain fishes and amphibians with special reference to their helminth and linguatulid parasites. Ecol. Monogr. 2: 83–107.

HUBBS, C. L. 1927. The related effects of a parasite on a fish. J. Parasitol. 14: 75–84.

HUNTER, G. W., III. 1941. Studies on the parasites of fresh-water fishes of Connecticut. In "A fishery survey of important Connecticut lakes". Bull. Connecticut Geol. & Nat. Hist. Surv. No. 63: 228–288.

HUNTER, G. W., III and HUNNINEN, A. V. 1933. Studies on the plerocercoid larva of the bass tapeworm, *Proteocephalus ambloplitis* (Leidy), in the small-mouthed bass. In "A biological survey of the Raquette watershed." Suppl. 23rd Ann. Rept. New York St. Conserv. Dept. 1933: 255–261.

HUNTER, G. W., III and HUNTER, W. S. 1938. Studies on host reactions to larval parasites. I. The effect on weight. J. Parasitol. 24: 477–481.

LINCICOME, D. R. and VAN CLEAVE, H. J. 1949. Distribution of *Leptorhynchoides thecatus*, a common acanthocephalan parasitic in fishes. Amer. Midl. Nat. 41: 421–431.

MARSHALL, W. S. and GILBERT, N. C. 1905. Notes on the food and parasites of some fresh-water fishes from the lakes at Madison, Wisconsin. Rept. U. S. Fish. Comm. 1904: 513–522.

PEARSE, A. S. 1924. The parasites of lake fishes. Trans. Wisconsin Acad. Sc., Arts & Let. 21: 161–194.

PRATT, H. S. 1919. Parasites of fresh-water fishes. Econ. Circ. U. S. Bur. Fish. No. 42: 1–8.

RICH, W. H. 1924. Progress in biological inquiries, 1923. Rept. Div. Sc. Inq. Fiscl. Yr. 1923, Appendix VII. Rept. U. S. Comm. Fish. 1923, Bur. Fish. Doc. No. 956: 1–27.

VAN CLEAVE, H. J. and MUELLER, J. F. 1934. Parasites of Oneida lake fishes. Part III. A biological and ecological survey of the worm parasites. Roosevelt Wild Life Ann. 3: 161–334.

WARD, H. B. 1910. Internal parasites of the Sebago salmon. Bull. U. S. Bur. Fish. 28: 1151–1194.

WELCH, P. S. 1935. Limnology. McGraw–Hill, N. Y. 471 pp.

WOODBURY, L. A. 1940. A quantitative study of parasites of fishes with special reference to *Clinostonum marginatum* in the perch in Walsh Lake, Michigan. Ph.D. Thesis, Univ. of Michigan.

THE CHEESE MANUFACTURING REGIONS OF WISCONSIN, 1850–1950

LOYAL DURAND, JR.
University of Tennessee

ANTECEDENTS OF THE INDUSTRY IN WISCONSIN

The manufacture of cheese, throughout three hundred years of American history, has "moved" from east to west across the northern portion of the nation—the agricultural region utilized for dairying, and known today as the American Dairy Region. The colonists of Rhode Island, Connecticut, and eastern Massachusetts were the main dairymen and cheesemakers of an early period, and Narragansett cheeses of Rhode Island, Braintree cheeses of Massachusetts, and Litchfield cheeses of Connecticut were well known in the seaboard markets of the colonies. In time, cheese manufacture was transported to interior New England, particularly the Berkshire region of Massachusetts and to Vermont as those areas were settled.

The settlement of upstate New York by New Englanders, following the Revolutionary War, resulted in the transfer of cheese manufacture to the Mohawk Valley and to western New York. New York State superseded New England as the great cheese state. The settlements of New Englanders in the Western Reserve of Ohio (the northeastern portion of that state) likewise resulted in the rise of an important cheese industry. For fifty years or more the Western Reserve bore the nickname "Cheesedom," and, during the period of one hundred years ago, New York State and Ohio contributed the bulk of the cheese manufactured in the United States. The cheese was marketed under either a regional name, as in New England, or as New York cheese. Actually nearly all of the production consisted of the English-style Cheddar Cheese, now known in the United States as American Cheese.[1]

---

[1] For a more detailed study of the historical geography of cheese manufacture in New England, New York, and Ohio see Loyal Durand, Jr., The Migration of Cheese Manufacture in the United States, *Annals of the Association of American Geographers,* Vol. 42, 1952, pp. 263–282. Further references are cited in this article.

Cheese Manufacture During the Settlement Days in Wisconsin

The southeastern portion of Wisconsin was settled during the 1830's and 1840's by pioneers who moved from the East by way of the Erie Canal–Great Lakes waterway. These settlers arrived mainly from New York State, but many Vermonters and other eastern Americans were among them.[2] Milwaukee and Southport (now Kenosha) were important points of entry, and from these ports the New Yorkers and Yankees spread to the interior counties of the extreme southeast.[3]

During the late 1840's the first of several waves of foreign immigrants also began to reach Wisconsin; Germans entered the lakeshore counties north of Milwaukee, Swiss settled in Green County, and Norwegians founded several communities.[4]

Dairying and cheese manufacture was important on some farms of southeastern Wisconsin from the days of earliest settlement. Some of the Eastern settlers, particularly New Yorkers who had moved from cheese regions, engaged in the manufacture of farm-dairy cheese almost from the time of their advent in their new homes.[5] The Census of 1850 records that 400,283 pounds of cheese were made on the farms of Wisconsin during 1849, a very respectable total considering the short time that settlers had been in the region. Kenosha County, the heart of Yankee settlement, produced 57,271 pounds of cheese, or nearly 15 per cent of the total. Other counties "high" in output were Walworth (53,240), Waukesha, Racine, Rock, Jefferson, Dodge, and Dane. At this time the "German" counties north of Milwaukee had practically no production, and the "Swiss" county of Green produced only 8,417 pounds.[6]

---

[2] The reader is referred to the numerous publications of the Wisconsin Historical Society if he is interested in more detail. The purpose of this paper is not that of dealing with the settlement, but with the cheese industry as influenced in part by that settlement.

[3] See Joseph R. Schafer, The Yankee and the Teuton in Wisconsin, *Wisconsin Magazine of History.* Vol. 6, Pt. 1, Dec. 1922, pp. 125–145. Pt. 2, Dec. 1922, pp. 261–279. Pt. 3, March 1923, pp. 386–402. Pt. 4, Vol. 7, Sept. 1923, pp. 3–19. Pt. 5, Dec. 1923, pp. 148–171.

[4] Guy-Harold Smith, The Settlement and the Distribution of the Population in Wisconsin, *Transactions of the Wisconsin Academy of Sciences, Arts and Letters,* Vol. 24, 1929, pp. 53–107.

[5] The first successful cheese factory in the United States was not established until 1851. Farm-dairy cheese was made at home before this.

[6] This original low output of the "foreign" areas is not surprising, despite popular belief to the contrary. Well-documented sources in the State Historical Library show that the Swiss, like others on the frontier, were originally wheat farmers, and turned to dairying in numbers only after their hilly fields became badly eroded, and their wheat became subject to the difficulties which beset wheat elsewhere in Wisconsin. Once the shift was made, however, they became avid dairymen. It was mainly the eastern American (called Yankee at the time, even though he need not have come from New England) who introduced cheese manufacture to Wisconsin.

Cheese Manufacture During the "Wheat Period" in Wisconsin

Wisconsin's cheese production was 1,104,300 pounds during 1859. At this time the state was still in the midst of its wheat boom; in fact the year 1860 witnessed the largest wheat crop grown in the state (but not the largest acreage). Thus, even during the wheat period of Wisconsin's agricultural history the farm-dairy manufacture of cheese was important, particularly in the southeast. Settlers from Ohio, as well as from New York and New England, were of importance in cheese manufacture. John V. Robbins of the Town of Burke, Dane County, who had migrated there from Cincinnati, exhibited a farm-dairy cheese weighing 650 pounds at the Wisconsin State Fair of 1859, and one weighing 1650 pounds at the Fair in 1860.[7] Many of the cheese producers of the southeastern part of the state worked cooperatively; neighbors "changed milk," one making the cheese one day and another the next out of the combined neighborhood supply of milk.[8] In fact, Koshkonong, Wisconsin, claims a "co-operative cheese factory" dating from 1848 or 1849, prior to the establishment of the first cheese factory in the United States in 1851 in Oneida County, New York; it was, however, not the actual forerunner of the cheese factory system, as was the Williams factory of New York.

The entire setting of the settled portions of Wisconsin, during the early period under discussion, was mainly that of a wheat state on the frontier. Dairying and cheese-making, although important over wide areas, was subordinated, except in a few regions, to wheat culture. The state was a leading wheat producer during the 1850's. By 1860 wheat occupied 15 per cent of the cultivated land, and was grown on more than a million acres; during the Civil War Wisconsin was the "granary" of the North; Milwaukee in 1862 led all wheat markets of the World. In 1878 over two million acres of wheat were harvested, the top year in acreage. However, the top in wheat production had been reached on the smaller acreage of 1860—nearly 30 million bushels. The late 1860's and 1870's saw declining wheat yields. Soils had been depleted by one-crop agriculture, chinch bugs had seriously affected the crop of several years, and rusts, smuts, blight diseases, and winter-killing had taken tolls. In the ten years 1878 to 1887, wheat acreage declined from over two million to less

---

[7] Charles L. Hill, John V. Robbins, Pioneer Agriculturist, *Wisconsin Magazine of History,* Vol. 34, No. 4, Summer 1951, p. 231.

[8] Benjamin H. Hibbard, The History of Agriculture in Dane County, Wisconsin, *Bulletin of the University of Wisconsin, No. 101,* Madison, 1904, p. 158.

than one million, and in 1895 it was down to only 300,000 acres in the entire state. The farmers of Wisconsin by this time could not compete in wheat with the newer lands of the prairies farther west; wheat declined in both actual acreage and in the percentage of cultivated land it occupied, until it soon was down to less than one per cent—the present situation.

Dairying became much more important in Wisconsin as wheat declined; the increased dairying added to, and built on, the foundation that had been made by some of the Eastern Americans and a few foreign settlers, from the start of settlement. In other words, while it is commonly said that "the state shifted from wheat to dairying," the shift was not made by the many individuals and regions which had been important in cheese and butter production from the first. The increase in dairying, and in cheese manufacture, was owing to many reasons.[9] Among these were: (1) the environmental similarity to New York dairy regions; (2) the fact that many settlers had possessed experience in dairying during their youth on the farms of New York and western New England; (3) recommendations made by many persons of the Wisconsin Agricultural Experiment Station; (4) the energy and enthusiasm of Governor Hoard, both officially and unofficially; (5) the early start made in dairying by hundreds of eastern settlers in their new homeland, many of whom had prospered during the time their neighbors had been beset by difficulties with wheat,—hence they served as examples to be copied in their neighborhoods; (6) the presence, in compact colonies, of Swiss in parts of southwestern Wisconsin and of Germans along the lake shore north of Milwaukee, many of whom, like the New Yorkers, had possessed dairy experience in their homelands; and (7) numerous other reasons, prominent locally. Negatively, as the shift was made from wheat, the Wisconsin farmers, owing to the environmental framework, could not engage in the Corn Belt agriculture which was developing to their south in Illinois.

Access to eastern markets was undoubtedly of great advantage to Wisconsin as it shifted from wheat to dairying. The lake route was utilized during the open season from the days of earliest settlement. However, by the 1850's and 1860's through railroad lines from Chicago to the East had been well established, and trunk and branch lines reached practically all parts of settled Wisconsin. The refrigerator railroad car had been perfected dur-

[9] A detailed account of the rise in dairying from the geographical viewpoint is given in: Glenn T. Trewartha, The Dairy Industry of Wisconsin as a Geographic Adjustment, *Bulletin of the Geographical Society of Philadelphia,* Vol. 23, 1925, pp. 93–119.

ing the period of 1870 to 1875, and "through fast freight" service was available. The railroads, anxious for business, promulgated special rates. Beginning with 1874, it was possible to ship Wisconsin cheese to New York in refrigerator cars for $1.00 per hundred pounds.[10] After this date Wisconsin joined New York in becoming an important exporter of cheese to Great Britain, and Wisconsin cheese competed with New York cheese in the cities of the Atlantic Seaboard.

THE DEVELOPMENT OF CHEESE FACTORIES IN WISCONSIN

The first cheese factory in Wisconsin was built in 1864 at Ladoga in Fond du Lac County by Chester Hazen, a transplanted New Yorker. Other early factories were erected in Bear Valley, Richland County, and in the southeastern counties. Between 1864 and 1870 fifty-three American cheese factories were built. The first Swiss cheese factory was built in 1870 near Monticello, Green County, by Niclas Gerber, a Swiss immigrant, who had previously spent several years making Limburger cheese in the Mohawk Valley of New York.[11] Following this year, the expansion in number of cheese factories was very rapid.

By the end of the nineteenth century several specialized cheese regions had developed (Fig. 1). Wisconsin's cheese production was 77,748,600 pounds, Ohio had been passed (1880) in production, Wisconsin had surpassed New York State in number of cheese factories, and was about to pass that state in cheese production, and assume first rank in the nation—this occurred between 1900 and 1910. By 1899, Wisconsin contained some 1,500 factories, located at rural crossroads—the central place to which farmers delivered their milk; of these 1,227 were making cheese alone.[12]

---

[10] Glenn T. Trewartha, The Green County, Wisconsin, Foreign Cheese Industry, *Economic Geography,* Vol. 2, 1926, p. 302.

[11] The relatively slow start of the Swiss cheese region in Wisconsin is shown by the fact that the cheese production of Green County in 1859 was only 7600 pounds, *less* than in 1849, while the state increase during these years was from 400,000 to more than a million pounds. This is even further evidence that it was the Eastern Americans rather than the "foreigners" who were the mainstay of the early industry in Wisconsin.

[12] The Commissioner of Agriculture in Wisconsin lists 2,522 dairy manufacturing plants operating in 1895–1896. Of these, 951 are listed as creameries, and 1,571 as cheese factories, but no distinction is made of combined butter and cheese plants. (*Biennial Report of the Dairy and Food Commissioner of Wisconsin for the years 1895-1896,* Madison, 1896). The United States Census of 1900 credits Wisconsin with 1,227 cheese factories making cheese only (see Table VII), and 60 combined cheese and butter factories. The first listing made in Wisconsin, that of 1892, contains names of plants as cheese factories which were later listed as creameries. These were apparently combined plants. The 1,571 cheese factories listed by the state are seemingly more nearly correct in this case, and the Census figure of 1,227 is possibly too low.

The great increase in number of cheese factories, and in cheese production in Wisconsin after 1870, was attendant upon many favorable market factors. Among these were: (1) the increasing market in the growing industrial cities of the Atlantic Seaboard and the Great Lakes shorelands, and (2) the important *(at that time)* overseas market in Great Britain, which was served mainly by the cheese regions of New York and Wisconsin, although Canada was a growing competitor during the 1880's, and virtually captured the entire British market by the late 1890's. So important was the British trade during this period that Wisconsin, like New York, received official complaints from England whenever cheese was not of high quality, or when "filled cheese" was shipped overseas.[13]

Regionalization of Wisconsin Cheese Regions to 1900

Cheese manufacture in Wisconsin was highly regionalized (Fig. 1). Two main areas stood out by 1900—(1) the lakeshore counties north of Milwaukee, and (2) part of southwestern Wisconsin. Within these areas, and adjacent to them, however, there were five well-developed cheese regions. These were based on (1) location and (2) the type of cheese manufacturd—whether the American cheddar cheese or a foreign variety, such as Swiss or Limburger. The five regions were:

1. The American cheese region of the extreme southeast of the state—Kenosha, Racine, Walworth, Waukesha, and nearby counties. This was the core region of original cheese manufacture based on Eastern American settlement.

---

[13] An example, published in the *First Annual Report, State Dairy and Food Commissioner of Wisconsin, 1890,* Madison, 1890, is the following—a letter from seven members of the Liverpool Trade Association written on March 26, 1890, to H. C. Thom, Dairy Commissioner of Wisconsin:

"Dear Sir: We desire to inform you that a committee of the undersigned has been appointed by this Association to watch the interests of the cheese trade, which are being seriously menaced by the continued increase in the manufacture of the article known as 'filled cheese.' . . .

"The legitimate interests of the 'Trade' are seriously imperiled, and the reasonable expectation of the consumer disappointed, and we are clearly of the opinion that the distribution of 'filled' cheese is disgusting to the British public with the pure article, and that our Trade and mutual interests are in danger of suffering a permanent and lasting injury.

"We are in communication with the Home Sanitary authorities, are placing the matter before our Agricultural Government department, and members of the House of Commons. . . ."

Of interest in the increasing awareness of Wisconsin in its position in cheese manufacture was the reply, which pointed out that no filled cheese was being manufactured in the state as of 1890, but admitted that some Wisconsin skimmed milk was being hauled six miles into Illinois for filling. The "filling" of cheese was usually with oleo oil; in other words this was substituted for butterfat. New York outlawed this practice during the 1880's, and Wisconsin soon followed suit with the enactment of stricter dairy regulations.

2. The Brick cheese region of Dodge County, also in glaciated southeastern Wisconsin northwest of Milwaukee. Although Brick cheese is classed as a "foreign" cheese, it was actually developed in Dodge County in the late 1860's by John Jossi, a cheesemaker who was interested in perfecting a type intermediate between Swiss and Limburger.
3. The American cheese region of the eastern lakeshore counties of Wisconsin. This extended from Milwaukee north to Green Bay and out the Door Peninsula, and inland to the Fox River Valley—Lake Winnebago countryside. The region centered on Sheboygan County. Much of this area received the bulk of the early German settlement in Wisconsin,[14] but had earlier a veneer of Eastern Americans who preceded the Germans and other foreign colonists—such as the Bohemians of parts of Manitowoc County, Belgians in Kewaunee and Door counties, Luxemburgers in northern Ozaukee County, Dutch in southeastern Sheboygan County, and others.
4. The Swiss and Limburger cheese region centering on the Swiss colonies of Green County.
5. The American cheese region of the southwest. This was north and northwest of the Swiss area, but contiguous to it. Included in this region were parts of Iowa, Grant, Richland, and Sauk counties.

In addition to the well-defined regions of cheese specialization, cheese was manufactured in scattered locations in the Driftless Area of western Wisconsin, and in the north-central area of developing agriculture. This latter region, destined to become one of Wisconsin's leading cheese regions of the twentieth century was beginning to be outlined in 1900, particularly by the increasing concentration of cheese factories in northwestern Wood, northeastern Clark, and western Marathon counties (Fig. 1). During this period, however, much of the region was still in its lumber era, or was just emerging into the period of agricultural development.

Wisconsin Cheese Regions at the Close of the Nineteenth Century

The reasons for the locations and the type of product of the cheese regions of Wisconsin are varied from place to place. Although some are clear (i.e., transfer by New Yorkers of

[14] For a map of the main regions of German settlement in Wisconsin see Loyal Durand, Jr., Dairy Barns of Southeastern Wisconsin, *Economic Geography,* Vol. 19, 1943, pp. 37–44.

American cheese production to southeastern Wisconsin and knowledge of Swiss types of cheese by many Swiss colonists who had had experience in the industry before they came to America) others are more involved. Many factors entered the picture, although they all operated under the general setting of a favorable climatic, economic, and human environment. The present paper does not purport to explain these; the following summary deals, rather, with the historical geography of the cheese regions as they existed at the close of the nineteenth century. As in New York, northeastern Ohio, and even in Europe at the time, *cheese manufacture in Wisconsin was carried on in highly specialized regions.* These did not include all of the dairy districts of the state; other regions, for example, specialized in the manufacture of butter.

(1) The Southeastern American cheese region, at the close of the century, had 72 cheese factories. Twenty of these were concentrated in Jefferson and Walworth counties in the environs of Whitewater. There were factories in the extreme southeast corner of the state, at that time well beyond the outer limits of the Chicago milkshed, and even in Milwaukee County. Unlike the other cheese regions, this area likewise contained many creameries and was important in butter production, and, also unlike other regions, it had passed its peak in number of factories. This was apparently attained during the 1880's. The peak cheese production of the extreme southeast was also attained during the 1880's; Kenosha County was higher in output at this time than in 1900, and Walworth County, during 1885, produced 2¼ million pounds of cheese, and Jefferson over 3 million pounds, and were fourth and third, respectively, in cheese manufacture among Wisconsin counties—positions they had lost by 1900.

(2) The Dodge County Brick cheese region was highly localized, but overspread slightly into adjacent counties. Dodge County alone contained 122 rural crossroads cheese factories, many of them less than two miles from one another.

(3) The cool eastern lakeshore region north of Milwaukee led Wisconsin as a *region* in numbers of factories and in cheese production. It contained well over 600 rural crossroads cheese factories, and was the heart area for the production of American cheese. Sheboygan County was the core of the region, and possessed 136 cheese factories, or one factory for *every 3.8 square miles of area.* Within the county, the marketing center of Plymouth, by the 1890's, had superseded Little Falls and other New York markets as the price-quoting center of the United States American cheese industry, and was the headquarters of the

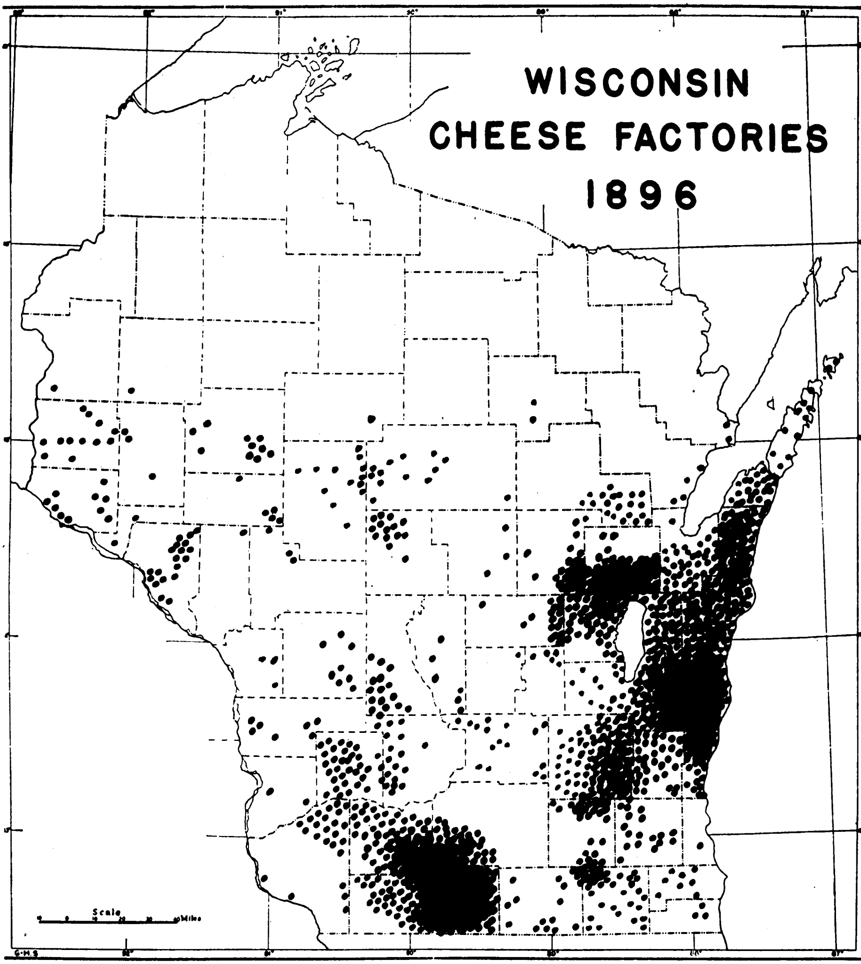


FIGURE 1. Wisconsin Cheese Factories, 1896. At this time the counties of the extreme southeast had passed their peak in number of factories. The Eastern Lakeshore American Cheese Region and the Green County Foreign Cheese Region of the southwest were outstanding; note the extreme concentration of cheese factories in both Sheboygan and Green counties. The Dodge County Brick Cheese Region was contiguous with the Eastern Lakeshore Region on the former's northeast.

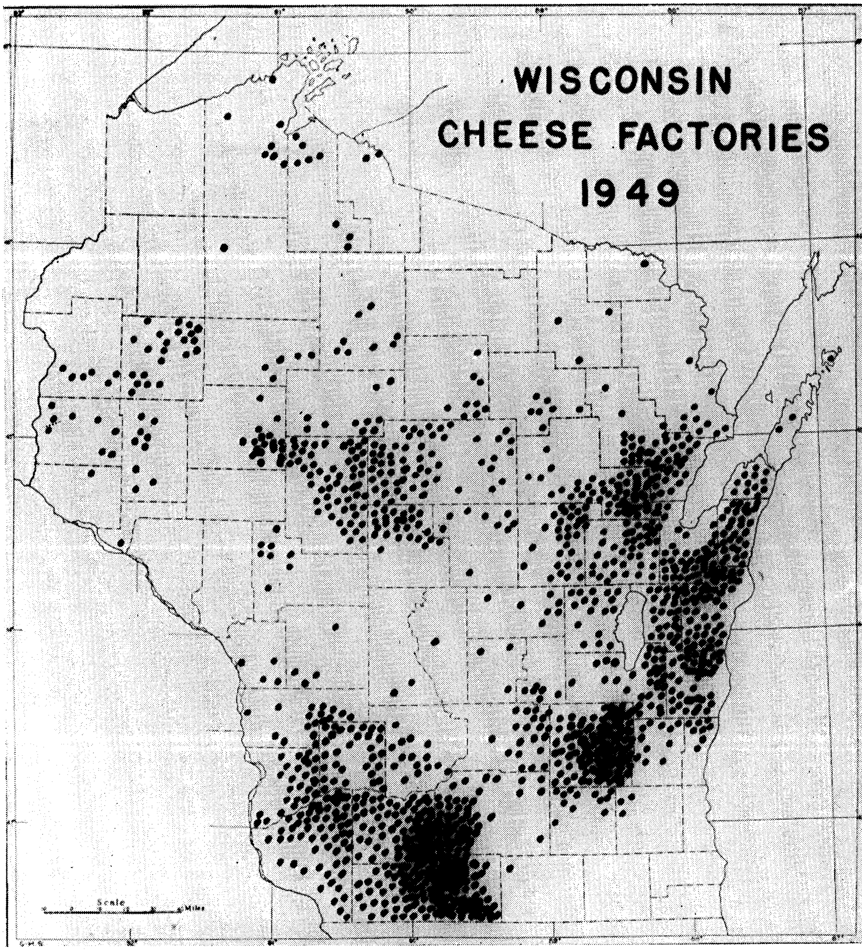


FIGURE 2. Wisconsin Cheese Factories, 1949. Note the absence of factories in the old producing region of extreme southeastern Wisconsin, and the northward and westward migration of Wisconsin's cheese factories. Factory densities in the Eastern Lakeshore American Cheese Region have declined appreciably. On a county basis the present greatest density of factories is now in Dodge County and in Green and immediately adjacent counties (southwestern Dane, southeastern Iowa, and eastern Lafayette).

Cheese Board. Adjacent Manitowoc County possessed 111 cheese factories, Fond du Lac County had 73, and Kewaunee 64. The manufacturing region started immediately north of Milwaukee and continued northward for over 150 miles, extending the entire distance out the Door Peninsula between Green Bay and Lake Michigan; Door County had 36 cheese factories, one even on Washington Island off the northern end of the peninsula.

(4) The Swiss cheese region of southwestern Wisconsin, beyond the glaciated territory, contained over 300 cheese factories. Green County led Wisconsin on the county basis in *number* of factories with 208; this was one cheese factory for *every 2.8 square miles of area.* The Swiss people of the region, frugal and excellent farmers, were expanding outward from their original locations; many of the farmers followed the custom of purchasing a farm for their sons upon the latter's marriage. The Swiss thus were moving into southwestern Dane and eastern Lafayette counties, and "transporting" Swiss cheese manufacture with them. By 1900 the six southwestern towns of Dane County had been included in the Swiss cheese region, and 43 factories were located here.[15] The region of manufacture was also expanding in other directions, including a southward movement into northwestern Illinois.[16] The Swiss region, located in the dissected Driftless Area, had cheese factories on the crests of limestone ridges as well as in sandstone (and some limestone) valleys. The late O. E. Baker, during his work in Wisconsin, attempted to correlate cheese manufacture with the limestone lands of the uplands.[17] Trewartha found no such correlation.[18] A factor of some importance in the spread was the continual arrival of cheesemakers from Switzerland, each anxious to start his own plant in the New World.

(5) Parts of the southwestern Driftless Hill lands of Wisconsin developed American cheese manufacture, particularly in Sauk and Richland counties to the north and northwest of the Swiss cheese region, and in parts of Iowa, Lafayette, and Grant counties to the west. The Richland County area was one mainly of Eastern and of Ohio settlement, the Sauk region of mixed eastern American and German settlement. This region possessed some 150 cheese factories in 1900. Iowa County, divided between the American and the Swiss cheese regions, had 88.

---

[15] Hibbard, *op. cit.*, page 178, recognizes this localization as "social." He also attempts a climatic interpretation as a partial explanation of why Dane County, consisting of 35 townships, had all but one of its cheese factories in this small southwestern section.

[16] Loyal Durand, Jr., Cheese Region of Northwestern Illinois, *Economic Geography*, Vol. 22, 1946, pp. 24–37.

[17] Wisconsin Agricultural Experiment Station, Bulletin 223, 1912.

[18] Trewartha, *op. cit.*, 1926, page 307.

(6) Lastly, cheese manufacture was developing in the east-west band of newly settled territory across the north-central part of the state. Here settlement followed the lumber period. During the 1890's this region, except locally, was still mainly in a semi-pioneering state. The sources of settlers were in the "old" lakeshore counties to the southeast, such as Sheboygan and Manitowoc, or directly from Europe. No doubt some of the lakeshore pioneers "transported" their interest in cheese manufacture with them.[19] Cheese factories entered the region as land was cleared and devoted to stumpy pasture, then to hay and improved pasture. Each factory helped materially in aiding farm improvement by providing a steady local market for the milk produced by the cattle grazing on new clearings. Marathon and Clark counties, destined later to become two of the leading cheese manufacturing counties of Wisconsin, had 13 cheese factories each in 1896.

Summary to 1900

Cheese manufacture was a firmly established subdivision of the dairy industry of Wisconsin by 1900. The industry was highly concentrated regionally, as in New York and elsewhere. Rural cheese factories, located at country crossroads, were important landscape features of the cheese regions, and were the focal points for the daily early morning delivery of milk by the farmers; in the foreign cheese areas, during the warmer portions of the summer, the factories received milk twice a day, after the morning and evening milking, and cheese was made twice a day during this season. Plymouth in Sheboygan County became the marketing center for American cheese, and Monroe in Green County the marketing center for the three main foreign varieties manufactured in the state—Swiss, Brick, and Limburger. At the close of the century the cheese regions of Wisconsin received practically no competition from city urban markets or from condenseries.

Cheese Manufacture in Wisconsin, 1901–1950

The cheese production of Wisconsin increased remarkably during the half-century 1901–1950. Cattle increased in number from one million to 2½ million. Milk production per cow in-

[19] For a more detailed study of part of this region see Loyal Durand, Jr., The West Shawano Upland of Wisconsin: A Study of Regional Development Basic to the Problem of Part of the Great Lakes Cut-Over Region, *Annals Association American Geographers,* Vol. 34, 1944, pp. 135–163.

creased to more than 5,500 pounds of milk per year (national average 4,500). Thus, although the state was invaded by the urban milkshed of Chicago, became a source of milk for the growing cities of Wisconsin, supplied fresh milk and cream to many Eastern and Southern cities,[20] became the leading producer of condensed and evaporated milk, and continued as a large butter manufacturer, the cheese industry was able to continue and expand. Cheese production rose to 148 million pounds in 1910 (greater than New York State's production had ever been), to 363 million pounds in 1925, and 561 million in 1950. Percentage-wise, Wisconsin's largest share of the nation's cheese production was in both 1923 and 1927, each with 71.5 per cent. At present, despite the large production, it is about half of the national output—reflecting the development of new cheese-producing regions elsewhere.

The number of rural crossroads cheese factories in Wisconsin reached a peak of 2,807 during 1922, and has declined steadily in numbers since then. More than 1,000 new factories were built between 1900 and 1918. However, by 1925 many factories began to close, and others consolidated. Closed factories generally were in the areas near the cities, and in their expanding milksheds, and could not compete in price for milk with the urban distributors. Others were forced out of production by the building of condenseries in their neighborhoods. Consolidation began with improved roads, with the advent of trucks for collection of milk from a wider area, and with the concentration of manufacturing operations in order to compete on a firmer basis with other types of dairy plants. The Depression and later the World War II consolidation hastened the elimination of marginal cheese factories. By 1928 the total number of cheese factories was down to 2,400; the figure dipped below 2,000 in 1937, then dropped steadily to 1,509 in 1945 and 1,313 in 1949 (Fig. 2). New multiple-purpose plants have been constructed, many of them in villages rather than at rural crossroads; these are equipped to manufacture not only cheese, but other dairy products, depending upon price conditions. The very fact that 1,313 plants produced half a billion pounds of cheese in 1950, and that 2,807 factories of 1922 made 301 million pounds, tells the story of the increasing size of Wisconsin cheese factories. Although several hundreds of the one- or two-man crossroads cheese factories remain in Wisconsin's cheese regions, and are a distinctive feature of the cultural landscape, they are even now being further reduced in numbers as a

---

[20] Loyal Durand, Jr., Recent Market Orientations of the American Dairy Region, *Economic Geography*, Vol. 23, 1947, pp. 32–40.

result of continuing trends toward consolidation of the industry into larger central plants, employing several cheesemakers.[21]

The general movement of the cheese industry in Wisconsin during the first fifty years of the twentieth century was north and west (Fig. 2). As will be noted in the following regional summary of cheese regions, all of the cheese areas outlined during the nineteenth century continued production, with the exception only of the extreme southeast — the earliest producing region, and the one closest to Milwaukee and Chicago. The other cheese regions, however, expanded northward, even into the Upper Peninsula of Michigan, and westward, to the Mississippi River in extreme southwestern Wisconsin. As a consequence of this expansion the cheese regions of southeastern Wisconsin in general attained their maximum number of cheese factories early in the century and even before this in the very southeastern counties; their decline had begun before the state maximum of 2,807 factories was reached. The cheese regions farther north and west reached their maximum number of factories somewhat later, and the more northern areas were ones which witnessed expansion in the total number of rural crossroads cheese factories even into the 1930's.

The cheese regions of Wisconsin, during the 1901–1950 period, retained their identity as "American" and "foreign" regions. At the end of the period the state was manufacturing just about half of all the American cheese made in the United States. Its percentage of foreign cheese was much higher, although the total poundage of these varieties is far less than that of American cheddar cheese. The Wisconsin Swiss cheese region makes two thirds of the national total of Swiss cheese. The state percentage of United States manufacture of Brick cheese is about 90, it having declined slightly from a top of 94.2 per cent in 1933. Wisconsin produces 95 per cent of the Muenster cheese, between a half and two thirds of the Limburger cheese, half of the Italian cheese, and 20 per cent of the Cream cheese of the country. For other varieties the combined output is 40 per cent of the national total; these include Neufchâtel, the Dutch types—such as Edam,

[21] The United States Census of Manufactures, 1947, does not shed much light on the size of cheese factories, in terms of employment, because the smallest listed classification is that of 1–19 employees. On this basis over 97 per cent of Wisconsin's cheese factories possessed 19 employees or less. Actually many of the factories may have only one or two cheesemakers, and perhaps employ five or six truckers to collect and deliver the milk, and then return the cans to the farm. There is still some patron-delivery of milk, but it is declining. This is also the situation "in old cheese regions" like New York, where 87 per cent of the cheese factories possess 19 or fewer employees. However, in "new cheese areas," to which the industry has been moving, there are very large cheese factories; thus in Tennessee, 60 per cent of the cheese factories have between 20 and 99 employees.

Gouda, and Leyden—types such as Primost, Bond Ost, and Nord Ost, the Blue Mold cheeses, French cheeses, Tilsit cheese, and others. In addition, a "secondary" production of *process cheese* occurs in the cheese regions.[22] The raw material for this is already-manufactured natural cheese. The cheese is ground up and processed at 16 large plants, located in cities of the cheese regions, and built next to railroad facilities for the national distribution of their product. Their location is thus urban, rather than at rural crossroads or in villages; Green Bay possesses four processing plants, Plymouth has two, Monroe and Manitowoc one each and the other eight are in smaller cities.

WISCONSIN CHEESE REGIONS, 1901–1950

There were seven cheese regions in Wisconsin during all or part of the period 1901–1950. One went out of production early in the century. Two northern ones developed mainly during the period, following the settlement and development of parts of the northern half of the state. The five older regions, as discussed in the section previous to 1900, will be described first.

(1) The old Southeastern American cheese region, at the southeastern corner of the state, succumbed to the inroads of condenseries early in the twentieth century, and later the few remaining cheese factories were overwhelmed by the great areal increase of the Chicago, Milwaukee, Racine and Kenosha milksheds. Today the former cheese region is the heart of the out-of-state shipments of market milk to Chicago. During 1950, Kenosha, Racine, and Walworth counties shipped over 311,000,000 pounds of milk out-of-state; this was 30 per cent of the total shipped from Wisconsin. Despite this, some condenseries still remain, but the cheese industry is unable to face the severe economic competition, and the high prices paid for market milk, and only a few factories persisted even into the 1920's.

(2) The Dodge County Foreign (Brick) cheese region continued its intensive cheese production. This region "overflows" slightly into adjacent counties, but Dodge County *alone* is the largest cheese producing county in Wisconsin, and in the entire United States. The 1950 cheese production of Dodge County, which contains only 897 square miles, was 42,552,000 pounds. This county total exceeded the cheese production of every state except New York, Illinois, Missouri, Minnesota, Ohio and Tennessee; it was approximately the same as the two last-named.

[22] These figures are not included in the total of cheese production, because the cheese which is processed has already been recorded as natural cheese.

The Dodge total in 1950 was composed of 14,546,000 pounds of Brick and Muenster cheese, 5,097,000 pounds of American cheese, 3,452,000 of Italian types, 15,000,000 or more pounds of Cream cheese, and the balance of other types. Originating as a Brick cheese region, the appellation with respect to the region is no longer strictly correct; other types are now more important in quantity. Brick cheese was perfected within the county in the late 1860's, however, and has continued to be important; the advent of other varieties in the county manufacture has been owing mainly (1) to difficulties in the Brick cheese market since the 1940's, and (2) the establishment, by a large national distributor, of a Cream cheese factory to service the midwestern markets with packaged cream cheese.

The manufacture of Brick and Muenster cheese is quite widespread in the region. Other types are more concentrated in their regional distribution, largely owing to individual choice and to establishment of local marketing and manufacturing operations. Beaver Dam is the center of Cream cheese manufacture. Mayville and its environs have an important Dutch-type-of-cheese industry. Rolling Prairie is the regional center for the French types. Campbellsport in adjacent Fond du Lac County is an important focus for the Italian types, but many crossroads factories in Dodge County contribute to this total.[23]

Dodge County, at the close of the first fifty years of the twentieth century, had 118 cheese factories, the greatest county total in Wisconsin. It was one of two southern Wisconsin counties with as many factories as in 1896, but had experienced a decline in numbers from the peak of 170 in 1922. At one time there were as many as three cheese factories in certain single rural square miles.[24] The *regional* total of cheese factories in the entire region today is about 165.

(3) The Eastern Lakeshore American Cheese Region intensified its production during 1901–1950. The region contained nearly 1,000 rural crossroads cheese factories in 1920. Factory densities per unit of area were very high; there was one cheese factory for every 4.2 square miles of area in Sheboygan County, for every 5 square miles of Manitowoc, 6.2 of Fond du Lac, and 6.7 of Kewaunee. During this period the region made over one third of Wisconsin's cheese. The names "Plymouth" and "Sheboygan" had replaced the names "Little Falls" and "Herkimer"

---

[23] Loyal Durand, Jr., Italian Cheese Production in the American Dairy Region, *Economic Geography,* Vol. 24, 1948, pp. 217–230.

[24] See maps in Loyal Durand, Jr., Cheese Region of Southeastern Wisconsin, *Economic Geography,* Vol. 15, 1939, pp. 283–292, especially the map on page 290.

as this Wisconsin region took over the national quotations and quality market formerly held by the New York city and county.

Some 450 cheese factories now constitute the operating units of the region. Cheese output remains at a third of the state total. Within the region the centers of manufacturing and marketing have shifted northward. This is partly because of (1) encroachments on the south by Milwaukee milk distributors, (2) because of the growth of fresh-milk markets in the lakeshore and Fox River Valley cities, (3) owing to the advent of condenseries in the region (built there by large national corporations desiring to locate their plants in very large milk-producing areas),[25] and (4) because of increased cheese production after 1910 in the farming regions north of Green Bay, following the lumber and cut-over period.[26] Plymouth retains its importance as a marketing, processing, and wholesaling center, as the location of the Cheese Board, and as the source of price quotations in the national marketing of American cheese, but it is no longer the geographical center of this cheese region. This location has been taken over by Green Bay with the northward advance of cheese manufacture; as a result Green Bay today possesses processing, wholesaling, and warehouse facilities, and is the site of several major national distributors of cheese.

(4) The Green County Foreign cheese area includes all of Green County, southwestern Dane and southeastern Iowa counties to its *north,* eastern Lafayette County to its *west,* and northern Stephenson County, Illinois, to its *south.* It has also expanded, during the 1940's, in a proturberance westward across Lafayette, and into Grant County, the southwestern county of Wisconsin. Green County is the core of the region, and manufactured 17,000,000 pounds of Swiss cheese in 1950, or just about 40 per cent of the total of the *Wisconsin portion of the region.* Green zealously guards its name for Swiss and Limburger cheese; like Herkimer County, New York, in the past, it has obtained a name for quality. Other forms of dairy manufacture (several condenseries have been built because of the very large milk production per unit of area) are tolerated but are not exactly welcomed. Monroe, Mount Horeb (Dane County) and some

---

[25] One large national chain-store organization built a condensery in the city of Manitowoc, said to be now the "largest" condensery in the world. During 1950, Manitowoc County produced 16 per cent of all the evaporated and condensed milk of Wisconsin, and a little over 3 per cent of that of the entire United States. Cheese production in the county dropped from 21 million pounds in 1933 to 15 million in 1950, and cheese factories declined in numbers during the same period from 104 to 59.

[26] For example, between 1896 and 1920 Shawano County cheese factories increased in number from 20 to 101, Oconto from 4 to 69, and Marinette from 2 to 40.

other towns conduct an annual cheese festival and elect a Cheese Queen; local Chambers of Commerce stress the industry. Every effort is made to aid the cheese industry and to advertise it nationally.

The expansion of the Swiss cheese region has been in part through out-movements of the sons of farmers of Swiss ancestry. A high percentage of the Swiss remain on farms, and buy out neighboring farmers. In large part, however, the expansion has come through the "migration" of Swiss cheesemakers, who move outward, yet who do not wish to be too far from their "regional capital" and center of the industry at Monroe. The region has received a constant influx of cheesemakers from Switzerland, many of whom have served apprenticeships on the Alpine upland pastures. A third factor in the movement has been the relatively high price for Swiss cheese. By no means are all of the cheesemakers Swiss, although the majority are; the Flanagan and Olson Cheese Company, for example, manufactures Swiss cheese in Green County near Argyle. The farmers who supply milk to the factories are mainly of Swiss descent near the core of the region, but are of Norwegian, Irish, German, and early American ancestry in other localities.

The production of Swiss cheese in 1950 in Wisconsin set an all-time new record; the output of 53,260,000 pounds increased by 5,000,000 pounds over 1949. Of the state total, Green County contributed 32 per cent, Lafayette 24, and Dane 12; the region contributed 83 per cent (Barron County in northwestern Wisconsin made 12 per cent). Monroe is the main marketing center, and Brodhead, also in Green County, a secondary center.[27]

The increased Swiss cheese production has been attained by fewer, but larger factories than in the past, although like lakeshore Wisconsin the rural crossroads factory is still a very important feature of the regional scene, and more than 150 still operate. The 208 Green County factories of 1896 had been reduced in number to 157 by 1922, exactly 100 by 1941, and 87 at present. The number in other counties has also decreased. Some very large factories, employing several cheesemakers, have been constructed in Monroe and other communities, and draw supplies of milk from greater distances than the small rural plants. They manufacture Swiss cheese throughout the year, while the smaller crossroads factories make Brick cheese during the winter

---

[27] Only Wisconsin, Illinois and Ohio are important in the manufacture of Swiss cheese. Actually the Illinois output is just south of Green County, mainly in Stephenson County, and is *regionally* a part of the Monroe and southwestern Wisconsin area. The Ohio Swiss cheese region is the second *regionally* in the nation, but Illinois is the second *state* in *production*.

if the daily supply of milk is not adequate for a 230-pound wheel of Swiss cheese.

Limburger cheese factories are scattered throughout the Green County region. Wisconsin in 1950 manufactured 3,479,000 pounds of Limburger, more than half the nation's total.[28] Monroe is the marketing center for this variety. It is, in fact, the "foreign cheese center," and quotes prices on Swiss, Brick, and Limburger cheese.

(5) The American Cheese Region of Southwestern Wisconsin merges on its east and south with the Swiss cheese region. Some 200 cheese factories constitute the operating units of the region. Of these, 74 are north of the Wisconsin River in the rugged Driftless Area hill lands of Sauk, Richland, Vernon, and Crawford counties; approximately 140 American cheese factories are south of the river, in the rugged north-facing escarpment lands in northern Iowa and Grant counties, and on the gently rolling back slope of Military Ridge in southwestern Iowa, western Lafayette, and southern Grant counties. Boscobel, Blue River, and one or two other towns serve as marketing and wholesaling centers; there is not the regional dominance of any one market such as is found in other Wisconsin cheese regions.

The eastern portion of the southwestern cheese region is "old cheese country," and was well established before the turn of the century. The western portion, next to the Mississippi River in Crawford and Grant counties is "newer cheese country,"—the cheese industry has expanded westward to the Mississippi, much as it has expanded northward in other parts of Wisconsin. Cheese production in Crawford and Grant counties has increased steadily; it gained by nearly 50 per cent in Crawford between 1940 and 1950, and by almost 150 per cent in Grant. Grant County, by 1950, had become the third American cheese county in Wisconsin, with a production of 24,315,000 pounds, and the fourth county in total cheese production—28,000,000 pounds.[29]

Finally (6 and 7), there are two cheese regions in Wisconsin which have developed mainly during the present century.

(6) The North-Central American Cheese Region is located (1) north of the Central Sand Plain of the state, and (2) south of the northern cut-over and forest region. The heart of the region

---

[28] Only Wisconsin, New York, and Illinois are important in production of Limburger cheese. The Illinois manufacture is immediately south of Green County, Wisconsin, and the regional situation parallels that of Swiss cheese (see footnote 27).

[29] Dodge, Clark, Marathon, Grant. In large part, of course, these are high on a *county basis* because of their large area, although Dodge heads the list on any basis.

is the heavy soil area (Colby Silt Loam and similar soils) of Marathon, Clark, and northern Wood counties. The pioneer and the cheese factory came to the region almost together. As new land was sold, the farmers utilized the land as stumpy pasture; as more land was cleared permanent pastures and hayfields followed. A cheese factory furnished a local market for milk. As more cattle were added to the farms of the region, the cheese factory expanded its production. A small crossroads cheese factory proved ideal under these "pioneer" conditions; the factory furnished an outlet for milk, provided the surrounding farmers with a monthly cash income, and manufactured a product which could withstand shipment from the region.

The North-Central Cheese Region was developed following a lumber period. It was settled mainly by colonies of Europeans—Germans, Poles, and others. Its early cheesemakers were American-trained, and were often graduates of cheesemaking courses (such as the Short Course at the University of Wisconsin), or American cheesemakers from southern Wisconsin who had served apprenticeships, and who themselves "migrated" northward. A regional product developed in this new area is the Colby-style American cheese, which differs slightly in its moisture content from the "normal" American cheese.

The North-Central Cheese Region was settled in only a few localities by 1900. In 1896 Marathon County possessed but 13 cheese factories, Clark had 13, and Wood 14. Between this year and 1922 the region was largely settled, and it witnessed the construction of 340 cheese factories. In the latter year Clark County had a total of 135 factories, Marathon 157, and Wood 64. Thus in a short quarter of a century the region attained its greatest number of factories. In line with the trend elsewhere in Wisconsin, the number has now been reduced to a total of 155 in the three-county area, plus a few additional in adjacent counties which are partly included in the region.

The late start of the North-Central Cheese Region, compared to older southern Wisconsin, is reflected in production figures. Marathon County produced only 51,000 pounds of cheese in 1895. The production expanded with settlement; it reached a million pounds in 1904, 10,000,000 in 1914, and 25,000,000 in 1924. Clark County followed an almost identical pattern in years and quantity. After 1925 the region was almost entirely settled and developed; in 1950 these two counties, each producing 36,600,000 pounds of cheese, stood tied for second and third among Wisconsin counties (after Dodge) in cheese manufacture. Practically all of the product is American cheese.

(7) The Northwestern American and Foreign Cheese Region lies in Barron, Polk, Dunn, and St. Croix counties. Like the North-Central Region it is mainly a development of the present century. This region does not have the closely-spaced cheese factories, even today, possessed by Wisconsin's other cheese regions. It is actually a dual area so far as American and Foreign product is concerned; the manufacture of Swiss, Italian, and American cheese is important, and the region actually constitutes the second cheese region of the state in the production of Swiss cheese. Individual factories specialize in one of the types. The northward migration of several Swiss cheesemakers from Green County to Barron County to found their own factories explains in part the origin of the Swiss industry. One of the Italian cheese companies, originally located at Lake Nebagamon in the cut-over country of Douglas County, south of Lake Superior, built several factories in the farming regions of the Northwestern Cheese Region when their needs for milk outgrew that which could be supplied by the farmers of the cut-overs. The American cheese industry of the region antedates the foreign types, it having originated during the 1890's in the southern, settled portions of that time, mainly the St. Croix County part.

SUMMARY

Wisconsin now produces half a billion pounds of cheese annually. This is half of the production of the United States. *Absolutely,* the manufacture of American cheddar cheese is the most important subdivision of the industry, but *relatively* the state's manufacture of foreign types of cheese is a greater percentage of the national total of these types.

The centers of cheese production in Wisconsin have shifted north and west from southeastern Wisconsin, the region to which early settlers from New York and New England first introduced the industry. Seven main regions of specialization in cheese manufacture have characterized Wisconsin; six remain in production. In gross form, the combined cheese regions of today form a crescent in the state, with the horns in the southwest and northwest, and the body along the eastern lakeshore. The crescent of cheese manufacture includes very diverse terrain; part of it is in the rugged sedimentary Driftless Area; part is in smoother Driftless Area; a large share is in glaciated eastern Wisconsin; and some lies over the crystalline rock areas of the north-center, in glaciated countryside of both new (Wisconsin) and old glacial drift, and also in some of the unglaciated territory of this section.

Cheese production is of such importance in the cheese regions, and so of the state, that national fame for cheese has been attained. So important is the industry that, although greatly concentrated in the specialized cheese regions, there is at present some cheese manufacture in 60 of the 71 counties of Wisconsin. All of the main geographic divisions of the state engage in the industry in some degree, and moderate manufacture is carried on even in the Central Sand Plain of the state, and in the Northern Cut-Over and Forest Region. However, despite the widespread manufacture, the cheese industry, as formerly, remains highly concentrated in specialized regions so far as the bulk of production is concerned.

THE MEMBRACIDAE OF THE UNIVERSITY OF WISCONSIN ARBORETUM[1]

CLIFFORD J. DENNIS AND ROBERT J. DICKE

During the summer of 1950, a survey of the adult Membracidae was made at the University of Wisconsin Arboretum. Certain species of the Membracidae or "tree-hoppers" are of importance as pests of agricultural crops, although the family is a large one comprising many "non-economic" forms. The purpose of this study was to determine the seasonal incidences and habitats of the Membracids in a restricted but diversified area such as in the Arboretum. A record was also taken of the plants on which Membracids were collected. No attempt was made to determine the reason for the insect's presence on a particular plant.

Procedure. Weekly collections were made from May 12 to November 16 in selected ecological areas. These areas are indicated in Fig. 1, and were as follows:

GENERAL DESCRIPTION	AREAS
Abandoned apple orchard	A
Sand prairie	B
Oak openings	C,D
Horticultural area	E
Black locust	F,G,H
High prairie	I
Low prairie	J
Marsh	K,L
Aspen	M
Cottonwood–aspen swamp	N
Oak–hickory	O,P
Willows	Q

Collections were made by means of a sweeping net. The sampling procedure was not designed to demonstrate numbers of the particular species.

Results and Discussion. Fifty species of Membracids were collected during the summer of 1950. These species and the plants on which they were collected are listed in Table 1. The preference of Membracids for oaks was apparent. On white oak, 26 species were collected, while 29 species were taken from black oak and bur oak. Of the 50 species collected, 36 belong to the tribes Telamonini and Smiliini which in general are tree-inhabit-

[1] The co-operation of the University of Wisconsin Arboretum Committee is acknowledged for their encouragement of this study and the use of their facilities, and for permission to reproduce the map used in Fig. 1.

ing, preferring oak. The relatively large numbers of species which were collected in the Horticultural and Cottonwood—aspen swamp areas reflect the presence of oak trees.

A number of species were collected from economically important crop plants. For example, eight species occurred on sweet clover and three on apple. A knowledge of collection records from wild hosts for economically important species is often an important factor in control. *Stictocephala bubalus,* for example, is an important pest of orchard crops. In addition to apple, this species was found on sweet clover, haw, American elm, goldenrod, nettle, and wild plum.

The seasonal incidences of the Membracids are summarized in Table 2. These data indicate that certain groups are variable in their occurrence. The Smiliini, for example, were the first adults to appear and uniformly occurred only during the spring and early summer. Seasonal incidence may indicate the overwintering habits of some species. Adults of *Entylia bactriana* and *Pubilia concava,* for example, appeared briefly early in spring although their principal occurrence was during late fall. Overwintering in the adult stage was indicated for these species. Generally, males of all species appeared earlier than females but did not persist as long.

The numbers of Membracid species collected in each of the habitats studied are indicated below.

Habitat	Number of Species
Abandoned apple orchard	4
Sand prairie	0
Oak openings	35
Horticultural area	28
Black locust	8
High prairie	3
Low prairie	1
Marsh	9
Aspen	0
Cottonwood–aspen swamp	13
Oak–hickory	35
Willows	0

Summary

1. A survey of the Membracidae was made at the University of Wisconsin Arboretum during the summer of 1950 to determine the number of species present, their seasonal incidences, habitats and plants on which they may be collected.

2. Fifty species of Membracids were collected. These were principally taken from oak, although many other plants harbored

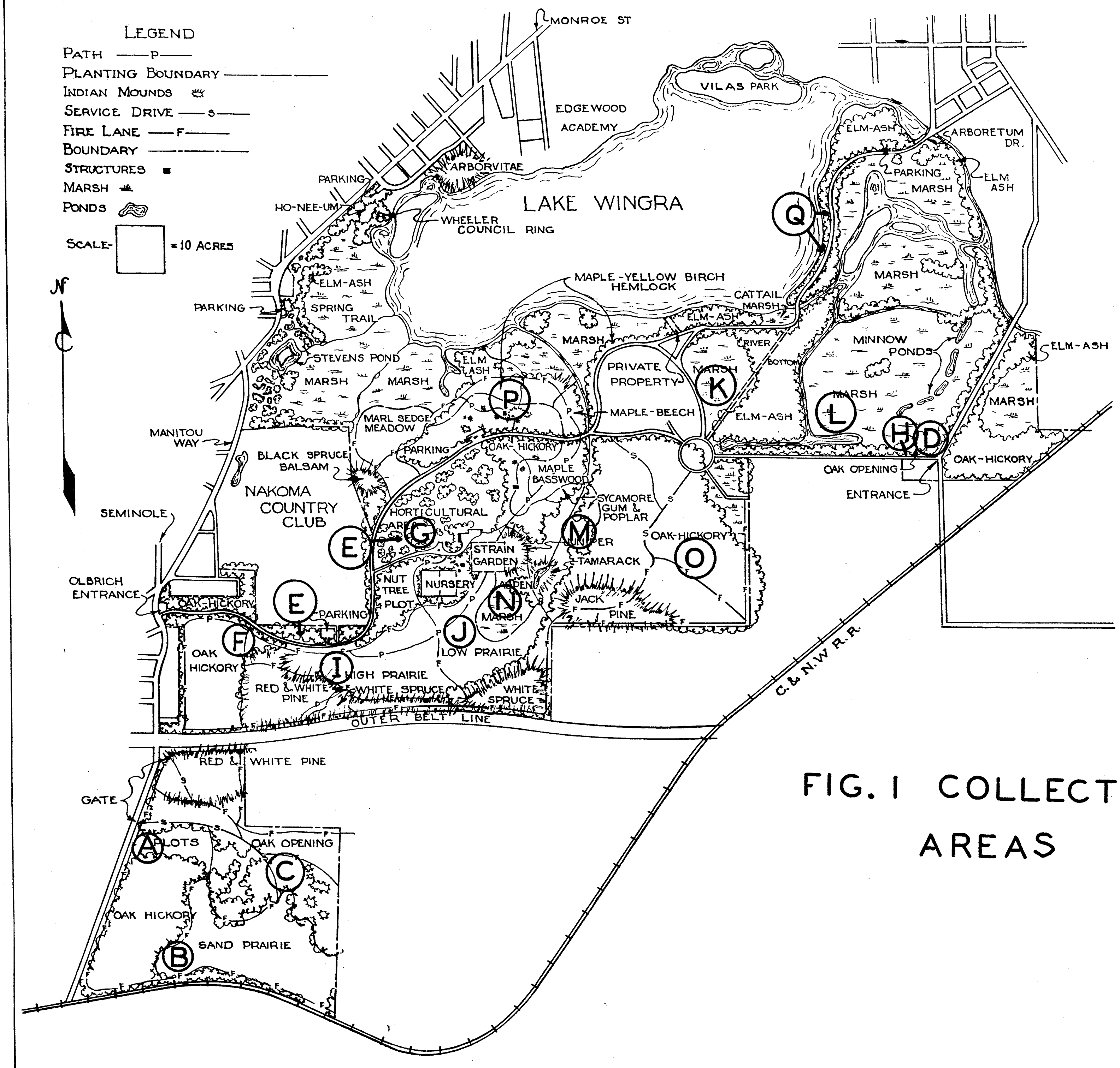


FIG. I COLLECTING AREAS

them. Studies on seasonal incidences have indicated the probable overwintering habits of two species.

3. Relatively few of the species studied were of economic importance as pests of agronomic crops. However, all species may be considered of potential importance to the agriculturist, and fundamental information on their biology and habits should be known. Of the economically important species such as the Buffalo Treehopper *(Stictocephala bubalus)* information was gained in respect to habits and plants harboring the species under uncultivated conditions.

TABLE 1

MEMBRACID SPECIES AND PLANTS ON WHICH THEY WERE COLLECTED

Subfamily Membracinae

Campylenchia latipes (Say)
Sweet clover, goldenrod, wild sunflower, red clover, giant ragweed, small ragweed, black oak, nettle, alfala

Enchenopa binotata (Say)
Black locust, sweet clover, black oak

Subfamily Smiliinae

Tribe Polyglyptini

Entylia bactriana Germar
Giant ragweed, goldenrod

Pubilia concava (Say)
Giant ragweed, wild sunflower, nettle, white oak, bur oak, sweet clover, compass plant

Vanduzea arquata (Say)
Black locust

Tribe Smiliini

Cyrtolobus arcuatus (Emmons)
Black oak, bur oak, white oak

Cyrtolobus discoidalis (Emmons)
White oak, bur oak, black oak, shagbark hickory

Cyrtolobus fenestratus (Fitch)
Black oak, bur oak

Cyrtolobus fuliginosus (Emmons)
Bur oak, white oak, black oak, shagbark hickory, hazel, black locust

Cyrtolobus fuscipennis Van Duzee
Bur oak, white oak, black oak

Cyrtolobus griseus Van Duzee
Bur oak, white oak, black oak

Cyrtolobus helena Woodruff
Bur oak, white oak, black oak, swamp white oak, chinquapan oak

Cyrtolobus inermis (Emmons)
Bur oak, white oak, black oak

Cyrtolobus maculifrontis (Emmons)
Bur oak, white oak, black oak, swamp white oak

Cyrtolobus pallidifrontis (Emmons)
White oak, bur oak, shagbark hickory

TABLE 1—*(Continued)*

MEMBRACID SPECIES AND PLANTS ON WHICH THEY WERE COLLECTED

Cyrtolobus pulchellus Woodruff
Black oak, bur oak, white oak
Cyrtolobus querci (Fitch)
White oak, bur oak, black oak
Cyrtolobus tuberosus (Fairmaire)
White oak, bur oak
Cyrtolobus vau (Say)
White oak, bur oak, black oak
Ophiderma definita Woodruff
White oak, bur oak, black oak
Ophiderma evelyna Woodruff
Black oak, white oak, bur oak, shagbark hickory
Ophiderma flava Goding
Black oak, white oak
Ophiderma grisea Woodruff
White oak, black oak, gray dogwood
Ophiderma pubescens (Emmons)
Black oak, white oak, bur oak
Ophiderma salamandra Fairmaire
White oak, bur oak, black oak, shagbark hickory, smooth sumac
Xantholobus intermedius (Emmons)
Black oak
Xantholobus lateralis Van Duzee
White oak, bur oak
Xantholobus muticus (Fabricius)
Black oak, white oak, bur oak
Smilia camelus (Fabricius)
Black oak, bur oak

Tribe Telamonini

Archasia belfragei Stal
Bur oak
Archasia galeata (Fabricius)
Black oak
Carynota mera (Say)
Shagbark hickory
Glossonotus crataegi (Fitch)
Haw
Telamona decorata Ball
Bur oak, white oak, black oak
Telamona maculata Van Duzee
Bur oak
Telamona monticola (Fabricius)
Bur oak, black oak
Telamona spreta Goding
Bur oak, black oak
Telamona tiliae Ball
Bur oak, white oak, black oak, haw, hackberry
Telamona tristis Fitch
Hazel

TABLE 1—*(Continued)*

MEMBRACID SPECIES AND PLANTS ON WHICH THEY WERE COLLECTED

Telamona westcotti Goding
White oak
Thelia bimaculata (Fabricius)
Black locust

Tribe Ceresini

Acutalis tartarea (Say)
Goldenrod, giant ragweed
Spissistilus borealis (Fairmaire)
Sweet clover, apple, nettle, black locust, goosefoot, black cherry
Stictocephala albescens (Van Duzee)
Hazel, choke cherry
Stictocephala bubalus (Fabricius)
Sweet clover, apple, haw, American elm, goldenrod, nettle, wild plum
Stictocephala constans (Walker)
Goldenrod, sweet clover
Stictocephala diceros (Say)
Nettle, black raspberry
Stictocephala lutea (Walker)
Sweet clover, wild sunflower, shagbark hickory, bur oak, black oak, white oak
Stictocephala taurina (Fitch)
Sweet clover, giant ragweed, small ragweed, apple, nettle, wild sunflower, wild plum, wild grape, goosefoot, black locust
Tortistilus inermis (Say)
Sweet clover, wild sunflower, giant ragweed, small ragweed, red clover

TABLE 2

SEASONAL INCIDENCE OF MEMBRACIDAE COLLECTED IN THE UNIVERSITY OF WISCONSIN ARBORETUM[1]

SPECIES	WEEK OF																						
	May 28	June 4	June 11	June 18	June 25	July 2	July 9	July 16	July 23	July 30	Aug. 6	Aug. 13	Aug. 30	Aug. 27	Sept. 3	Sept. 10	Sept. 17	Sept. 24	Oct. 1	Oct. 8	Oct. 15	Oct. 22	Oct. 29
Campylenchia latipes (Say)...............	... ...	... ...	... ...	... ...	x ...	x o	x o	x o	x o	x o	x o	x o	x o	... o	... o	... o	... o	... o	... o	... ...	... ...	... ...	... ...
Enchenopa binotata (Say)...............	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... o	x ...	... o	... ...	x ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...
Entylia bactriana Germar...............	... ...	... o	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	x ...	... ...	... o	x o	... ...	... ...	x o	... ...	... ...	... ...	... ...
Pubilia concava (Say)	x o	... ...	x ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... o	x o	x o	x o	x o	x o	x o	x o	x o	... ...	... ...	... ...
Vanduzea arquata (Say)...............	... ...	... ...	... ...	... ...	x o	x o	x o	x o	x o	x o	x o	x o	x o	x o	x o	x o	x o	x o	x o	x o	x o	x o	... o
Cyrtolobus arcuatus (Emmons)............	... ...	... ...	x o	... ...	... o	... o	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...
Cyrtolobus discoidalis (Emmons)..........	... ...	x ...	x o	x o	x o	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...
Cyrtolobus fenestratus (Fitch)	... ...	... ...	... ...	... ...	... ...	... o	... o	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...
Cyrtolobus fuliginosus (Emmons)..........	... ...	x o	x o	x o	x o	x o	... ...	... ...	... ...	... ...	x o	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...

TABLE 2—(Continued)

SEASONAL INCIDENCE OF MEMBRACIDAE COLLECTED IN THE UNIVERSITY OF WISCONSIN ARBORETUM[1]

Species	Week of																						
	May 28	June 4	June 11	June 18	June 25	July 2	July 9	July 16	July 23	July 30	Aug. 6	Aug. 13	Aug. 30	Aug. 27	Sept. 3	Sept. 10	Sept. 17	Sept. 24	Oct. 1	Oct. 8	Oct. 15	Oct. 22	Oct. 29
Cyrtolobus fuscipennis Van Duzee	...	x	x	x	x	x	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	o	o	o	o	...	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cyrtolobus griseus Van Duzee	...	...	x	x	x	x	x	x	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	...	o	o	o	o	o	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...
Cyrtolobus helena Woodruff	...	...	x	x	x	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	...	o	o	o	o	o	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...
Cyrtolobus inermis (Emmons)	...	...	...	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	...	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cyrtolobus maculifrontis (Emmons)	...	...	x	x	x	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	...	o	o	o	o	o	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...
Cyrtolobus pallidifrontis (Emmons)	...	x	x	x	x	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	...	o	...	o	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cyrtolobus pulchellus Woodruff	...	x	x	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	o	o	o	o	o	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cyrtolobus querci (Fitch)	...	x	x	x	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	o	o	o	o	o	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cyrtolobus tuberosus (Fairmaire)	...	x	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	o	...	...	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

TABLE 2—*(Continued)*

SEASONAL INCIDENCE OF MEMBRACIDAE COLLECTED IN THE UNIVERSITY OF WISCONSIN ARBORETUM[1]

Species	Week of																						
	May 28	June 4	June 11	June 18	June 25	July 2	July 9	July 16	July 23	July 30	Aug. 6	Aug. 13	Aug. 30	Aug. 27	Sept. 3	Sept. 10	Sept. 17	Sept. 24	Oct. 1	Oct. 8	Oct. 15	Oct. 22	Oct. 29
Cyrtolobus vau (Say)	...	x	x	x	x	x	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	o	o	o	o	o	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ophiderma definita Woodruff	...	x	x	...	x	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	o	o	o	o	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ophiderma evelyna Woodruff	...	x	x	x	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	o	o	o	o	o	o	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...
Ophiderma flava Goding	...	x	x	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	...	o	o	...	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ophiderma grisea Woodruff	...	...	x	x	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	...	o	o	o	...	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ophiderma pubescens (Emmons)	...	x	x	x	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	o	o	o	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ophiderma salamandra Fairmaire	...	x	x	x	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	...	o	o	o	...	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Xantholobus intermedius (Emmons)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Xantholobus lateralis Van Duzee	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	o	...	...	...	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

TABLE 2—*(Continued)*

SEASONAL INCIDENCE OF MEMBRACIDAE COLLECTED IN THE UNIVERSITY OF WISCONSIN ARBORETUM[1]

Species	Week of																							
	May 28	June 4	June 11	June 18	June 25	July 2	July 9	July 16	July 23	July 30	Aug. 6	Aug. 13	Aug. 30	Aug. 27	Sept. 3	Sept. 10	Sept. 17	Sept. 24	Oct. 1	Oct. 8	Oct. 15	Oct. 22	Oct. 29
Xantholobus muticus (Fabricius)	...	x o	x o	x o	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Smilia camelus (Fabricius)	...	x o	x o	x	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Archasia belfragei Stal	...	...	...	...	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Archasia galeata (Fabricius)	...	...	...	...	...	...	...	...	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...
Carynota mera (Say)	...	...	...	...	...	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Glossonotus crataegi (Fitch)	...	...	...	...	...	...	...	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Telamona decorata Ball	...	...	...	...	...	x	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Telamona maculata Van Duzee	...	...	...	...	...	...	o	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Telamona monticola (Fabricious)	...	...	x o	...	...	...	o	...	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Telamona spreta Goding	...	...	...	x	...	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

TABLE 2—*(Continued)*

SEASONAL INCIDENCE OF MEMBRACIDAE COLLECTED IN THE UNIVERSITY OF WISCONSIN ARBORETUM[1]

SPECIES	WEEK OF																						
	May 28	June 4	June 11	June 18	June 25	July 2	July 9	July 16	July 23	July 30	Aug. 6	Aug. 13	Aug. 30	Aug. 27	Sept. 3	Sept. 10	Sept. 17	Sept. 24	Oct. 1	Oct. 8	Oct. 15	Oct. 22	Oct. 29
Telamona tiliae Ball	...	...	x	x o	...	x	x o	o	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...
Telamona tristis Fitch	...	...	...	...	...	...	...	...	...	...	...	...	o	...	...	...	...	...	...	...	...	...	...
Telamona westcotti Goding	...	...	...	...	...	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Thelia bimaculata (Fabricius)	...	...	...	...	...	x	x o	x o	x o	x o	x o	x o	x o	x o	x o	x o	x o	x o	x o	x o	x o	o	o
Acutalis tartarea (Say)	...	...	...	...	...	...	...	...	x o	x	o	x o	o	...	...	...	...	...	...	...	...	...	...
Spissistilus borealis (Fairmaire)	...	...	...	...	...	...	...	x	o	x o	x o	...	x o	o	o	o	o	o	...	...	...	...	...
Stictocephala albescens Van Duzee	...	...	...	...	...	...	...	...	...	x o	...	...	o	x o	o	o	o	o	o	...	...	...	...
Stictocephala bubalus (Fabricius)	...	...	...	...	...	...	...	...	x	x o	x o	x	x o	x o	o	x o	o	x	x o	x o	o	o	...
Stictocephala constans (Walker)	...	...	...	...	...	...	...	...	...	...	...	o	...	...	...	o	...	...	...	...	...	...	...
Stictocephala diceros (Say)	...	...	...	...	...	...	...	...	o	x	x o	o	o	x o	x o	...	...	...	...	...	...	...	...

TABLE 2—*(Continued)*

SEASONAL INCIDENCE OF MEMBRACIDAE COLLECTED IN THE UNIVERSITY OF WISCONSIN ARBORETUM[1]

Species	Week of																						
	May 28	June 4	June 11	June 18	June 25	July 2	July 9	July 16	July 23	July 30	Aug. 6	Aug. 13	Aug. 30	Aug. 27	Sept. 3	Sept. 10	Sept. 17	Sept. 24	Oct. 1	Oct. 8	Oct. 15	Oct. 22	Oct. 29
Stictocephala lutea (Walker).............	... ...	x o	x o	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...
Stictocephala taurina (Fitch).............	... ...	... ...	... ...	... ...	... ...	... ...	x ...	x o	... ...	x o	x o	... o	x o	... o	... o	... o	... ...	... ...	... ...	... o	... ...	... ...	... ...
Tortistilus inermis (Say)...............	... ...	... ...	... ...	... ...	... ...	x o	x o	x o	x o	... o	x o	x o	... o	... ...	... o	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...

*1*x = male specimens collected
o = female specimens collected

ONE HUNDRED YEARS OF EARTH SCIENCE AT MILWAUKEE-DOWNER COLLEGE

KATHERINE GREACEN NELSON

In March, 1951, Milwaukee-Downer College celebrated the one-hundredth anniversary of the granting of the charter which gives it the right to operate as an institution of higher learning and to grant degrees. A month later, the Wisconsin Academy of Sciences, Arts and Letters met on the campus, and it seemed to be an appropriate time to take stock of the role science has played at the college in that time. To cover the role of all the sciences over a period of a hundred years, however, seemed too broad a subject for a limited paper, and so the author has confined her investigation to her own fields of Geology and Geography.

This bit of research was really started in order to answer a questionnaire from the Association of Geology Teachers, which asked—among other things—when geology was first taught at the college. As the files in the Museum did not reveal this information, the old catalogues of both Milwaukee Female College and Wisconsin Female College were investigated. Surprisingly enough, both colleges list geology in their earliest catalogues, and the teaching of it has been almost continuous throughout the century. It must be admitted that at times this continuity was maintained through close affiliation with a preparatory department, which is no longer a part of the college. But if we acknowledge that early relationship between the college and the seminary, Milwaukee-Downer can trace the history of the teaching of the earth sciences back more than a hundred years.

The very first announcement of the new school that was to open in the young city of Milwaukee, Wisconsin, on September 14, 1848—Milwaukee Female Seminary—lists Geology among the Middle Class studies. Geography was considered a preparatory study.

Three years later, under the influence of Catherine Beecher, the Seminary was expanded and the advanced classes were known as the Normal Institute, and a little later as Milwaukee Female College. The college course was divided into three Departments, each with a principal teacher. These were:

1. Mathematics and Natural Science.
2. Geography, History and Mental Science.
3. Language, Belles Lettres and Composition.

Geography was taught in all classes, and was under the supervision of Mrs. Lucy Parsons, who had started the Seminary in 1848. Geology was taught by Mrs. Wilson, in the Department of Mathematics and Natural Science. It was commenced in the third term of the Middle Class, and continued in the Senior Class.

The course listings are the same for several years, although the teachers changed frequently. Additional interest in the earth sciences is evidenced in the catalogue for 1852–1853, which announced that a Cabinet of Natural History had been commenced. That marked the founding of the Museum. In order to add to this Cabinet, as well as to the Library, there was organized in November, 1855, the "Curious Society."[1] It was divided into sections, and the one interested in geology was called the "Rockites." They learned about geology from Increase Lapham, engineer and early investigator of Wisconsin's geology and archeology, who was the first president of the Board of Trustees of Milwaukee Female College.

In 1863, S. S. Sherman became principal of the college, and he took over the lectures on geology, which for many years continued to be taught in the second term of the third or junior year. Sherman put his own cabinet of minerals, fossils and shells at the disposal of the class, and ordered Hall's Great Geological Charts and Guyot's Mineral Charts. Dr. Lapham's cabinet was also available to the class, and continued to be so after Mr. Sherman left the college, apparently taking his cabinet with him.

The catalogue of 1872–1873 states that a valuable cabinet of Natural History was added that year. The next year Miss Harriet E. Ohlen was teaching physical geography and geology, and a half year of each was required. That is the year when Mrs. Thomas A. Greene was first listed as a trustee. Her husband's geological collection was a valuable addition to the college much later.

From 1874 on, physical geography was taught only in the Seminary. The College continued to teach geology in the junior year. The text listed in the 1874–1875 catalogue is Dana's Manual. This book, in its Fifteenth Edition, Revised, was being used as the text in Mineralogy in 1951, Milwaukee–Downer's centennial year. The same catalogue notes two important occurrences: the transfer of the Museum of Natural History to a

---

[1] Kieckhefer, Grace Norton, *The History of Milwaukee–Downer College, 1851–1951,* Milwaukee–Downer College Bulletin, Series 33, No. 2, November, 1950, p. 96.

special room; and the introduction by President Farrar of a course for women patrons. A year later this became the Ladies' Art and Science Class, which not only attended series of lectures at the college, but which donated many valuable books to the Library, and bought some of the early specimens, casts and models for the Museum. Mrs. Greene was a member of this class.

The catalogues of these years note additions of ores to the mineral collection. Field excursions, in connection with the science course, are mentioned.

William S. Barnard, Ph.D., held the position of Professor of Natural History in 1877–1878. At this time, five cabinets were purchased from Professor Henry A. Ward of New York, for instruction in Lithology, Mineralogy, Geology, Osteology and Zoology.

Beginning in 1880, geology was no longer required of all students, but was considered an elective.

A drawing of the Natural History Room, in the catalogue of 1885–1886, is surprisingly similar to the ground-floor exhibit room of the Museum today. The cases are the same, and some of the specimens can be recognized. The resemblance is even more striking in the photograph in the 1891 catalogue. These catalogues state that there are optical lanterns for use in Geography, History, Geology and Art lectures. The number of views for the lanterns increased from 5,000 in 1886 to 10,000 the following year.

Meanwhile, another college had been established at Fox Lake, in 1855. This was known for many years as Wisconsin Female College, but in 1889 the name was changed to Downer College, out of gratitude to its benefactor, Judge Jason Downer. (It is interesting to note that his wife was a member of the Ladies' Art and Science Class of Milwaukee College.) Downer's offerings and requirements in regard to the earth sciences were similar to those of Milwaukee College. Geography was taught in the Junior or High School Division, and geology in the College or Senior Division. Geology, known as Science 4, was taught in the first semester of the senior year. There were four recitations a week. Downer's science club was called the Agassiz Society.

Miss Ellen Sabin, as president of Downer College, had been so successful that the trustees of Milwaukee College approached her with an offer. In 1895, the two colleges were combined. The Downer faculty, students and equipment were moved to the Milwaukee campus, and the institution became Milwaukee-Downer College. President Sabin, herself, was interested in the teaching of geography, and her large globe of the world is now housed in the Greene Memorial Museum. Sabin Science Hall is named in her honor.

At Milwaukee–Downer College, geology continued as an offering in the first semester of the senior year. It was required in the science course, and was an elective in the other courses. The Agassiz Club continued for several years. The catalogue of 1896–1897 stresses the importance that laboratory work and field trips played in all the science classes. Trips to the Public Museum as well as to the college museum are mentioned.

The college was moved to its present location in 1899. The science classrooms and the museum were located on the third floor of Merrill Hall. From 1900 to 1912, the catalogues continue to describe the museum and its collections of minerals and fossils, but apparently geology was not taught in the college during those years. Until 1911, however, the year in which the Seminary and the College were separated, the high-school courses were described in the college catalogue, and physical geography was taught continuously there. It included a bit of physiography, meteorology, mineralogy, astronomy and visits to the Public Museum and to the Weather Bureau. In the later years of this period, a study of the geology of Wisconsin formed a unit of this inclusive course in earth science.

The years 1912–1913 mark the beginning of a new era for earth science at Milwaukee–Downer. Thomas A. Greene, whose wife had been one of Milwaukee College's first women trustees, and whose daughter, son and grandson have served as trustees of Milwaukee–Downer, had accumulated one of the finest collections of minerals and fossils in the middle west. Following his death, the collection awaited disposal for several years. Then, in 1912, his daughter, Mrs. Horace A. J. Upham and his son, Colonel Howard Greene, gave the collection to Milwaukee–Downer College. Mrs. Upham also gave $10,000 toward building a museum to house the collection. The Greene Memorial Museum was completed in 1913, and dedicated that year, with Rollin D. Salisbury as the principal speaker on the occasion. While the Greene Collection occupied the main or upstairs floor of the new building, the other specimens and cabinets of the college were placed in a large room on the ground floor. A classroom was provided for the new Department of Geology.

The story of the Museum and its additional collections is another one from this brief history of the teaching of the earth sciences at the college. The history of the departments of Geology and Geography since 1913 is much more complete than the earlier development. This paper can only skim briefly over the years in which these departments have been staffed by Margaret Louise Campbell, Olive J. Thomas, Carol Y. Mason, Esther Aberdeen, Elmer R. Nelson and Katherine F. Greacen, now Mrs. Frank H. Nelson. Under their direction the courses offered in both geology and geography have been enlarged and multiplied, and the exhibits in the Museum have been made available to many. Neither geology nor geography is a required course today, but a good number of students continue to elect both. There are not a great many girls who major in either at any college, but the equipment and instruction are available at Milwaukee–Downer for those who choose the earth sciences as their field.

Bibliography

1. Greacen, Katherine F. and Ball, John R. Studies of Silurian Fossils in the Thomas A. Greene Memorial Museum at Milwaukee–Downer College. *Trans. Wis. Acad. Sciences, Arts and Letters*, Vol. XXXVI, 1944, pp. 415–419.
2. Kieckhefer, Grace Norton. The History of Milwaukee–Downer College, 1851–1951. Milwaukee–Downer College Bulletin, Ser. 33, No. 2, November, 1950.
3. Catalogues of:
   Downer College
   Milwaukee Female College
   Milwaukee–Downer College
   Wisconsin Female College

STRATIOMYIDAE OF WISCONSIN (DIPTERA)

JUANITA SORENSON AND C. L. FLUKE*

The family Stratiomyidae is a relatively small one. Essig, 1942, estimated the species in the world at 1,200. These flies are generally distributed throughout the world with the greatest number of species in the Neotropical region.

Stratiomyidae are quite common in Wisconsin. There are thirty-nine identified species representing sixteen genera in the University of Wisconsin collection.

The adult Stratiomyidae, in general, fall into three easily recognizable groups. The first group is medium to large, black flies with yellow or greenish striped abdomens. These are the typical "soldier flies." The second group is small to medium sized, metallic flies with elongated abdomens; the third group is small black flies with telescoped abdomens which are rarely marked with yellow.

The antennae are of two general types. The first type is conical and has an arista; the second type is elongated with a flagellum and often terminating in a style.

The adult Stratiomyidae can always be recognized by the discal cell which is located toward the fore margin of the wing with four veinlets leading from the discal cell toward the hind margin, but often one or two of these veinlets have disappeared or are not easily visible.

In most species the eyes of the males are contiguous and those of the females are widely separated. Occasionally the eyes are separated in both sexes.

Stratiomyidae are commonly referred to in the literature as being found on flowering bushes and shrubs in the same localities as Syrphidae. In collecting around Madison in the summer of 1951, the black and yellow striped species were found commonly on flowering plants; the metallic groups were found most abundantly on foliage bushes in shaded areas, and the small black flies were collected almost exclusively on the inside of windows in old buildings. Usually the best collecting time on the windows was in late afternoon when the windows were shaded.

Although the adult forms have been studied extensively, relatively little is known of the immature stages.

* University of Wisconsin.

Eggs that have been observed are usually in clusters lying parallel to each other on the undersides of leaves or aquatic weeds.

The larvae are aquatic, semi-aquatic or terrestrial in habitat. They vary in length from four to forty millimeters and in color from a dirty white to nearly black. The aquatic larvae usually have a fusiform body with an elongated terminal segment. They are often found in creeks and muddy streams where they feed on micro-organisms. Many larvae of the subfamily Stratiomyinae are aquatic.

The semi-aquatic larvae, often found in decaying organic matter are less than one inch long and have nearly parallel sides with blunt head and terminal segments. Many members of the subfamily Sarginae belong to this group.

Terrestrial larvae are usually very small and are often found under bark. All segments are about equal in length and have on them long conspicuous setae.

Stratiomyidae larvae are distinguished from all other dipterous larvae because of a heavy deposit of calcium carbonate on all body parts. This secretion is at times so thick that it obscures the delicate larval parts.

The pupal stage is inactive and spent within the last larval skin. Usually larval characteristics are in evidence in the pupa, and can be seen through the pupal case.

The following keys and descriptions are based on specimens in the collections of the University of Wisconsin, Milwaukee Public Museum, and Juanita Sorenson.

STRATIOMYIDAE OF WISCONSIN

Key to the Genera[1]

1. Abdomen with seven visible dorsal segments 2
   Abdomen with six or less distinct abdominal dorsal segments....... 3
2. Scutellum four-spined ....*ACTINA* Meigen
   Scutellum unspined ....*ALLOGNOSTA* Osten Sacken
3. Antennae with an arista 4
   Antennae without an arista; often terminating in a style 5
4. Abdomen long and slender; often resembling a club 6
   Abdomen usually short and broad 8
5. Four posterior veins all of which arise from the discal cell; medium to large flies usually having black and yellow striped abdomens... 13
   Three posterior veins; if four posterior veins, only three arise from discal cell; small flies sometimes marked with yellow 15

[1] Modified from James and Curran.

6. Second segment of antennae produced finger-like into third segment .... *PTECTICUS* Loew
   Second segment of antennae not produced finger-like into third segment 7
7. Anterior ocellus remote from the other two a distance greater than the length of base of ocellar triangle .... *SARGUS* Fabricius
   Ocellar triangle equidistant .... *MEROSARGUS* Loew
8. Metallic flies 9
   Non-metallic flies, usually black 10
9. Discal cell small; posterior veins weak and not extending to wing margin; very small flies .... *MICROCHRYSA* Loew
   Discal cell normal; posterior veins strong and extending to wing margin; medium-sized flies .... *CEPHALOCHRYSA* Kertesz
10. Black flies strongly marked with yellow; four weak posterior veins .... *OXYCERA* Meigen
    Wholly black flies; three strong posterior veins 11
11. Antennae elongate .... *BERKSHIRIA* Johnson
    Antennae disc-like 12
12. Dark brown spot on inside of antennae. .*NEOPACHYGASTER* Austen
    Antennae wholly light-colored .... *PACHYGASTER* Meigen
13. Five-segmented flagellum, never forming a style; ratio of first segment to second, 2:1 or more; large flies 14
    Six-segmented flagellum; fifth segment short and ring-like; sixth segment set on an angle to rest .... *ODONTOMYIA* Meigen
14. Face receding; scutellar spines located outside median third of scutellar rim .... *STRATIOMYS* Geoffroy
    Face produced; scutellar spines weak and usually located at apex on median third of rim .... *LABOSTIGMINA* Enderlein
15. Face strongly produced to a snout .... *NEMOTELUS* Geoffroy
    Face not strongly produced .... *EUPARYPHUS* Gerstaecker

ACTINA Meigen

Actina viridis (Say)

Beris viridis Say, 1824, Long's Exped. App., 368; 1859, Compl. Works 1:251.
Actina viridis James, 1939, Annals Ent. Soc. Amer. 32:548.

MALE *Head:* Face and front dark metallic green with long, stiff black hairs; antennae black and elongate with terminal segments forming a horn; eyes separated by one-fifth the width of head. *Thorax:* Entirely metallic green with long white hairs on dorsum; scutellum with four spines; legs yellowish brown; stigma brown. *Abdomen:* Metallic green to brown; seven visible dorsal segments.

FEMALE *Head:* Similar; face and front shining metallic green with only a few scattered white hairs; eyes separated by one-third the width of head. Thorax and Abdomen same as male. Length 3 to 5 mm.

Found commonly in Columbia and Dane Counties during May and early June.

ALLOGNOSTA Osten Sacken

Key to the Species

1. Abdomen with yellowish transparent areas in center of tergites .... *fuscitarsis* (Say)
2. Abdomen with tergites uniformly black or bronze.. *obscuriventris* (Loew)

Allognosta fuscitarsis (Say)

Beris fuscitarsis Say, 1823, Journ. Acad. Sci. Philadelphia, 3:29, 6:155.

Allognosta fuscitarisis James, 1939, Annals Ent. Soc. Amer. 32:544.

MALE *Head:* Face and front black and densely covered with silvery pubescence; antennae elongated with basal segments yellow, terminal segments black; eyes contiguous. *Thorax:* Dorsum black with white hairs; legs yellow to brown; wings with definite brown stigma. *Abdomen:* Black with yellow transparent areas in middle of tergites; seven visible dorsal segments.

FEMALE *Head:* Face black with dense silvery pubescence; front black with two sclerites above antennae outlined with silvery pubescence; eyes separated by a distance one-third the width of head. *Thorax:* Dorsum black with yellow pile; pleura black to brown.

Widely distributed in Dane and Columbia Counties but found also in Racine and Brown Counties. Most common during June and July.

Allognosta obscuriventris (Loew)

Metoponia obscuriventris Loew, 1863, Centuria 4:45.

Allognosta obscuriventris James, 1939, Annals Ent. Soc. Amer. 32:544.

MALE *Head:* Face black; front black with silvery pubescence along eye margin; antennae elongate with basal segments brown, terminal segments black; eyes contiguous. *Thorax:* Black with scattered yellow hairs; wings hyaline without a stigma. *Abdomen:* Uniformly bronze tergites; seven visible dorsal segments.

FEMALE *Head:* Face and front black with two sclerites above antennae outlined with silvery pubescence.

Collected commonly in Fond du Lac, Waupaca, Dane and Columbia Counties during June and July.

ODONTOMYIA[1] Meigen

Key to the Species

(Modified from James)

FEMALES (Eyes widely separated)

1. R-m cross vein present 4
   R-m cross vein absent 2
2. Two yellowish vittae on disc of thorax 3
   Disc of thorax entirely black .... *vertebrata* Say
3. Face prominent below base of antennae .... *trivittata* (Say)
   Face receding below base of antennae .... *truquii* Bellardi
4. Femora black; apices often yellowish .... *interrupta* Latreille
   Femora yellow (or yellowish) 5
5. Pile beneath anterior basitarsi as long or longer than width of segment 6
   Pile beneath anterior basitarsi less than the width of the segment.... 7
6. Face tuberculate .... *pilimana* Loew
   Face receding below antennae .... *borealis* James
7. Abdomen black with interrupted yellow bands on posterior edges of tergites 2, 3, and 4 .... *pubescens* Day
   Abdomen green or yellow in ground color with median black stripe.... 8
8. Face yellow (or dark reddish yellow)............................. 9
   Face black .... *virgo* (Wiedemann)
9. Face yellowish with dark ocellar triangle and a dark spot on each side of front .... *cincta* Latreille
   Face decidedly reddish with darker lines in sutures
   .... *hydroleonoides* Johnson

MALES (Eyes contiguous)

1. R-m cross vein present 4
   R-m cross vein absent 2
2. Face yellow (or yellowish) 3
   Face brown; oral margin black .... *vertebrata* Say
3. Disc of thorax black with two yellowish spots .... *truquii* Bellardi
   Disc of thorax entirely black .... *trivittata* (Say)
4. Femora black; apices often yellowish .... *interrupta* Latreille
   Femora wholly yellow (or yellowish) 5
5. Pile underneath anterior basitarsi as long as or longer than width of segment 6
   Pile underneath anterior basitarsi not as long as width of segment.... 7
6. Face tuberculate .... *pilimana* Loew
   Face receding .... *borealis* James
7. Face and front yellow .... *cincta* Latreille
   Face and front black 8
8. Abdomen black with interrupted yellow bands on posterior edges of segments two, three and four .... *pubescens* Day
   Abdomen green or yellow with median black stripe 9
9. Third antennal segment black; style blunt.......... *virgo* (Wiedemann)
   Third antennal segment yellow; style sharp..... *hydroleonoides* Johnson

[1] Odontomyia Meigen, 1803 = Eulalia Meigen, 1800.

Odontomyia vertebrata Say

Odontomyia vertebrata Say, 1824, Long's Exped. App. 2:369; 1859, Compl. Works 1:251.
Odontomyia vertebrata Johnson, 1895, Trans. Amer. Ent. Soc. 22:260.

MALE *Head:* Face and front brown; antennae brown. *Thorax:* Black with yellow tomentum; legs yellow; r-m cross vein absent. *Abdomen:* yellow to green with a narrow, median, black stripe.

FEMALE *Head:* Face yellow with a brown spot on each side of facial prominence; front yellow with a brown, wavy, interrupted transverse band above antennae and three brown markings below ocellar triangle; ocellar triangle brown; occiput yellow. *Thorax:* Black with scutellum, spines, and lateral margin behind the suture yellow. *Abdomen:* Yellow with tergites having a wide black transverse band.

Specimens collected in Dane and Walworth Counties during June and July, and in Door and Vilas counties during late July and early August.

Odontomyia interrupta Latreille

Odontomyia interrupta Latreille, 1811, Ency. Meth. 8:433, 434.
Odontomyia interrupta Johnson, 1895, Trans. Amer. Ent. Soc. 22:265.

MALE *Head:* Face and front black with long white hairs; antennae black with sharply pointed styles. *Thorax:* Black with scutellar rim and spines yellow; femora dark brown; r-m cross vein present. *Abdomen:* Black with narrow yellow indentations along posterior edges of tergites.

FEMALE *Head:* Face black with long white hairs; front black with yellow lateral stripes along frontal suture and a yellow spot on each side of ocellar triangle.

Very common in Dane and Columbia Counties and found also in Door, Brown, and Racine Counties. Most commonly collected during late May and early June.

Odontomyia pilimana Loew

Odontomyia pilimana Loew, 1865, Centuria 6:27.
Odontomyia pilimanus Johnson, 1895, Trans. Amer. Ent. Soc. 22:263.
Odontomyia pilimana James, 1936, Annals Ent. Soc. Amer. 29:531.

MALE AND FEMALE *Head:* Face black and tuberculate; front black; antennae light brown to yellow with black styles. *Thorax:*

Black with white tomentum; legs yellow; pile under front basitarsi as long or longer than width of segment; r-m cross vein present. *Abdomen:* Yellow with narrow black median stripe dorsally.

Distributed throughout Dane and Jefferson Counties during July and August.

Odontomyia trivittata (Say)

Stratiomys trivittata Say, 1829, Journ. Acad. Nat. Sci. Phil. 6:160; 1859, Compl. Works 2:356.

Odontomyia trivittata Johnson, 1895, Trans. Amer. Ent. Soc. 22:259.

MALE *Head:* Face tuberculate; face and front yellow; antennae brown. *Thorax:* Black with scutellum and lateral margin yellow; legs yellow; r-m cross vein present. *Abdomen:* Yellow with narrow median black stripe dorsally.

FEMALE *Head:* Face tuberculate; face yellow with brown spot on each side of facial prominence; front yellow with brown interrupted transverse band. *Thorax:* Black dorsally with two pale vittae; wide lateral margins and scutellum yellow.

Dane County, July 5, 1951, 1 female (C. L. Fluke). *Madison,* June 2, 1931, 1 female (C. L. Fluke); June 30, 1929, 1 male (M. H. Doner); August, 1946, 1 female.

Odontomyia truquii Bellardi

Odontomyia truquii Bellardi, 1859, Saggio di Ditterol Messico 1:37.

Odontomyia truquii Johnson, 1895, Trans. Amer. Ent. Soc. 22:273.

MALE *Head:* Face and front yellow; antennae brown. *Thorax:* Dorsum black with two large yellow spots; pleura, lateral margins and scutellum yellow; pectus black; r-m cross vein absent. *Abdomen:* Yellow with median black stripe dorsally.

FEMALE *Head:* Face yellow and receding below antennae; front yellow with a brown, wavy, transverse line above antennae which is connected by narrow brown vertical lines to a wide brown transverse spot around ocellar triangle. *Thorax:* Dorsum black with two pale vittae. *Abdomen:* Yellow with first segment almost wholly black dorsally and tergites two to five with black transverse bands.

Columbus: July 8, 1924, 1 female. *Dane County:* July 19, 1914, 1 male (Wm. S. Marshall); August 30, 1950, 1 male (D. G. Allen). *Madison:* May, 1946, 1 female.

Odontomyia borealis James

Odontomyia borealis James, 1936, Annals Amer. Ent. Soc. 29:537.

MALE AND FEMALE *Head:* Face and front black; face receding below base of antennae; antennae yellow with black, sharply pointed styles. *Thorax:* Black with yellow hairs; legs entirely yellow; pile under anterior basitarsis as long or longer than width of segment; r-m cross vein present. *Abdomen:* Yellow to green with median black stripe dorsally.

Specimens collected in Dane, Crawford and Jefferson Counties during July. Paratypes of males and females are in the University of Wisconsin collection.

Odontomyia pubescens Day

Odontomyia pubescens Day, 1882, Proc. Acad. Nat. Sci. Phila. 77.

Odontomyia pubescens Johnson, 1895, Trans. Amer. Ent. Soc. 22:264.

Odontomyia pubescens James, 1936, Annals Ent. Soc. Amer. 29:530.

MALE *Head:* Face and front black; antennae black with pointed styles. *Thorax:* Black with long white pile; scutellar rim and spines yellow; femora yellow. *Abdomen:* Black with conspicuous indentations of yellow on tergites two, three and four.

FEMALE *Head:* Face black; front black with yellow streaks along and covering the frontal suture; yellow spot on each side of ocellar triangle. *Thorax:* Black with short yellow hairs. *Abdomen:* Black with yellow indentations on posterior borders of tergites.

Very common in Dane and Columbia Counties during May and June. Found also in Door and Winnebago Counties.

Odontomyia virgo (Wiedemann)

Stratiomys virgo Wiedemann, 1830, Ausser. Zweifl. Ins. 2:69.

Odontomyia virgo Johnson, 1895, Trans. Amer. Ent. Soc. 22:262.

MALE AND FEMALE *Head:* Face and front black; antennae black with blunt styles. *Thorax:* Black with short yellow hairs; legs entirely yellow; pile on anterior basitarsi not as long as width of segment; r-m cross vein present. *Abdomen:* Green with median black stripe dorsally.

Found very commonly in Columbia, Dane and Door Counties during July and August.

Odontomyia cincta Latreille

Figure 3

Odontomyia cincta Latreille, 1811, Ency. Methodique 8:432.
Odontomyia cincta Johnson, 1895, Trans. Amer. Ent. Soc. 22: 253.
Odontomyia cincta James, 1936, Annals Ent. Soc. Amer. 29:547.

MALE *Head:* Face and front green; antennae yellow with black styles. *Thorax:* Disc and pectus black; scutellum, spines and lateral margins green; legs entirely yellow; r-m cross vein present. *Abdomen:* Green with black triangular spots forming a median stripe dorsally.

FEMALE *Head:* Face green; front green with a black spot along each eye margin; ocellar triangle black; occiput green. *Thorax:* As in male. *Abdomen:* Green with black central triangles which unite but do not form a stripe.

Collected commonly in Dane and Columbia Counties during May and June. Specimens found also in Crawford, Manitowoc and Oshkosh Counties.

Odontomyia hydroleonoides Johnson

Figure 10

Odontomyia hydroleonoides Johnson, 1895, Trans. Amer. Ent. Soc. 22:261.
Odontomyia hydroleonoides James, 1936, Annals Ent. Soc. Amer. 29:535.

MALE *Head:* Face black and receding below antennae; front black; antennae reddish yellow with black, sharply pointed styles. *Thorax:* Black with erect white pile; legs yellow; pile beneath anterior basitarsi no longer than width of segment; r-m cross vein present. *Abdomen:* Yellow with median black stripe dorsally.

FEMALE *Head:* Face and front shining reddish yellow. *Thorax* and *Abdomen:* As in male.

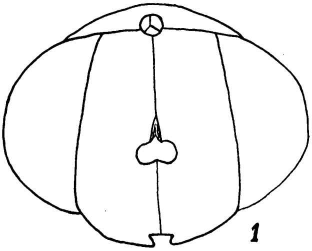
Door County: August 9, 1929, 1 female (C. L. Fluke). *Madison:* July 19, 1929, 1 female (C. L. Fluke); July 4, 1941, 1 female (C. L. Fluke); July 14, 1917, 1 female (C. L. Fluke); July 15, 1930, 1 female, 1 male (C. L. Fluke); July 3, 1929, 1 male (C. L. Fluke).

PLATE I

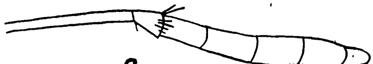
All drawings were made with the aid of the camera lucida

FIGURE

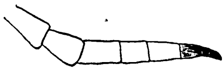
1.—*Stratiomys bruneri* Johnson, female. Anterior view of face.
2.—*Stratiomys badia* Walker, male. Antenna.
3.—*Odontomyia cincta* Latreille, male. Antenna.
4.—*Sargus decorus* Say, male. Antenna.
5.—*Odontomyia pubescens* Day, male. Wing.
6.—*Sargus decorus* Say, male. Wing.
7.—*Berkshiria aldrichi* Malloch, female. Wing.
8.—*Stratiomys bruneri* Johnson, female. Scutellum.
9.—*Nemotelus unicolor* Loew, male. Abdomen—dorsal view.
10.—*Odontomyia hydroleonoides* Johnson, female. Abdomen—dorsal view.
11.—*Sargus decorus* Say, male. Abdomen—dorsal view.



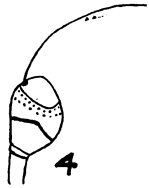
1



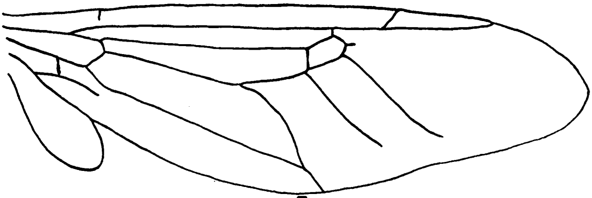
2



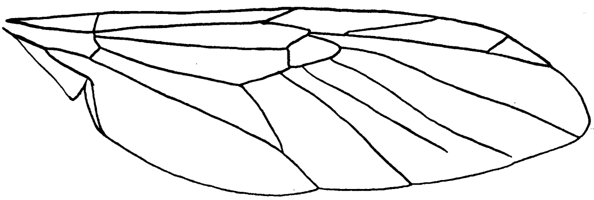
3



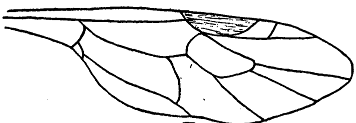
4



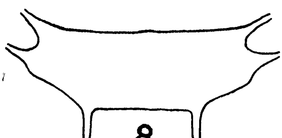
5



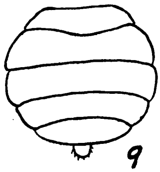
6



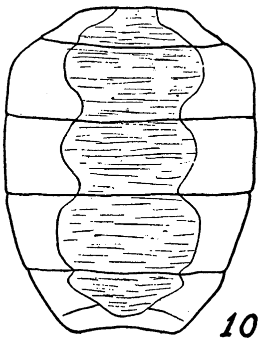
7



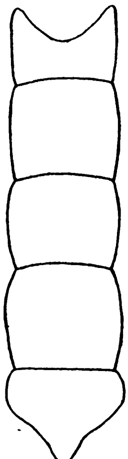
8



9



10



11

STRATIOMYS Geoffroy

Key to the Species

FEMALES (Eyes widely separated)

1. Eyes hairy .... *badia* Walker
   Eyes bare 2
2. Fore femora yellow (usually entire leg yellow) .... *bruneri* Johnson
   Fore femora black or half black 3
3. Fourth abdominal tergite with entire posterior border yellow 4
   Fourth abdominal tergite entirely black or with interrupted yellow posterior border 5
4. Face and oral margin yellow .... *obesa* Loew
   Face and oral margin black .... *normula unilimbata* Loew
5. Fourth abdominal tergite entirely black 6
   Fourth abdominal tergite with interrupted yellow posterior border.... 7
6. Only slight extension of yellow inward on tergites of segments two and three; fourth tergite entirely black .... *meigenii* Wiedemann
   Yellow trapezoids or triangles extending in from lateral edges of tergites of segments two and three 8
7. Fore tibia with definite brown band; small yellow spot below ocellar triangle .... *normula normula* Loew
   Fore tibia entirely yellow to reddish brown; large yellow spot around ocellar triangle .... *norma* Wiedemann
8. Basal half of posterior femora yellow .... *adelpha* Steyskal
   Posterior femora entirely black .... *discalis* Loew

MALES (Eyes continguous)

1. Eyes hairy .... *badia* Walker
   Eyes bare 2
2. Fore femora yellow (usually entire leg yellow) .... *bruneri* Johnson
   Fore femora black or half black 3
3. Fourth abdominal tergite with posterior border entirely yellow...... 4
   Fourth abdominal tergite entirely black or with interrupted posterior yellow border 5
4. Face yellow .... *obesa* Loew
   Face black .... *normula unilimbata* Loew
5. Fourth abdominal tergite black with at most extremely short prolongations of yellow inward 6
   Fourth abdominal tergite with interrupted yellow posterior border.... 7
6. Abdominal tergites two and three without yellow markings .... *meigenii* Wiedemann
   Abdominal tergites two and three with yellow triangles or trapezoids.. 8
7. Fore tibia with definite brown band .... *normula nomula* Loew
   Fore tibia entirely yellowish to reddish brown .... *norma* Wiedemann
8. Basal half of posterior femora yellow (usually large flies) .... *adelpha* Steyskal
   Posterior femora entirely black (usually medium-sized flies) .... *discalis* Loew

Stratiomys badia Walker

Figure 2

Stratiomyia badius Walker, 1849, List 3:529.
Stratiomyia badius Johnson, 1895, Trans. Amer. Ent. Soc. 22: 243.
Stratiomys badia James and Steyskal, 1952, Annals Ent. Soc. Amer. 45:392.

MALE *Head:* Face yellow with median dark brown stripe; front brown; antennae black with bristle-like hairs on second segment; eyes hairy. *Thorax:* Black with scutellar rim and spines yellow; legs yellow to brown. *Abdomen:* Black with interrupted yellow bands on posterior border of tergites two and three; entirely yellow posterior border on tergite four.

FEMALE *Head:* Face as in male; front yellow, lined with one transverse brown band just above the antennae, a second transverse brown band extends from the ocellar triangle, and a verticle band centrally connects the two transverse bands. *Thorax:* Black with scutellum and spines yellow. *Abdomen:* Black with interrupted yellow posterior borders on tergites two, entire yellow posterior border on tergite three, and entire yellow posterior border tapering to a point ventrally on tergite four.

Not found commonly in Wisconsin. A few collections made in Oneida, Dane, and Door Counties during July and August.

Stratiomys bruneri Johnson

Figures 1 and 8

Stratiomyia bruneri Johnson, 1895, Trans. Amer. Ent. Soc. 22: 233.
Stratiomys bruneri James and Steyskal, 1952, Annals Ent. Soc. Amer. 45:392.

MALE *Head:* Face yellow with median brown stripe; front brown; antennae dark brown. *Thorax:* Black with yellow hairs; metapleura, propleura, scutellum and spines yellow; legs yellow. *Abdomen:* Yellow with wide transverse black band on tergites.

FEMALE *Head:* Face yellow with narrow median brown stripe; front yellow with variable brown transverse spot extending ventrad from around ocellar triangle. *Thorax* and *Abdomen:* As in male.

Collected in Dane County most commonly in July.

Stratiomys obesa Loew

Stratiomyia obesa Loew, 1865, Centuria 6:11.
Stratiomyia lativentris Johnson, 1895, Trans. Amer. Ent. Soc. 22:233.
Stratiomys obesa James and Steyskal, 1952, Annals Ent. Soc. Amer. 45:392.

MALE *Head:* Face yellow with median brown stripe; front dark brown; occiput yellow; antennae black. *Thorax:* Black with scutellum and spines yellow; legs light brown. *Abdomen:* Black with interrupted yellow band on tergite two, usually interrupted yellow band on tergite three and entire yellow posterior border on tergite four.

FEMALE *Head:* Face yellow with narrow light brown median stripe; front yellow with black "W" mark over ocellar triangle. *Thorax:* As in male. *Abdomen:* Black with usually interrupted yellow posterior borders on tergites two and three; entire yellow posterior border on tergite four; often, however, the yellow posterior border on tergite three is not interrupted.

Collected in Dane and Door Counties during June and July.

Stratiomys normula unilimbata Loew

Stratiomyia unilimbata Loew, 1865, Centuria 6:6, 12.
Stratiomyia unilimbata Johnson, 1895, Trans. Amer. Ent. Soc. 22:236.
Stratiomys normula unilimbata James and Steyskal, 1952, Annals Ent. Soc. Amer. 45:402.

MALE *Head:* Face and front black with long white hairs; antennae black. *Thorax:* Black with scutellum and spines yellow; legs brown to yellow with black femora. *Abdomen:* Black with interrupted yellow bands on posterior borders of tergites two and three; entire yellow posterior border tapering to a central point on tergite four. (Description from a male from Waukegan, Illinois.)

FEMALE *Head:* Face black with yellow spot along eye margin; front black with yellow spot below ocellar triangle.

Madison: June 28, 1918, 1 female (C. L. Fluke); June 17, 1914, 1 female (A. C. Burrill).

Stratiomys meigenii Wiedemann

Stratiomys meigenii Wiedemann, 1830, Ausser. Zweifl. Ins. 2:61.
Stratiomyia meigenii Johnson, 1895, Trans. Amer. Ent. Soc. 22:238.
Stratiomys meigenii James and Steyskal, 1952, Annals Ent. Soc. Amer. 45:396.

MALE *Head:* Face and front black with long white hairs. *Thorax:* Black with short white hairs; scutellum black with narrow rim and spines yellow; legs yellow with black femora. *Abdomen:* Black with widely interrupted yellow posterior bands on tergites two and three; almost no yellow band on tergite four; median yellow stripe on tergite five; whole abdomen has a convex glossy appearance.

FEMALE *Head:* Face black with yellow spot along eye margin; front black with yellow spot below ocellar triangle; antennae black. *Thorax:* As in male. *Abdomen:* Usually entirely black dorsally except for median stripe on fifth tergite.

Uncommon in Wisconsin. Collected in Dane County during May and June.

Stratiomys normula normula Loew

Stratiomyia normula Loew, 1865, Centuria 6:5.
Stratiomyia normula Johnson, 1895, Trans. Amer. Ent. Soc. 22: 235.
Stratiomys normula normula James and Steyskal, 1952, Annals Ent. Soc. Amer. 45:402.

MALE *Head:* Face and front entirely black. *Thorax:* Black with long white hairs; scutellum and spines yellow; fore tibia with definite brown band; femora black. *Abdomen:* Black with interrupted yellow posterior bands on tergites two, three and four; median yellow stripe on tergite five.

FEMALE *Head:* Face black; front black with small yellow spot below ocellar triangle. *Thorax:* Black with dark yellow pile.

The abdominal markings in both the males and females of this subspecies vary considerably.

Widely distributed in Dane, Columbia and Fond du Lac Counties. All specimens collected in June.

Stratiomys norma Wiedemann

Stratiomys norma Wiedemann, 1830, Ausser. Zweifl. Ins. 2:62. (N.A.)
Stratiomyia norma Johnson, 1895, Trans. Amer. Ent. Soc. 22: 236.
Stratiomys norma James and Steyskal, 1952, Annals Ent. Soc. Amer. 45:396.

MALE *Head:* Face and front entirely black. *Thorax:* Black with dark yellow hairs; scutellum and spines yellow; fore tibia entirely yellow to reddish brown. *Abdomen:* Black with interrupted yellow posterior bands on tergites two, three and four; median yellow stripe on tergite five.

FEMALE *Head:* Face black with yellow spot near eye margin; front black with large yellow spot extending ventrad from around ocellar triangle. *Thorax* and *Abdomen:* As in male except usually a central yellow triangle on tergite three.

Collected commonly in Columbia, Dane, Crawford, Fond du Lac, and Waupaca Counties during June, July and early August.

Stratiomys adelpha Steyskal

Stratiomys adelpha Steyskal, 1952, Annals Ent. Soc. Amer. 45: 393.
Stratiomyia discalis Auctt. (non Loew).

MALE *Head:* Face and front black with long white pile. *Thorax:* Black with long pale yellow pile; scutellar rim and spines yellow; posterior femora with basal half yellow, apical half black. *Abdomen:* Black dorsally with large yellow lateral rectangle on tergite two and a small lateral yellow triangle on tergite three; tergite four entirely black; median yellow stripe on tergite five.

FEMALE *Head:* Face black; front black with yellow spot below ocellar triangle.

This species is unusually large and is the *Stratiomys discalis* of Auctt. non Loew.

Collected commonly in Dane, Columbia and Green Counties during May and June.

Stratiomys discalis Loew

Stratiomyia discalis Loew, 1865, Centuria 6:14.
Stratiomyia discalis Johnson, 1895, Trans. Amer. Ent. Soc. 22: 240.
Stratiomys media James, 1933, Journ. Kan. Ent. Soc. 6:67.
Stratiomys discalis James and Steyskal, 1952, Annals, Ent. Soc. Amer. 45:393.

MALE *Head:* Face and front wholly black. *Thorax:* Black with silvery hairs on dorsum; narrow rim and spines of scutellum yellow; posterior femora entirely black, rest of leg yellow. *Abdomen:* Entirely black with yellow lateral rectangles on tergite two, small yellow lateral triangles on tergite three, and no yellow posterior border on tergites four and five.

FEMALE *Head:* Face black with long white hairs; front black with a small yellow spot below ocellar triangle. *Thorax:* Black with dense white hairs. *Abdomen:* As in male.

This species is smaller than *Stratiomys adelpha* and is most easily told by the femora which are entirely black in *S. discalis* and half yellow and half black in *S. adelpha*.

Found in Dane, Columbia and Green Counties during late May and June.

LABOSTIGMINA Enderlein

Key to the Species

(From James and Steyskal, 1952)

1. Eyes densely and distinctly pilose .... *viridis* (Bellardi)
   Eyes bare .... obscura (Latreille)

Labostigmina viridis (Bellardi)

Odontomyia viridis Bellardi, 1859, Saggio di Ditterol. Messico 1:36.

Odontomyia viridis Johnson, 1895, Trans. Amer. Ent. Soc. 22: 270.

Labostigmina viridis James and Steyskal, 1952, Annals Ent. Soc. Amer. 45:406.

MALE: No specimens available.

FEMALE *Head:* Face strongly produced below antennae; face yellow with a brown spot around protuberance and extending over protuberance and to each side of it; front yellow with interrupted brown transverse band; large brown spot around ocellar triangle; eyes hairy. *Thorax:* Black dorsally with pale yellow pubescence; calli, humeri, pleura and scutellum yellow; scutellar spines reduced; femora black. *Abdomen:* Black with continuous posterior border on tergites three and four.

Waukesha County: July 21, 1913, 1 female.

Labostigmina obscura (Latreille)

Odontomyia obscura Latreille, 1811, Ency. Methodique 8:433.

Odontomyia obscura Johnson, 1895, Trans. Amer. Ent. Soc. 22: 270.

Labostigmina obscura James and Steyskal, 1952, Annals Ent. Soc. Amer. 45:408.

MALE *Head:* Face and front entirely black; antennae amber at base with black terminal segment; eyes bare and contiguous. *Thorax:* Scutellum yellow with small apical, proximal spines; dorsum black with golden colored pubescence; legs yellow with black femora. *Abdomen:* Black with interrupted yellow band-like indentations on posterior edges of tergites two and three and faintly on four. (Description from a Mississippi male, Oxford, April, 1940. F. M. Hull.)

FEMALE *Head:* Face strongly produced to a prominence below base of antennae; face black with yellow markings at lower lateral angles where yellow extends inward from the occiput; front black with a large yellow spot below the ocellar triangle and a pair of yellow spots lateral to this central spot; a second pair of yellow proximal spots are located above the antennae and a third pair are lateral to the antennae; occiput and vertex are yellow with an area around the ocellar triangle; eyes bare and widely separated. *Thorax:* Dorsum black with short silvery pile; metapleura with yellow borders on anterior and dorsal edges; scutellum and small apical scutellar spines yellow. *Abdomen:* Black with a narrow yellow lateral margin.

Madison: July 21, 1929, 1 female (C. L. Fluke).

Nemotelus unicolor Loew

Figure 9

Nemotelus unicolor Loew, 1863, Centuria 3:11.
Nemotelus unicolor Melander, 1903, Psyche 10:176.

MALE *Head:* Face and front entirely black; face produced to a snout; antennae elongate and project from head just below the middle of head in profile; eyes contiguous. *Thorax:* Wholly shining black; scutellum black; halteres pale yellow; femora black, rest of legs yellow except posterior tibia which have a dark brown band. *Abdomen:* Shining black; abdomen broader than thorax.

FEMALE *Head:* Similar to male; antennae elongate and project at the middle of the head in profile; eyes widely separated. *Thorax* and *Abdomen:* As in male. Length: 3–4½ mm.

Collected commonly in Dane and Columbia Counties during June and July.

Euparyphus tetraspilus Loew

Euparyphus tetraspilus Loew, 1866, Centuria 7:15.
Euparyphus tetraspilus Curran, 1927, Trans. Royal Soc. of Canada 5:217.

MALE *Head:* Face brown; front yellow; antennae and ocellar triangle black; eyes contiguous. *Thorax:* Black with two yellow longitudinal vittae; scutellum, spines, humeri, calli and lateral margins yellow. *Abdomen:* Black dorsally with two yellow spots on each of tergites three and four; a large central yellow spot on tergite five.

FEMALE *Head:* Face black with silvery stripe along eye margin; front black with two yellow vittae near eye margin; lower occiput yellow to silvery, upper occiput black with yellow spot on each side of ocellar triangle. *Thorax* and *Abdomen:* As in male. Length: 4 to 5 mm.

Found commonly in Dane and Columbia Counties during June and July.

Oxycera albovittata Malloch

Oxycera albovittata Malloch, 1915–17, Bull. Illinois State Lab. of Nat. Hist. 12:330.

MALE *Head:* Face black with silvery stripe along eye margin; front black; antennae reddish yellow; eyes contiguous. *Thorax:* Dorsum black with four bright yellow vittae; lateral margin, calli, humeri, scutellum and scutellar spines yellow. *Abdomen:* Black with a large yellow spot on tergite three; yellow border on lateral edges of tergites two, three, four and five.

FEMALE *Head:* Face as in male; front black with two yellow vittae; occiput and vertex yellow; eyes separated by one-third the width of head. *Thorax* and *Abdomen:* As in male. Length: 4 to 5 mm.

Madison: June 12, 1918, 1 male (C. L. Fluke); July 6, 1918, 1 male (C. L. Fluke); June, 1933, 1 female.

SARGUS Fabricius

Key to the Species

(Modified from James, 1935)

1. Femora metallic green .... *viridis* Say
   Femora black or yellow; not metallic 2
2. Femora black; dark cloud over discal cell .... *cuprarius* Linneaus
   Femora yellow; wings entirely hyaline 3
3. Metapleura white; other pleurites metallic .... *clavis* Williston
   Metapleura brown; other pleurites brown .... *decorus* Say

Sargus viridis Say

Sargus viridis Say, 1823, Journ. Acad. Sci. Phila. 3:87; 1859, Compl. Works 2:77.

Geosargus viridis James, 1935, Can. Ent. 67:271.

MALE *Head:* Face metallic green; front entirely metallic green; antennae and arista black; eyes separated by a distance slightly greater than width of ocellar triangle. *Thorax:* Entirely metallic blue; femora metallic, rest of legs black; wings without cloud over discal cell. *Abdomen:* Shining metallic green; same width as thorax and elongate.

FEMALE *Head:* Face metallic green; front metallic blue-green with very small interrupted ivory frontal calli; eyes separated by a distance equal to one-third the width of the head. *Thorax:*

As in male. *Abdomen:* Shining metallic green; wider than thorax.

Collection data show scattered collecting from May through August in Dane, Columbia and Fond du Lac Counties.

Sargus cuprarius Linnaeus

Musca cuprarius Linnaeus, 1758, Systema Naturae 10:598.
Geosargus cuprarius James, 1935, Can. Ent. 67:271.

MALE *Head:* Face brown to black; front dark metallic green with small interrupted ivory-white calli; antennae black with black arista; eyes narrowly separated by width of ocellar triangle. *Thorax:* Metallic green-blue; legs brown to black; dark cloud over discal cell. *Abdomen:* Metallic with coppery to violet reflections.

FEMALE *Head:* Face brown; front metallic green with interrupted ivory-white calli; eyes separated by one-fourth the width of head. *Thorax* and *Abdomen:* As in male.

Scattered distribution in Kewaunee, Dane, Green, Door, Racine and Washburn Counties from late June to mid-August.

Sargus clavis Williston

Sargus clavis Williston, 1885, Can. Ent. 17:123.
Geosargus clavis James, 1935, Can. Ent. 67:271.

MALE *Head:* Face brown to yellow; front white; antennae reddish brown with black arista; eyes contiguous. *Thorax:* Metallic green with lateral margins and metapleura white; legs yellow. *Abdomen:* Club-shaped with metallic coppery lustre; segments longer than wide. (Males from Tennessee.)

FEMALE *Head:* Face brown; front metallic green with non-interrupted white frontal calli; eyes separated by one-fourth the width of head. *Thorax:* As in male. *Abdomen:* Less club-shaped than in male; dark metallic with violet reflections.

Walworth County: July 15, 1913, 1 female (62209 M.M.).

Sargus decorus Say

Figures 4, 6 and 11

Sargus decorus Say, 1824, Long's Exped. App. 2:376; 1859, Compl. Works 1:257.
Geosargus decorus James, 1935, Can. Ent. 67:272.

MALE *Head:* Face black; front metallic blue-green with interrupted ivory-white calli; eyes narrowly separated by ocellar triangle. *Thorax:* Dorsum metallic green; pleura brown; legs yellow. *Abdomen:* Metallic coppery color with dense golden pile.

FEMALE *Head:* Similar to male; eyes separated by one-third the width of head. *Thorax:* As in male. *Abdomen:* Uniformly dark with metallic reflections; wider than in male.

Found in Dane, Columbia and Kewaunee Counties. Common in late May and early June and again in August and early September.

Merosargus coerulifrons (Johnson)

Sargus coerulifrons Johnson, 1900, Ent. News 11:325.
Merosargus coerulifrons James, 1941, Ent. News 52:107.

MALE: No specimens available.

FEMALE *Head:* Face brownish yellow; front metallic blue-green with a wide white transverse ridge above antennae; antennae reddish brown; arista black; eyes separated by one-fourth the width of head; ocellar triangle equilateral. *Thorax:* Dorsum metallic green; pleura brownish yellow; pectus black; legs yellow except hind tibia which are white on basal halves and black on apical halves; posterior basitarsi and first tarsal segments white; wings hyaline with dark veins. *Abdomen:* Dark metallic with violet reflections.

Madison: July 16, 1951, 1 female (J. S. Sorenson).

PTECTICUS Loew

Key to the Species

Front black .... *sackenii* Williston
Front yellow .... *trivittatus* (Say)

Ptecticus trivittatus (Say)

Sargus trivittatus Say, 1830, Journ. Acad. Sci. Phila. 6:159; 1859, Compl. Works 2:355.
Ptecticus similis Williston, 1885, Can. Ent. 17:124.
Ptecticus trivittatus James, 1935, Can. Ent. 67:269.

MALE *Head:* Face white to light green; front yellow; second antennal segment produced finger-like into third segment; eyes nearly contiguous. *Thorax:* Yellow to pale brown; hind basitarsi and all tarsal segments yellow to light brown. *Abdomen:* Yellow dorsally with pale brown transverse band on anterior half of each segment.

FEMALE: Differs from male only in having eyes widely separated. Length 9–11 mm.

Dane County: August 7, 1947, 1 male (Student). *Madison:* September 27, 1950, 1 male (D. G. Allen); July 5, 1951, 1 female (J. S. Sorenson).

Ptecticus sackenii Williston

Ptecticus sackenii Williston, 1885, Can. Ent. 17:124.
Ptecticus sackenii James, 1935, Can. Ent. 67:269.

MALE *Head:* Face white; front black; antennae yellow with pale brown arista; second antennal segment produced finger-like into third segment; eyes nearly contiguous. *Thorax:* Yellow with basitarsi and base of second tarsal segment black to dark brown; second and third tarsal segments white or yellow. *Abdomen:* Yellow dorsally with brown transverse band on anterior half of each segment.

FEMALE: Same as in male except eyes widely separated.

Madison: August 1, 1917, 1 male (C. L. Fluke); August 13, 1926, 1 female (C. L. Fluke).

Cephalochrysa nigricornis (Loew)

Chrysonotus nigricornis Loew, 1866, Centuria 7:14.
Isosargus nigricornis James, 1935, Can. Ent. 67:274.
Cephalochrysa nigricornis James, 1939, Ent. News 50:218.

MALE *Head:* Face and front black. *Thorax:* Metallic green to coppery with heavy golden pile dorsally; legs yellow; large angular discal cell. *Abdomen:* Metallic blue-green; as wide as thorax.

FEMALE *Head:* Face brown; front metallic blue with distinct white transverse band above antennae. *Thorax:* Metallic green to blue dorsally. *Abdomen:* Broader than thorax; metallic blue to green.

Found in Dane and Columbia Counties during June and July. One specimen collected in Washburn County.

Microchrysa polita Linnaeus

Musca polita Linnaeus, 1758, Systema Naturae 10:598.
Microchrysa polita James, 1935, Can. Ent. 67:272.

MALE *Head:* Face and front metallic brown; antennae and arista dark brown; eyes contiguous. *Thorax:* Metallic blue-green; legs yellow with dark band on femora and tibia; very small discal cell. *Abdomen:* Metallic green with golden hairs; broader than thorax.

FEMALE *Head:* Face and front bright metallic green; eyes separated by a distance more than one-third width of head. *Thorax* and *Abdomen:* As in male. Length: 3 to 4½ mm.

Found in June through mid-September in Dane, Door and Washburn Counties.

Berkshiria aldrichi (Malloch)

Figure 7

Johnsonomyia aldrichi Malloch, 1915, Annals Ent. Soc. Amer. 8:313.

MALE *Head:* Face and front shining black; silvery pile along eye margin on face; ocellar triangle black with brownish ocelli; eyes contiguous; antennae elongate with two basal segments yellow, remainder black; arista black at base with white flagellum; antennae project above middle of head in profile. *Thorax:* Shining black with fine light brown pubescence; thoracic suture distinct; scutellum black with a definite marginal rim; legs yellow except apices of tibiae and basal joints of tarsi yellow. *Abdomen:* Shining black with indistinct divisions between segments. Length: 3 to 4 mm.

FEMALE: No specimens available.

Madison: (University Arboretum) May 14, 1951, 1 male (C. L. Fluke).

Neopachygaster maculicornis (Hine)

Pachygaster maculicornis Hine, 1902, Ohio Naturalist, 2:228.
Neopachygaster maculicornis Malloch, 1915, Annals Ent. Soc. Amer. 8:318.

MALE *Head:* Face black with wide silvery band on eye margin; front black with depressions above antennae covered with silvery pile; front comparatively narrower between eyes than in female; antennae conical, yellow with a conspicuous glossy dark brown spot on inner surface of third complex segment. *Thorax:* Mesonotum shining black and covered with silvery pile; distinct silvery diagonal stripe on metapleura. *Abdomen:* Shining black; abdominal divisions not distinct.

FEMALE *Head:* Similar to male. *Thorax:* Mesonotum shining black and covered with short brassy colored pile. *Abdomen:* As in male. Length 2 to 3.5 mm.

Collected on windows in Dane County in June and July.

Pachygaster pulcher Loew

Pachygaster pulcher Loew, 1863, Centuria 3:16.
Pachygaster pulcher Malloch, 1915, Annals Ent. Soc. Amer. 8: 315.

MALE: No specimens available.

FEMALE *Head:* Face and front shining black; silvery pile along eye margin on face; antennae yellow with dark brown arista; antennae situated below middle of head in profile. *Thorax:* Black, covered with short yellow hairs; halteres with dark brown spot on under side; scutellum projects upward, without distinct rim; legs yellow except for brown band on femora. *Abdomen:* Uniformly shining black. Length: 2 to 3 mm.

Dane County: July 23, 1951, 2 females (J. S. Sorenson).

BIBLIOGRAPHY

ALDRICH, J. M. 1905. A Catalog of North American Diptera, Smithsonian Institute, No. 1444.

CURRAN, C. H. 1927. Synopsis of the Canadian Stratiomyidae. Trans. Royal Soc. Canada. Section V. 21:191–228.

——— 1934. The families and genera of North American Diptera. The Ballou Press, N. Y.

GRAENICHER, S. 1913. Records of Wisconsin Diptera. Bull. of Wis. Nat. Hist. Soc. Vol. 10. Nos. 3 and 4:175–178.

HULL, FRANK M. 1930. Notes on several species of North American Pachygasterinae. Ent. News 41:103–106.

JAMES, MAURICE T. 1933. New Stratiomyidae in the Snow Entomological Collection. Journ. Kan. Ent. Soc. 6:66–71.

——— 1935. A review of the nearctic Geosarginae. Can. Ent. 67:267–275.

——— 1936a. Some evolutionary trends in the Stratiomyidae. Annals Ent. Soc. Amer. 29:624–626.

——— 1936b. A proposed classification of the nearctic Stratiomyinae. Trans. Amer. Ent. Soc. 62:31–36.

——— 1936c. The genus *Odontomyia* in America North of Mexico. Annals Ent. Soc. Amer. 29:517–550.

——— 1936d. The Stratiomyidae of Colorado and Utah. Journ. Kan. Ent. Soc. 9:33–48.

——— 1939a. A review of the nearctic Beridinae. Annals Ent. Soc. Amer. 32:543–548.

——— 1939b. Synonomy of Isosargus. Ent. News 50:218.

——— 1941a. Notes on the nearctic Geosarginae. Ent. News 52:105–108.

——— 1941b. A preliminary study of the new world Geosarginae. Lloydia. 4:300–309.

JAMES and STEYSKAL. 1952. A review of the nearctic Stratiomyini. Annals Ent. Soc. Amer. 45:385–412.

JOHANSEN, O. A. 1935. Aquatic Diptera. Part II. Cornell University Ag. Experiment Station Memoir 177.

JOHNSON, C. W. 1895. A review of Stratiomyia and Odontomyia of North America. Trans. Amer. Ent. Soc. 22:227–278.

MALLOCH, J. R. 1915. A revision of the North American Pachygasterinae with unspined scutellum (Diptera). Annals Ent. Soc. Amer. 8:305–321.

——— 1915–17. Bull. Illinois State Lab. of Nat. Hist. 12:330.

WILLISTON, SAMUEL W. 1908. Manual of North American Diptera. 3rd Edition.

VERRALL, G. H. 1905. British Flies V. Stratiomyidae Etc. London.

DETERMINATION OF ELECTROMETRIC PROPERTIES OF GROUND WATER BY A FIELD METHOD[1]

R. S. PIERCE[2]
Soils Department, University of Wisconsin

The reaction, oxidation-reduction potential, and specific conductance of ground water exert pronounced influence on the distribution of vegetation on hydromorphic soils. These properties taken together express two major ecological conditions: degree of water oxygenation and supply of nutrient elements, particularly bases (Hartmann, 1928; Averell and McGrew, 1929; Laatsch, 1944).

As revealed by a study of organic soils in Wisconsin (Wilde *et al.*, 1950), stagnant bogs, characterized by an average reaction of pH 4.2, redox potential of —250 m.v., and specific conductance of 7.8 mhos $\times$ 10^5, support only struggling stands of black spruce and tamarack. Ground water of organic soils with slow but constant internal drainage showed average values of pH 6.1, redox potential —50 m.v., and specific conductance 25 mhos $\times$ 10^5; such soils support mixed stands of hardwoods and conifers which attain yields as high as 30 or 40 cords per acre. Alluvial soils, subirrigated by well-oxygenated ground water enriched in bases, are correlated with forest stands whose rate of growth at times exceeds that of most productive upland soils. The ground water of alluvial soils usually has a nearly neutral reaction, positive redox potential and specific conductance approaching 40 mhos $\times$ 10^5. However, the ground water of periodically inundated areas shows great variation in its composition, and therefore average values have questionable significance.

Another study (Wilde and Randall, 1950) detected that stands of aspen on siliceous soils owe their rapid growth to the fertilizing effect of hard water enriched in electrolytes by contact with lenses of lacustrine clay or other fertile substrata. In other instances, however, tree growth was found to be depressed by ground water carrying an excess of calcium and magnesium car-

---

[1] Publication authorized by the director of the Wisconsin Agricultural Experiment Station. This work was supported in part by the Wisconsin State Conservation Department.

[2] The writer owes a debt of gratitude to Dr. S. A. Wilde, Soils Department, under whose direction this work was conducted, and to Dr. G. A. Rohlich, Hydraulics Laboratory, University of Wisconsin, for helpful suggestions concerning methods for analysis of ground water.

bonates. There is evidence that the chemical composition of ground water affects the activity of microorganisms, development of humus layers (Hesselman, 1910; Feher, 1933), and in turn, natural regeneration of selectively logged forest stands.

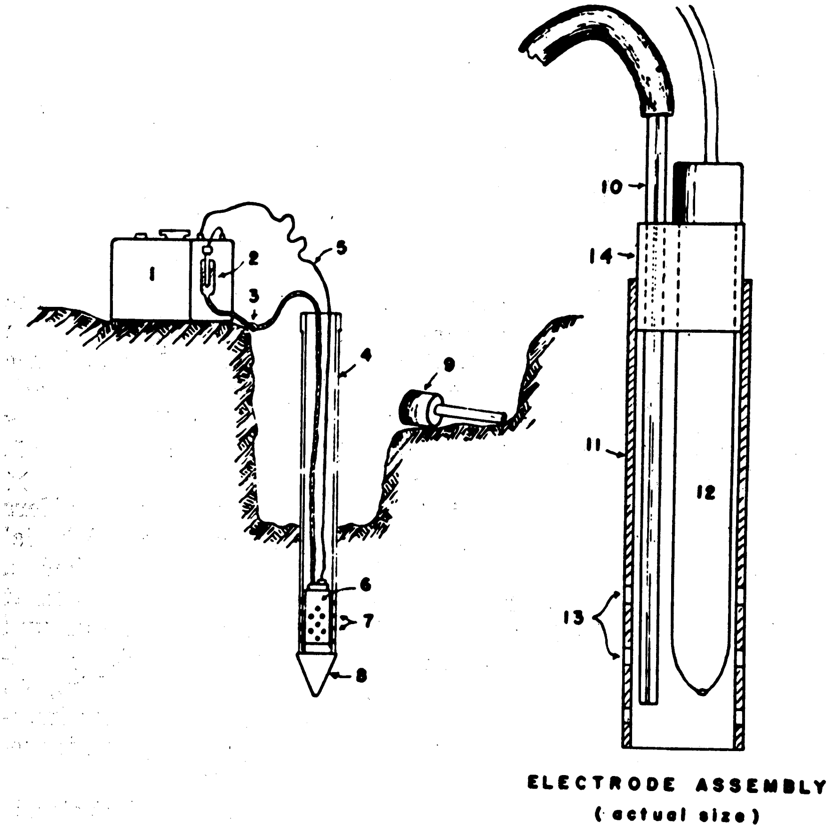


FIGURE 1. Portable apparatus for the determination of redox potential of soils *in situ* (schematic diagram): (1) potentiometer, (2) calomel half cell in reservoir with saturated KCl solution, (3) bead valve in ¼ inch Tygon tubing, (4) galvanized sampling pipe, length 3 feet, diameter 1 inch, (5) electrode lead, (6) electrode assembly, (7) 100-mesh screen openings, (8) removable steel point, (9) metal driving hammer, (10) glass capillary tube, (11) plastic insulating sheath, (12) platinum electrode, (13) water inlets, (14) fitted rubber stopper.

The technique of electrometric analysis of ground water is extremely simple and rapid. Unfortunately it is handicapped by difficulties in obtaining samples not contaminated with oxygen, as well as the preservation of samples in their original condition during transportation. Therefore, an attempt was made to follow the technique used by Starkey and Wight (1946) in their study of corrosion of iron in soil, and to develop a direct electrometric method for analysis of ground water *in situ*. The procedure is reported in this paper.

The soil is excavated until slight seepage of ground water is evident. A galvanized-iron well point is tapped into the gley horizon with a driving hammer to a depth of 18 inches (Figure 1). The assembly of the platinum electrode and capillary tube of the KCl bridge is inserted into the well pipe. The calomel half cell is placed in a glass tube with saturated KCl solution. This is connected with the capillary tube to form a KCl bridge from the calomel half cell to the water, a device which precludes contamination of the cell by suspended colloids. The platinum electrode and calomel half cell are connected to a portable Beckman potentiometer, Model N–2 (Beckman Instruments, Inc.). Two drops of KCl, released by pinching the bead valve, assure a complete circuit. After allowing a few minutes for the system to reach equilibrium, the reading is taken. The pH value is obtained in a similar manner by substituting a glass electrode for the platinum electrode.

Before the determination of specific conductance, the temperature of the water is recorded by an ordinary thermometer. Then, a conductivity cell is inserted into the well pipe and connected to a portable Solu-Bridge (Industrial Instruments, Inc.). The scale of the bridge is set at the recorded temperature and the reading is taken. The entire analysis consumes not more than 15 minutes, not counting the time required for soil excavation.

The technique devised appears to provide not only simplification and acceleration of ground water analysis, but also greater accuracy of the results obtained. It is hoped that this method will find application in silviculture, soil drainage, irrigation practice, and artificial regulation of ground water.

LITERATURE CITED

AVERELL, J. L. and P. C. MCGREW. 1929. The reaction of swamp forests to drainage in northern Minnesota. State Dept. of Drainage and Waters. St. Paul, Minn.

FEHER, D. 1933. Untersuchungen über die microbiologie des Waldbodens. Berlin.

HARTMANN, F. K. 1928. Kiefernbestandestypen des nordostdeutschen Diluviums. Neudamm.

HESSELMAN, H. 1910. On the oxygen content of water and its influence on the development of bogs and forest growth. Meddel. Statens Skogsförs. 7:91–125 (In Swedish).

LAATSCH, W. 1944. Dynamik der deutschen Acker-und Waldböden. Ed. 2. Th. Steinkopff, Dresden.

STARKEY, R. L. and K. M. WIGHT. 1946. Anaerobic corrosion of iron in soil. Amer. Gas Assoc., 420 Lexington Ave., N. Y.

WILDE, S. A. and G. W. RANDALL. 1950. Chemical characteristics of ground water in forest and marsh soils of Wisconsin. Trans. Wis. Acad. Sci. Arts and Letters. 40: 251–259.

WILDE, S. A., J. TRACH and S. F. PETERSON. 1950. Electrometric properties of ground water in major types of Wisconsin organic soils. Soil Sci. Soc. Amer. Proc. 14:279–281.

DECOMPOSITION OF HARD MAPLE SAWDUST BY TREATMENT WITH ANHYDROUS AMMONIA AND INOCULATION WITH *COPRINUS EPHEMERUS*[1]

CHARLES B. DAVEY[2]
Soils Department, University of Wisconsin

The growth of population and the development of civilization are always paralleled by a depletion of soil organic matter, caused by cultivation, erosion, and burning. This explains why numerous efforts are now being made to replace the lost soil organic matter by waste materials. One of these materials is sawdust, produced daily in enormous quantities by wood-using industries.

Numerous attempts to use sawdust for the preparation of composts or direct treatment of the soil have been made, with results which have not always been satisfactory (Allison and Anderson, 1951; Attoe, 1949; Johnson, 1944; Lunt, 1950; Motte, 1931; Nostitz, 1937; Turk, 1943; Viljoen and Fred, 1924; Walters, Fox, and Wycoff, 1951; and Wells, 1950). The adverse properties of sawdust, which reduce its value as a fertilizer, are: high content of alcohol-benzen solubles, resistance to decay, general poverty of nutrient elements, high carbon-nitrogen ratio, and fixation of nitrogen and other nutrients by organisms employed in the decomposition of cellulose.

This study aimed to remove or reduce some of these adverse effects of sawdust by preliminary chemical and microbiological treatments. Sawdust of hard maple (*Acer saccharum* Marsh.) was treated with anhydrous ammonia, the alkaline reaction neutralized with phosphoric acid, and the material brought to a desirable nutrient content by the addition of potassium sulfate and other nutrient salts. This prepared medium was inoculated with wood-decomposing fungi. The details of this procedure and the results obtained are presented in this report.

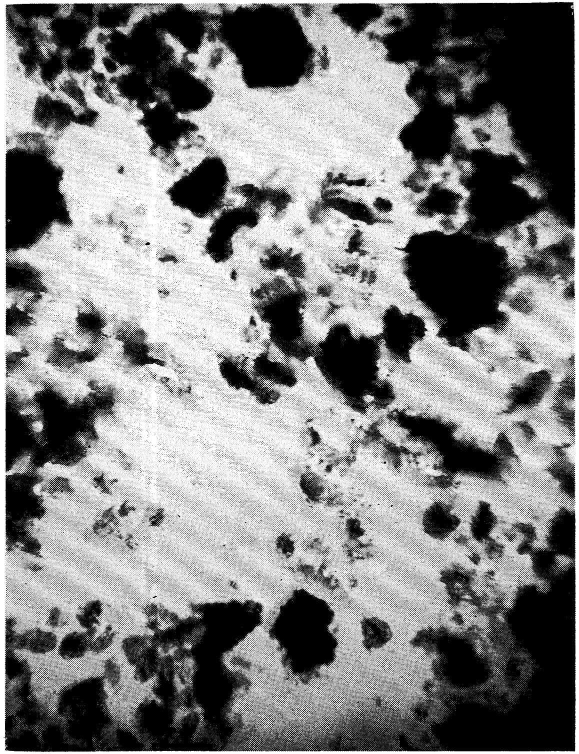
The first step in the procedure involved the estimation of the amount of anhydrous ammonia needed to overcome the unfavor-

---

[1] Publication authorized by the director of the Wisconsin Agricultural Experiment Station. This work was supported in part by the Wisconsin State Conservation Department.

[2] The writer is indebted to Dr. S. A. Wilde, under whose guidance this investigation was conducted, and to the late Dr. C. Audrey Richards of the U. S. Forest Products Laboratory, Division of Forest Pathology, for helpful advice and cultures of cellulose-destroying fungi.

A



B

FIGURE 1. Photomicrographs showing degree of decomposition of maple sawdust treated with 15 lbs. anhydrous ammonia, 2.5 lbs. phosphoric acid, and 5 lbs. potassium sulfate, per cubic yard, after 3 months composting. A. Inoculated with *Lenzites trabea.* B. Inoculated with *Coprinus ephemerus* 250x.

able effect of the high carbon-nitrogen ratio. The sawdust was treated with anhydrous ammonia at rates ranging from 1 to 24 pounds of elemental nitrogen per cubic yard, using the technique for peat composting of Voigt *et al.* (1949). These trials indicated that 12 pounds of elemental nitrogen, or 15 pounds of anhydrous ammonia, per cubic yard is the optimum amount, considering both economic and nutritional aspects.

By further tests, it was established that ammonia-treated sawdust requires 2½ pounds of phosphoric acid per cubic yard to bring the reaction of ammonia-treated sawdust to pH 6.5. This treatment enriches the sawdust in phosphorus at the rate of about 2 pounds of P_2O_5 per cubic yard. This amount is well correlated with average phosphorus requirements of crops, provided the sawdust is applied to the soil at the rate of 20 to 30 cubic yards per acre.

Considering the standards for average soil fertility maintenance, the application of 50 per cent potassium sulfate was made at the rate of 5 pounds per cubic yard of sawdust.

In initial trials, the chemically treated sawdust was inoculated with two species of wood-decomposing fungi: *Lenzites trabea* and *Lentinus lepidius*. Pure cultures of these organisms were obtained from the U. S. Forest Products Laboratory, Division of Forest Pathology. After periods of 3 and 6 months, the incubated media were examined and the effect of microorganisms determined analytically. However, the results indicated only a moderate rate of decomposition.

Concurrent with this work, some chemically treated compost was treated with a small quantity of hardwood-hemlock leafmold. Three weeks after the addition of leafmold, the sawdust showed prolific growth of *Coprinus ephemerus*, a fungus with short-lived fruiting bodies, but tremendously active mycelia.

Coprinus ephemerus was isolated and transferred to fresh chemically treated sawdust. The mycelia developed with great rapidity and within three weeks produced another crop of fruiting bodies. The growth of *Coprinus* was followed by the development of larvae and adults of *Sciaridae* spp., commonly called "fungus gnats." Microscopic observation revealed the presence of a dense and diversified population of microorganisms, as well as a greatly reduced particle size of the sawdust material (Figure 1). The energetic fermentation was associated with emanation of ammonia and an odor resembling that of actively decomposing horse manure.

After fermentation for 5 months, the energy material apparently had become exhausted and the compost had reached the end point of microbiological activity. Samples of fresh sawdust, chemically treated sawdust, and sawdust that had been decomposed by *Coprinus ephemerus,* were analyzed for color, particle size, and base exchange capacity. The results are reported in Table 1.

TABLE 1

EFFECT OF CHEMICAL TREATMENT AND INOCULATION WITH *Coprinus ephemerus* ON COLOR, PARTICLE SIZE, AND BASE EXCHANGE CAPICITY OF HARD MAPLE SAWDUST

TREATMENT	COLOR MUNSELL NOTATION	PARTICLE SIZE—DISTRIBUTION BY SIEVING: Under 30 Mesh (Per cent)	30-60 Mesh (Per cent)	Over 60 Mesh (Per cent)	AVERAGE PARTICLE SIZE DETERMINED MICROSCOPICALLY MM. [2]	BASE EXCHANGE CAPACITY M.E. PER 100 G.
Fresh sawdust	10YR:7/4	10.0	72.6	17.4	1.87	8.22
Sawdust treated with anhydrous ammonia, phosphoric acid, and potassium sulfate	10YR:4/3	6.3	66.8	26.9	1.39	9.87
Sawdust chemically treated, decomposed by *Coprinus ephemerus*	10YR:2/2	0.0	44.9	55.1	0.19	68.53

The results of particle size analysis indicate drastic change in the physical makeup of fermented sawdust. This was paralleled by a pronounced melanization of material, as indicated by Munsell notation, and a nearly 700 per cent increase in the ionic exchange capacity. It should be noted that the latter property indicates the accumulation of lignin, i.e., the fraction which is, in a great degree, responsible for retention of nutrient elements, particularly bases.

LITERATURE CITED

1. ALLISON, F. E. and ANDERSON, M. S. 1951. The use of sawdust for mulches and soil improvement. Agr. Res. Adm., B.P.I., S. and E., Div. Soil Mgmt. and Irrig., Beltsville, Md.
2. ATTOE, O. J. 1949. Shavings for bedding save plant food. Hoard's Dairyman, 94: No. 1, p. 18.
3. JOHNSON, W. A. 1944. The effect of sawdust on the production of tomatoes and fall potatoes and on certain soil factors affecting plant growth. Proc. Amer. Soc. Hort. Sci., 44:407–412.

4. LUNT, H. A. 1950. Wood chips as a soil amendment. Bul. 33, Northeastern Wood Util. Council, 8 p.
5. MOTTE, M. H. 1931. The use of sawdust as a fertilizer. Jour. Agr. Prat., 95:192.
6. NOSTITZ, A. V. 1937. The effect upon the soil of sawdust used as stable litter. Bodenkunde u. Pflanzenernahr, 3:211–218.
7. TURK, L. M. 1943. The effect of sawdust on plant growth. Mich. Agr. Exp. Sta. Quart. Bul., 26: No. 1, 10–22.
8. VILJOEN, J. A. and FRED, E. B. 1924. The effect of different kinds of wood and wood-pulp cellulose on plant growth. Soil Sci., 17:199–212.
9. VOIGT, G. K., BRENER, W. H., and WILDE, S. A. 1950. Liquid ammonia treatment of composting fertilizers. Soil Sci. Soc. Amer. Pro., 14: 281–283.
10. WALTERS, C. S., FOX, H. W., and WYCOFF, H. R. 1951. Composting coarse hardwood sawdust with a bacterial accelerator. Jour. For., 49: No. 12, 910–911.
11. WELLS, J. S. 1950. Use of sawdust for ericaceous crops. Amer. Nurseryman, 91:7–8, 33.

RELATION OF THE UNDERSTORY TO THE UPLAND FOREST IN THE PRAIRIE-FOREST BORDER REGION OF WISCONSIN[1]

MARGARET L. GILBERT AND J. T. CURTIS
University of Wisconsin, Madison

As part of a study of the plant communities of Wisconsin, started in 1946, Curtis and McIntosh (1951) studied the tree composition of the upland deciduous forest in southwest Wisconsin. They found that "No distinct groups of stands were apparent—rather the entire series of communities formed a continuum in which a definite gradient was exhibited from initial stages composed of pioneer species to terminal stages composed of climax species." Such a pattern of community change along a gradient was termed by these authors a "vegetational continuum." Brown and Curtis (1952) have shown a similar continuum for the tree communities of the northern conifer-hardwoods in Wisconsin. The present paper is concerned with the relationship of the understory shrub-herb population to the tree continuum in southwest Wisconsin, the same area studied by Curtis and McIntosh (1951).

The area studied is in the ecotone between grassland and deciduous forest, south of the tension zone between southern and northern hardwood forests, and west of the maple-beech forest. Before settlement by Europeans, the prairie-forest border region was kept in prairie and oak-opening by frequent fires set by the Indians. Only sites protected from these fires could support closed forest. Since settlement, and cessation of the fires, the oak-openings have grown into closed oak woods. These woods are composed of open-grown trees, and of a first generation of forest trees, mostly of the species which were present on the site as scattered trees or grubs when the fires stopped. Although there has not been time for canopy succession on most of the sites, the understory has changed from a prairie to a forest community.

The physiography, climate, soil, and vegetation of the area are discussed in detail in Curtis and McIntosh (1951).

The authors wish to express their appreciation to Drs. R. P. McIntosh, and P. B. Whitford for use of data from their files,

[1] This work was supported in part by the Research Committee of the Graduate School of the University of Wisconsin from funds supplied by the Wisconsin Alumni Research Foundation.

and to Mr. F. J. Gruenberger of the University of Wisconsin Computing Service for his aid in the coding and statistical treatment of the data.

Methods

Most of the stands used in this study are the same as those employed to determine the upland forest continuum in the area. In addition, a few stands studied by Whitford (1949) in northern Illinois are included. The three criteria used for selection of the stands were, that they be large enough to minimize the edge effect (minimum of 15 acres), free from disturbance such as fire, cutting, or grazing, and on upland sites where no runoff waters accumulate.

Presence was taken in the entire stand, in a preliminary survey to determine the condition of the stand with regard to disturbance. Frequency data were taken in 64 stands investigated in 1949 and 1950 in connection with the tree continuum study. Twenty one-quarter milacre quadrats, placed at one-half the random point samples, were laid down in each stand. Species present in the quadrat were recorded on field data sheets. Later, in the laboratory, these data were transferred to standard data sheets, and frequency was computed.

Values for presence were transferred to marginal punch cards, and to Holorith cards. Cole's index of association (Cole, 1949) was calculated for each of fifty species with every other, using the I.B.M. electronic calculator and tabulator. The species were chosen on the dual bases of occurrence in over 10 per cent of the stands and of reaching a frequency of 40 per cent or more in at least one of the stands studied.

The taxonomic nomenclature follows that of Gray's Manual of Botany, 8th edition, 1950.

Results

In order to evaluate forest stands in terms of their total tree composition, Curtis and McIntosh (1951) developed the continuum concept. This is the idea of a gradient of some factor along which other factors may vary according to predictable patterns. The concept is applicable to gradients of environment as well as to gradients of vegetation. In the case of the trees, a continuum index (C. I.) value for each stand was calculated as a weighted summation of relative values of frequency, density, and dominance for all tree species in the stand. The weighting, by a "climax adaptation value," indicates primarily the shade-tolerance of the species as compared to *Acer saccharum*, the most

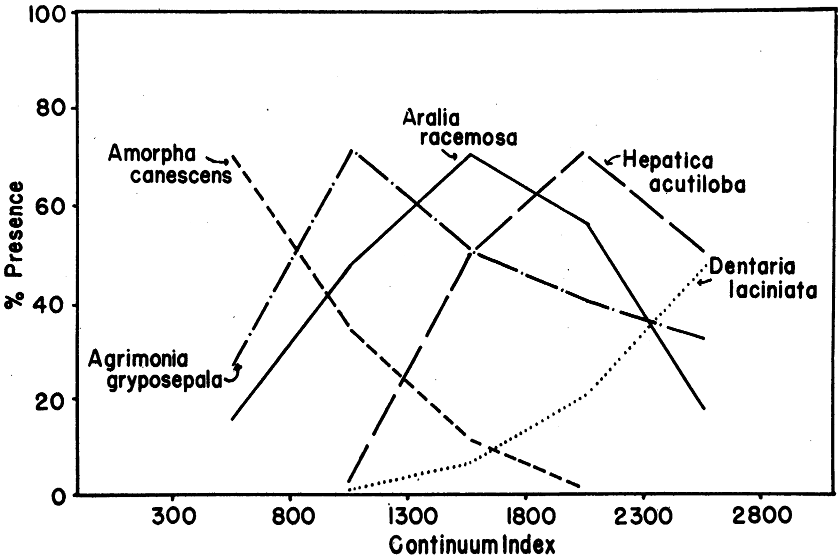


FIGURE 1. Per cent presence in 500 unit intervals of the tree continuum index.

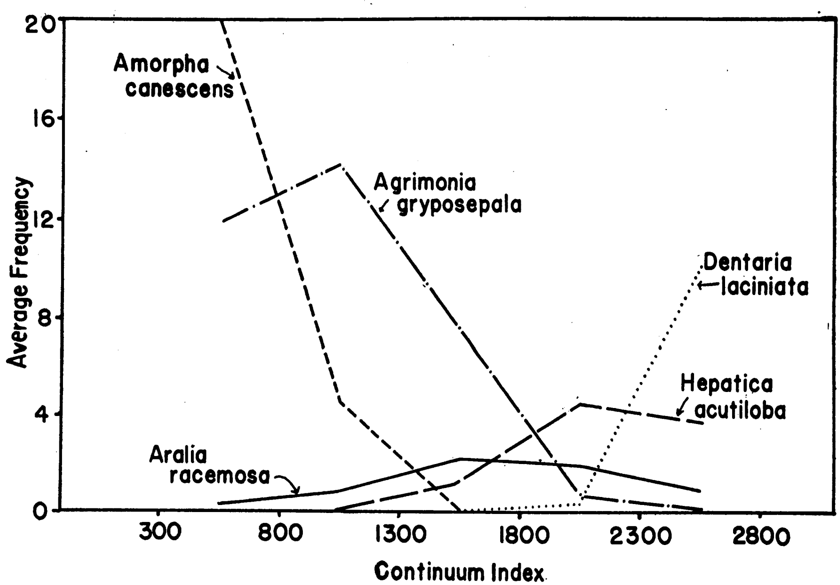


FIGURE 2. Average frequency in 500 unit intervals of the tree continuum index.

shade-tolerant species within the limits of the study. When a number of stands are arranged in the order given by the continuum index, not only the trees, but also the shrubs, herbs, other organisms, and environmental factors show definite trends.

Figures 1 and 2 show per cent presence and average frequency for selected understory species with points plotted in consecutive intervals of 500 units along the tree continuum. The size of the intervals chosen to obtain the frequency and presence values is arbitrary. A different interval size, or a different base unit would not change the total reaction picture of the species, but might change the location of the mode on the C.I. gradient.

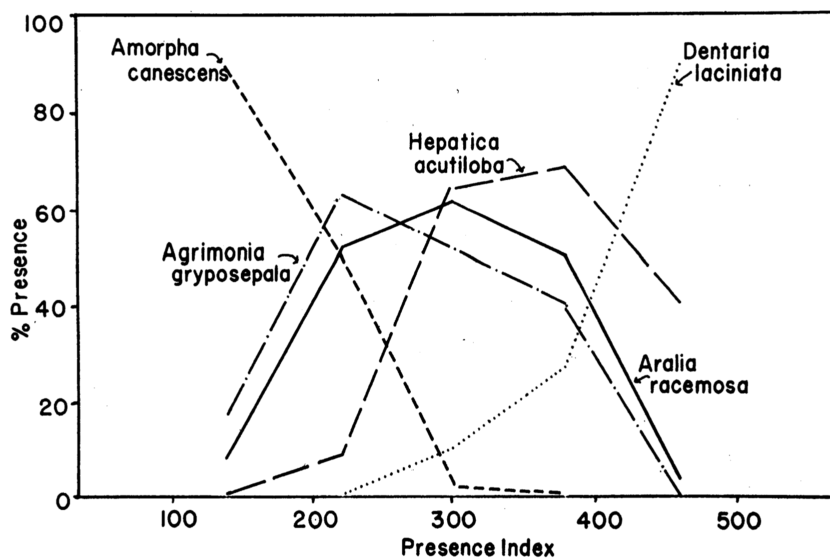


FIGURE 3. Per cent presence in 80 unit intervals of the presence index.

To determine how closely the shrub-herb population follows the gradient of canopy change as measured by the tree C.I., five groups of ten species each were chosen on the basis of the species in each group having a definite high point in per cent presence somewhere within one of the 500 unit C.I. intervals. The species shown in Figure 1 illustrate the general pattern of response of the species chosen to make up the groups. A list of the species is given in Table 1.

To make further computations easier, the particular species out of the fifty which were present in each stand were punched on a marginal punch card, and the percentage of the total which occurred in each group was computed. These per cents were

TABLE 1

Presence index groups compared with the classification of Dansereau (1943). Symbols *I, L,* and *S* refer to light tolerance: I, indifferent; L, heliophile; S, sciophile. Symbols *A, M,* and *H* refer to moisture tolerance: A, arid; M, mesophile; H, hydrophile.

Presence index group		*Dansereau (1943)*
I.	Amorpha canescens	
	Comandra umbellata	
	Cypripedium calceolus v. pubescens	
	Galium boreale	
	Monarda fistulosa	
	Physocarpus opulifolius	
	Rhus glabra	
	Rubus idaeus v. strigosus	
	Smilacina stellata	
	Vicia americana	
II.	Agrimonia gryposepala	I A
	Apocynum androsaemifolium	L A
	Asclepias exaltata	
	Helianthus strumosus	
	Lonicera prolifera	
	Potentilla simplex	
	Pteridium aquilinum v. latiusculum	L A
	Rubus allegheniensis	L A
	Taenidia integerrima	
	Zizia aurea	
III.	Aquilegia canadensis	L A
	Aralia racemosa	S M
	Aster sagittifolius	
	Bromus purgans	
	Diervilla lonicera	L A
	Hystrix patula	
	Lathyrus ochroleucus	
	Lysimachia quadrifolia	
	Panicum latifolium	
	Thalictrum dioicum	S M
IV.	Asarum canadense	S M
	Brachyelytrum erectum	S M
	Caulophyllum thalictroides	S M
	Cornus alternifolia	S M
	Hepatica acutiloba	S M
	Mitella diphylla	S M
	Polygonatum pubescens	S M
	Ranunculus abortivus	S H
	Viburnum acerifolium	I A
	Xanthoxylum americanum	S M
V.	Allium tricoccum	S M
	Claytonia virginica (C. caroliniana)	S M
	Cystopteris fragilis	S H
	Dentaria laciniata (D. diphylla)	S M
	Dicentra cucullaria	S M
	Erythronium albidum (E. americanum)	S M
	Laportea canadensis	S H
	Menispermum canadense	I M
	Tovara virginiana	S M
	Trillium recurvatum	S M

weighted according to the tree C.I. interval of the group. Thus the group representing the interval from 300 to 800 C.I. was weighted *1;* the group from 801 to 1300 C.I., *2;* and so on, to the group from 2301 to 2800 C.I. which was weighted *5.* The weighted per cents were summed to give a *presence index* for the stand. The range of this index, 100 to 500 units, corresponds to that of 300 to 2800 units on the tree C.I. A sample computation of the presence index is given in Table 2. As shown in Table 3, the correlation between the tree C.I. values, based on the canopy species, and the presence index, based on the shrubs and herbs, is highly significant. The trends in per cent presence exhibited when individual species are plotted along the presence index (Figure 3) are similar to their trends along the tree C.I. (Figure 1). Figure 4 indicates the trends exhibited by other representative species.

TABLE 2

Sample computation of the presence index. See Table 1 for species comprising the groups.

Stand #: 1035
C. I. : 2451
Frequency index: 495

Group	# Sp. Present	Percent of Total	Wt.	Index
I.	0	0.0	1	0.0
II.	1	6.3	2	12.6
III.	1	6.3	3	18.9
IV.	5	31.2	4	124.8
V.	9	56.3	5	281.5
	16	100.1		437.8

TABLE 3

Correlation coefficients (r) and significance of indices calculated.

	C.I.	*Presence index*	*Frequency index*
Presence index	r = 0.726 d.f. = 89 $r_{.01}$ = 0.274		
Frequency index	r = 0.765 d.f. = 62 $r_{.01}$ = 0.348	r = 0.890 d.f. = 62 $r_{.01}$ = 0.348	
Acer-Quercus index	r = 0.868 d.f. = 62 $r_{.01}$ = 0.274	r = 0.902 d.f. = 116 $r_{.01}$ = 0.251	r = 0.854 d.f. = 62 $r_{.01}$ = 0.348

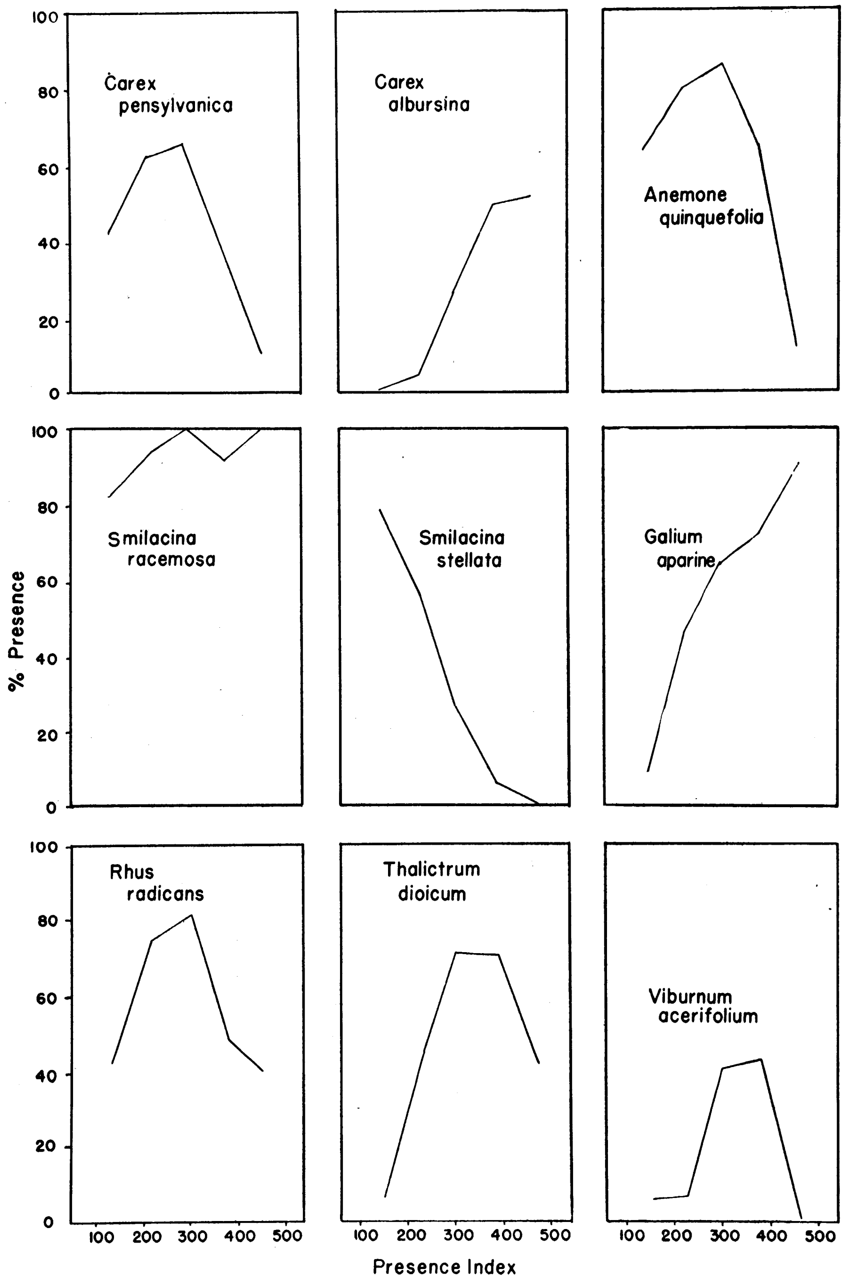


FIGURE 4. Per cent presence in 80 unit intervals of the presence index.

The same procedure as that followed above in calculating the presence index was repeated, using frequency data. The per cent of the total frequency found in each group was calculated, weighted, and summed, to give a *frequency index* to the stand. In the stand used as an example in Table 2, the frequency index is 495, the presence index, 438. While there were species of groups II, III, and IV present in the stand, they were represented by few individuals. Therefore the relative frequency of group V is higher than its relative presence. Although there are differences between the two indices in individual stands, the relative positions of the stands in the frequency index are highly significantly correlated with the positions in both the presence index, and the tree C.I. (Table 3).

TABLE 4

Species used in deriving the *Acer saccharum-Quercus velutina* index. Species in set A occur in the 10 stands where *Quercus velutina* reaches its highest importance values, and are not found in the 10 stands where *Acer saccharum* reaches its highest importance values. Species in set B occur in the *Acer* stands and not in the *Quercus* stands. Roman numerals indicate the presence index group of the species (Table 1).

	A.		B.
I	Amorpha canescens		Carex albursina
	Anomone cylindrica		Conopholis americana
II	Apocynum androsaemifolium		Cornus rugosa
III	Aquilegia canadensis	V	Dicentra cucullaria
	Ceanothus americana	V	Erythronium albidum
I	Comandra umbellata		Festuca obtusa
I	Monarda fistulosa		Floerkea proserpinacoides
II	Pteridium aquilinum v. latiusculum		Impatiens capensis
I	Smilacina stellata		Isopyrum biternatum
	Vaccinium virginianum	V	Laportea canadensis
	Veronicastrum virginicum		Orchis spectabilis
			Panax quinquefolia
			Phlox divaricata
			Ranunculus septentrionalis
			Solidago flexicaulis
		V	Tovara virginiana
			Trillium grandiflorum
		V	Trillium recurvatum
		IV	Viburnum acerifolium

To determine whether the understory population changes would follow the reactions of individual canopy species as well as the gradient of the total tree complex, two sets of 10 stands were chosen. One set comprised the 10 stands in which *Acer saccharum* reaches its highest importance values, the other set the 10 stands in which *Quercus velutina* reaches its highest importance values. *Acer saccharum* was chosen as an example of a shade-tolerant, *Quercus velutina* as an example of a shade-intolerant tree. The herbs and shrubs present in these stands were recorded on standard data sheets, and lists of species which occurred in one set and not the other were compiled (Table 4). These two groups of species correspond in tolerance to groups I and V of Table 1. The groups were therefore weighted *1*, and *5*, and another index was computed in the same manner as the above. The stand index values according to this *Acer saccharum-Quercus velutina* index are highly significantly correlated with the values of the tree C.I., the presence index, and the frequency index, as shown in Table 3.

All of the indices calculated above are highly significantly correlated with each other, and with the tree C.I. This indicates that the shrub-herb population, taken as a whole, responds to changing environment in the same way as does the canopy population, when the data are based on the evidence of groups of species chosen for their tolerances as compared with the tolerances of the trees. Since no two species have the same pattern of tolerance to the changing environment, it would seem better to start on an individual species basis, and derive any arbitrary groups needed for a particular problem from the pattern of all the species present in the population.

Using data obtained from the application of Cole's index of association (Cole, 1949) to fifty understory species, a start was made toward the independent derivation of a continuum of shrubs and herbs for the southern Wisconsin upland forests. The criteria used for the original choice of the fifty species were such as to include common species which did not necessarily show any tolerance pattern within the limits of the study. Presence of the species was punched on Holorith cards, one card for each stand studied. The cards were fed through an electronic calculator which computed the association of each species with every other according to Cole's index, and the standard error of each index value. Significance of the index values was tested by the *t* test (Snedecor, 1946). Out of 1,225 tests, 23 were significant. Eight species pairs showed negative association; 15 showed positive association. The pattern of occurrences together for these species is shown in Figure 5. Similar methods of association analysis have been employed by Agrell (1945) and by Tuomikoski (1942). The species shown in Figure 5 arrange themselves into two terminal groups, connected by species such as *Parthenocissus inserta* and *Osmorhiza claytoni* whose tolerance limits are greater than the environmental range studied. The upland forest stands in southern Wisconsin contain varying proportions of "pioneer" and "climax" species together with species with wide tolerance limits.

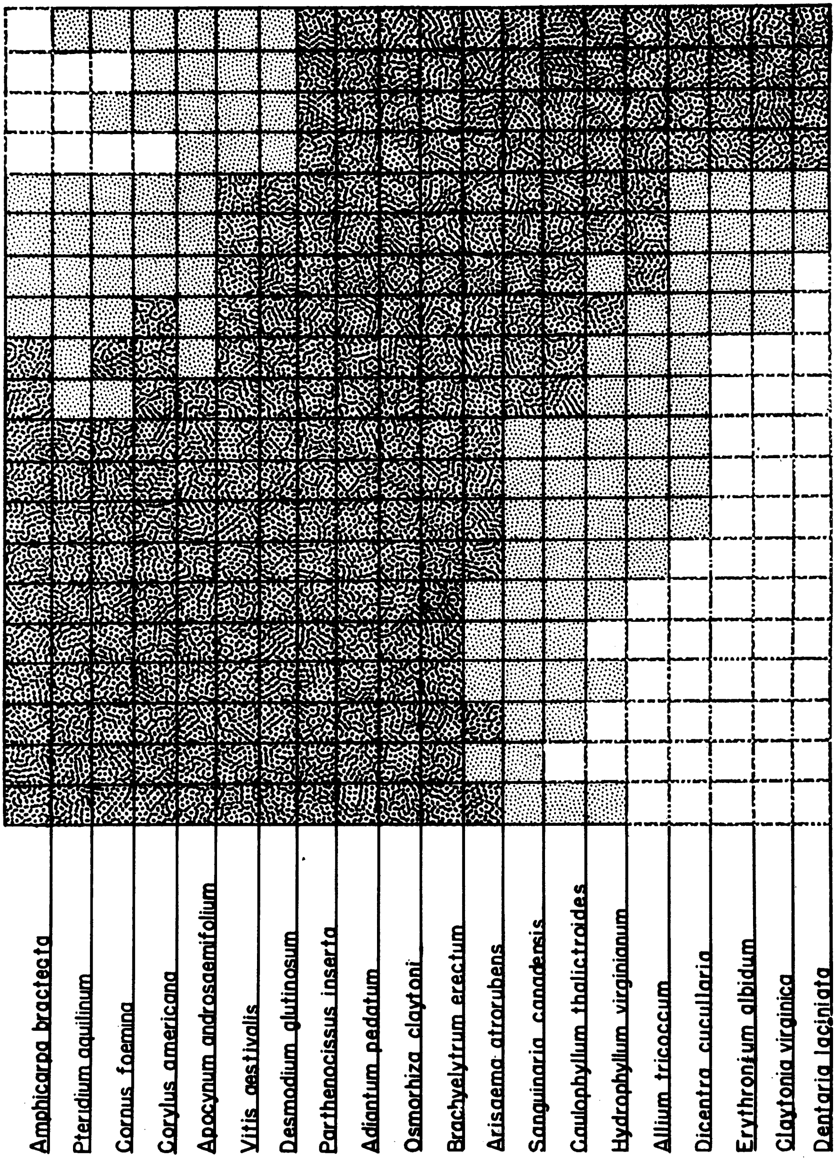


FIGURE 5. Relative per cent of occurrence together of species showing significant association with Cole's Method. Dark shading indicates occurrence of from 100 to 74%; moderate shading from 73 to 48%; light shading from 47 to 22%.

DISCUSSION

When stands are arranged along a continuum based on the tree complex, the shrubs and herbs show definite trends in presence and frequency. However, no two species show exactly the same tolerance pattern. There are no groups of species evident; instead there is a continuous variation in the population similar to that found in the canopy population by Curtis and McIntosh (1951), and Brown and Curtis (1952).

Some species, such as *Aralia racemosa, Agrimonia gryposepala,* and *Hepatica acutiloba* in Figure 3, and *Carex pensylvanica* and *Rhus radicans* (Figure 4) reach a definite high point in per cent presence and average frequency within the limits of the upland deciduous forest continuum studied. Below and above this point, the species are present in fewer stands, and are less frequent in the stands in which they do occur. Other species seem to reach their optimum habitat right at the limits of the study, or beyond them. *Amorpha canescens* (Figure 3) and *Smilacina stellata* (Figure 4) are prairie plants which persist in the woods, but with a decreasing presence, and low frequencies. *Dentaria laciniata* (Figure 3) and *Carex albursina* (Figure 4) are examples of species which are characteristic of the mesic, closed-canopy upland woods. These species are not present in the dryer, more open woods, but may become still more common in woods which are more moist than those studied. Current investigations of the oak-openings and the floodplain hardwoods will better delimit the tolerances of such marginal species. Species in one genus often show very different tolerance patterns, as for example *Carex albursina* and *C. pensylvanica,* and *Smilacina racemosa* and *S. stellata* in Figure 4.

In general, both presence and frequency show the same trends along all the indices studied. The mode of the species curve based on presence data may not fall in the same class interval as that based on frequency data, however, and one measure may show a broad optimum range, while the other shows a definite high point. Frequency values are greatly influenced by the distribution of individuals in the stand, as shown by Whitford (1949). Better methods of determining the kind and amount of departure from a random distribution are urgently needed.

Many authors have come to the conclusion that, "The plant-indicator value of individual species is distinctly less than that of groups of species, on the same basis of classification" (Kittredge, 1938). Although each species exhibits a different adaptive response to the complex of environmental factors, arbitrary groups of species which have optimum ranges more or less in common may be chosen, and made useful tools in studying the reaction of the whole population to changing habitat conditions. In the present study, groups of species chosen either on the basis of their response to the total tree complex, or of their association with some tree which is dominant in a certain environmental range, were used to compare the variation in the understory along the tree continuum. In accordance with the findings for prairie plants (Curtis, 1951), it was determined that presence based on groups of species, is of considerable value as a quantitative measure of population reaction.

Similar arrangements of species are found with all methods employed in the study. Using the presence index groups (Table 1) as the basis of comparison, species arrangements derived from the occurrence of species with two trees (Table 4) and from relative mutual occurrences (Figure 5) show that species which appear to have similar tolerance patterns along the tree C.I. occur with one dominant, and have a high relative mutual occurrence. In Figure 5, species which have a broad mode in per cent presence, such as *Osmorhiza claytoni*, show high mutual occurrence with all the other species tested, and thus are placed in the center of the series until further information as to their tolerance limits is available.

It is interesting to compare the general range of tolerance for the same, or closely related, species found in Quebec (Dansereau, 1943) and in Wisconsin (Table 1). Both regions are at the edge of the southern hardwood forest. In Quebec, the transition is to northern conifer-hardwood and boreal forest; in Wisconsin to northern conifer-hardwood forest and prairie. Thus, the "pioneer" species are different in the two regions. None of the species in group I of the indicator groups in the Wisconsin study occur in the Quebec study (Table 1). In Wisconsin the species which occur in the drier stands come from the prairie, in Quebec from the boreal forest. As the environment changes toward a closed canopy and moister conditions, more species are found in common. Most of the species seem to show similar environmental requirements in both regions. *Viburnum acerifolium* (Figure 4) is an exception, and some species such as *Thalictrum dioicum* (Figure 4) and *Aralia racemosa* (Figure 3) which occur throughout the environmental range studied in Wisconsin appear to be confined to the maple woods in Quebec.

SUMMARY

1. The upland hardwood forests of the prairie-forest border region of Wisconsin and northern Illinois were studied by means of a presence survey in 118 stands, and twenty one-quarter milacre quadrats laid down at random in 64 of the 118 stands.

2. The relation of the shrub-herb population to the tree complex was tested by the use of indices, based on presence and frequency, of groups of shrub and herb species which reached their optimum development in some interval of the tree continuum index. The indices were compared with the pattern of canopy change based on importance values. An index based on the response of shrubs and herbs to two dominant trees was also compared with the tree continuum index. Correlations of these three shrub-herb indices with each other, and with the tree continuum index were significant beyond the 1 per cent level.

3. A study of the internal dynamics of the shrub-herb population was started using data obtained from Cole's index of association. Species which were used both in deriving the presence index and in the test for association appear in the same relative position in both methods.

4. There are no discrete groups of species to be found in the understory layers of the upland hardwoods of this area. Instead, as found for the trees, there is a continuously shifting complex of species along the environmental gradient.

LITERATURE CITED

AGRELL, I. 1945. The collemboles in nests of warm-blooded animals; with a method for sociological analysis. Lunds Universitets Arskrift. *41:* 1–19.

BROWN, R. T. and J. T. CURTIS. 1952. The upland conifer-hardwood forests of northern Wisconsin. Ecol. Monog. *22:* 217–234.

COLE, L. C. 1949. Measurement of interspecific association. Ecology *30:* 411–424.

CURTIS, J. T. 1951. A Wisconsin prairie continuum based upon presence data. Bull. Ecol. Soc. Amer. *32:* 57. Abst.

CURTIS, J. T. and R. P. MCINTOSH. 1951. An upland forest continuum in the prairie-forest border region of Wisconsin. Ecology *32:* 476–496.

DANSEREAU, P. 1943. L'erabliere Laurentienne. Can. J. Res. *21:* 66–93.

KITTREDGE, J. 1938. The interrelations of habitat, growth rate, and associated vegetation in the aspen community of Minnesota and Wisconsin. Ecol. Monog. *8:* 151–246.

SNEDECOR, G. W. 1946. Statistical Methods. Iowa State College Press, Ames.

TUOMIKOSKI, R. 1942. Untersuchungen ueber die Untervegetation der Bruchmoore in Ostfinnland I. Zur Methodik der Pflanzensoziologischen Systematik. Ann. Bot. Soc. Zool. Bot. Fenn. Vanamo *17:* 1–200.

WHITFORD, P. F. 1949. Distribution of woodland plants in relation to succession and clonal growth. Ecology *30:* 199–208.

THE WHITE-TAILED DEER IN EARLY WISCONSIN

A. W. SCHORGER

The white-tailed deer *(Odocoileus virginianus)* has always been the most important large game animal east of the Mississippi River. The settlers upon the fringe of civilization depended largely upon it for food and clothing. Also, deer skins formed an important commodity in overseas commerce. In the Trans-Allegheny region they served as currency, a skin having a value of one dollar in trade. The present-day slang term of one "buck" had its origin in this custom. In Wisconsin there was a considerable traffic in hides when the fur trade was active. Venison became an important source of income during the latter half of the nineteenth century, since the building of railroads furnished access to distant markets.

This deer has remarkable recuperative powers and when given reasonable protection will soon multiply to the carrying capacity of the land. It is one of the few large game animals that will adapt itself to old, agricultural regions. Within recent years it has spread southward in Wisconsin as far as Rock County.

Presettlement History. The first definite mention of deer in Wisconsin appears to have been by Radisson, who was in northwestern Wisconsin the winter of 1661–62. He wrote in his quaint style: "The weather continued so 3 dayes that we needed no racketts [snowshoes] more, for the snow hardened much. The small staggs are [as] if they were stakes in it after they made 7 or 8 capers. It's an easy matter for us to take them and cutt their throats with our knives."[1]

Large and small stags were reported abundant at Lake Poygan by Allouez[2] in 1669. The large stags of the early French explorers were wapiti, commonly called elk. While descending the Wisconsin River in 1673, on their voyage to the Mississippi, Joliet and Marquette[3] saw many deer on the lower Wisconsin. Marquette, in November, 1674, followed the Wisconsin shore of Lake Michigan southward. In Manitowoc County, an Indian brought the party a deer, and at the Milwaukee River one of Marquette's men shot another.[4]

Deer appear to have occurred sparingly along the southern shore of Lake Superior. This is understandable in view of the prevalence of coniferous trees and the deep snow that rendered the deer an easy prey to wolves and Indians. According to Hubbard[5] deer were unknown along Lake Superior in the Upper Peninsula of Michigan prior to 1840. Shiras[6] stated that deer were unknown on the north shore in 1870 and that there were only a few on the south shore. Their remarkable increase later, attributed to lumbering, is shown by the killing of 80,000 deer in each of the years, 1879, 1880, and 1881. Most of them were taken within ten miles of Lake Superior. The source of Shiras' statistics is unknown.

The few early references to deer on the south shore indicate that the population was small prior to 1850 and that it increased rapidly after this date. When Henry[7] arrived at Chequamegon Bay in 1765, he found the Indians clothed mainly with "dressed deer-skin." The large Indian population residing at this place had to live mainly on fish, the mammals having been virtually exhausted. When the Indians set out on their hunt for furs the winter of 1765–66, they went 100 leagues westward to the Superior–Duluth region.

Interesting information on the early presence of deer in the Upper Peninsula is given by Foster and Whitney. "Within this township [Iron County] the Mackigamig receives from the right its two principal tributaries, the Mitchikau or Fence river and the Nebegomiwini or Night-watching river. The origin of these terms as explained by our voyageurs was this: At one time the deer were observed to be very numerous about the mouth of the former, and the Indians, to secure them, built a fence from one stream to the other. They [deer] would follow rather than leap over this barrier, until they were entrapped by their concealed foe. This method of capturing the deer is also practised on the Menomonee."[8] They discovered remains of deer in the ancient copper mining pits. Near the Ontonagon River fragments of the cranium, humerus, and horn of a deer were discovered under nineteen feet of debris.

Lieut. Allen[9] in 1832 reported that the Indians of Grand Island, Lake Superior, live on fish and some game, principally the "common red deer," which were killed between this place and Lake Michigan. He remarked that the Indians of Huron and Kewenaw Bays had exhausted the deer and bear that once furnished them food.

Deer are mentioned by some of the travelers in the Upper Peninsula. McKenney,[10] while at the Ontonagon River on July 23, 1826, wrote that there was no game in the Porcupine Mountains except bear and the "common red deer." On October 7, 1844, about ten miles west of Grand Island, Pitezel[11] found on the shore of Lake Superior the remains of wigwams with the bones of deer and bear hanging in the bushes.

Deer became common after 1850. Kohl was at La Pointe, Wisconsin, the summer of 1855, and wrote: "I recently saw here a hunter who had returned from the hunting-grounds in the upper peninsula, with an extraordinary quantity of game. In six weeks he had killed to his own gun no less than fifty-five deer."[12]

The hunters at Marquette complained in 1862 that the wolves were driving away all the deer.[13] Cartwright[14] and a companion, hunting in Marquette County, Michigan, killed 67 deer the winter of 1870–71; and in two subsequent seasons 97 and 80 deer respectively. A party of five hunters from Winnebago County, Wisconsin, returned in January, 1874, from the Sturgeon River with 80 deer.[15] In the 1880's, deer were very plentiful in Schoolcraft County, "upwards of forty" being in sight at one time.[16]

There is an interesting comment on one means of distribution of deer by Andrews: "By the action of drifting ice . . . even animals, such as squirrels, rabbits, deer, moose, caribou, and bears have navigated the waters of Lake Superior, and been landed on islands to which they could not otherwise have gained access."[17]

Early references to deer along the Wisconsin shore of Lake Superior are few. Governor Doty[18] wrote in 1820 that the Fond du Lac Indians (Duluth–Superior region) do not have deer. Rev. Ely[19] traveled extensively in extreme northwestern Wisconsin in the years 1833–54. It was not until February 27, 1839, that a deer is mentioned for the vicinity of Duluth. On this day he recorded that an Indian had killed a deer that had been chased by dogs for three days. There is no mention of deer being seen in his frequent journeys by land and water between Superior and La Pointe. In September, 1848, Peyton[20] made an overland journey from La Pointe to the St. Croix River. Then as now the route covered for the most part a sandy plain sparsely timbered. He mentioned the distant sight of deer.

Schoolcraft, in his journey up the St. Croix River in 1832, stopped at Chief Kabamappa's village and wrote: "He observed in speaking of game that the red deer was found on the adjoining plains."[21] This village was about ten miles below Upper St. Croix Lake, hence near modern Gordon, Douglas County. Rev. Ely[19] recorded on June 27, 1834, that before reaching the same village, which he spells Kabomob, his Indian guide jumped a deer.

Deer were more plentiful in the latitude of Lac du Flambeau. Malhiot[22] was in charge of a trading post at this lake during the fall and winter of 1804–05. On October 5 he recorded that he had traded for 528 deer skins. It is impossible to determine how many of them represented deer taken in the immediate vicinity. Allen[9] stated in 1832 that the Indians of this lake, in fall and winter, kill large numbers of deer which are very plentiful along the Chippewa River. This stream lies about 40 miles west of Lac du Flambeau. It is possible that the Indians, to obtain deer in quantity, descended the Flambeau River to its junction with the Chippewa in extreme southern Rusk County.

The Lac Vieux Desert region, Vilas County, according to Cram,[23] had a fair number of deer in 1841. On the approach of winter, however, the Indians went southward to hunt deer. The valley of the Menominee had deer in great abundance and was a favorite winter hunting ground for Indians from various quarters. Cram remarked that all of the country on the upper part of the river had been burned over.

The St. Croix River and its tributaries seem to have had a good deer population. Curot[24] makes numerous references to the purchase of deer skins and venison at his post on the Yellow River, Burnett County, during the winter of 1803–04. Not all of the deer were killed in Wisconsin. An entry for March 2, 1804 reads: "Mr. Sayer's Men arrived after Dinner today with 20 pieces of dried meat, the remains of 41 Deer that the savages of the river au serpent [Snake River, Minnesota] had killed."

Rev. Ely[19] recorded on June 27, 1834, that his Indian raised a deer near the headwaters of the St. Croix. An Indian guide on April 19, 1839, below the mouth of the Yellow River, shot a doe with "three foetuses," and on the following day another deer was seen near the mouth of the Namekagon River. Schoolcraft, writing on July 27, 1831, offered a suggestion for the presence of deer in the region: "The country as we descend [the Namekagon River] assumes more the appearance of upland prairie, from the repeated burnings of the forest. The effect is, nearly all the small trees have been consumed, and grass has taken their place. One result of this is, the deer are drawn up from the more open parts of the Mississippi, to follow the advance of the prairie and open lands towards Lake Superior."[25] In 1843 Rev. Alfred Brunson[26] drove a wagon from Prairie du Chien to La Pointe, a good indication of the openness of the country. Schoolcraft[27] wrote in 1831 of the abundance of "Virginia deer" from Rice Lake, Barron County, southward along the Red Cedar River.

The Green Bay area was well stocked with deer from the earliest times. De Lignery, in the expedition of 1728 to chastise the Foxes, reached Green Bay where: "Our savages went into the woods, but soon returned bringing with them several roebucks. This species of game is very common at this place, and we were enabled to lay in several days provisions of it."[28] The spring of 1780, the expedition to which John Long[29] was attached, reached Green Bay where plenty of deer, bear, and other provisions were obtained.

Lahontan,[30] in 1688, found deer plentiful at Lakes Winnebago and Butte des Morts. In 1837 Marryat[31] found the tracks of deer plentiful near Lake Winnebago and saw a herd of fifteen.

In the winter of 1827–28, Fonda[32] was engaged to carry the mail from Green Bay to Fort Dearborn (Chicago). He was dressed in a hunting shirt of smoke-tanned buckskin, a cap of wolf-skin with tail attached, and moccasins of elk hide. After leaving Green Bay he would frequently find herds of deer that had yarded in the "heavily timbered bottoms." Deer were also abundant when southeastern Wisconsin was reached. According to Le Claire[33] deer were plentiful in the Milwaukee region in 1800.

There was a plausible, well-established belief that a pronounced increase in deer took place in southern Wisconsin after the close of the Black Hawk war in 1832. Most of the Indians were moved to reservations west of the Mississippi or to northern Wisconsin. This did not deter them, however, from returning for winter hunts. White immigration, a trickle in the beginning, required a number of years to affect the increase of deer. When Keating's party crossed southwestern Wisconsin in the summer of 1823, only one deer was seen.[34] The absence of game was attributed to the killing of deer at all seasons by the Indians due to the feeling that they were gradually losing the use of the land.

Later the case was put as follows: "Since the Indians have left this part of the country, wild game has become plenty. As their principal subsistence has been derived from hunting, notwithstanding the strong efforts made to permanently introduce agriculture among them, they have made game of all kinds very scarce in the neighborhood of the settlements, where they delighted to camp. Deer are now found in this vicinity [Prairie du Chien] in large numbers."[35] McCleod[36] thought that deer had increased three-fold since the withdrawal of the Indians.

In spite of Indians and mining developments, deer were abundant in southwestern Wisconsin in the 1830's. Hoffman[37] found large herds on the prairies in February, 1834. Smith wrote of the summer of 1837: "The deer are often seen sporting over the prairie, and in the groves and oak openings; they are frequently aroused out of the high grass, and as the rifle of the hunter has not yet sufficiently alarmed them in their secret lairs, they are in a measure less wild than in parts more densely settled; I have often seen them in my rambles, quietly gazing at the traveller, until he had passed by."[38]

It is related by Grignon[39] that the Menomonees made their hunt on the Black River during the winter of 1795–96. Two Indian brothers got into a dispute as to their prowess in killing deer. The following day they hunted from dawn until evening. One Indian returned with the tongues of nine deer and the other with ten.

The Chippewa River was long famous for its game. Le Sueur[40] informs us that this stream was known as the Bon-Secours from the abundance of buffalo, elk, bear, and deer *(chevreuils)* to be found there. Guignas[41] was with the French party that built Fort Beauharnois on the western shore of Lake Pepin in 1727. In October, when the buildings were finished, some of the people set out to find the herds of fallow deer *(bêtes fauves)* of all species of which they had heard so much in Canada. Deer proved to be scarce and it was difficult to kill any. They were hunting on the wrong side of the river as the Wisconsin shore had much more game than the Minnesota.

Methods of Hunting

Prior to the introduction of firearms, the Indians had four methods of hunting deer. These are described by George Copway,[42] an educated Ojibway, who spent considerable time in Wisconsin. 1. The deer was snared by placing a rope noose made of wild hemp *(Apocynum)* along the runways. When caught the deer choked to death. 2. Sharp stakes were driven into the ground beside a log over which a deer was expected to jump. When successful, the stake pierced the deer's vitals. 3. Deer were run into the water by dogs and then could be taken easily; or they were exhausted by a chase in deep snow. 4. They were killed with bow and arrow at salt-licks, or at the borders of lakes and streams where they were accustomed to feed. An Indian could shoot a deer at a distance of 50 paces. Flambeaus made of birch bark or other combustible materials were used for night hunting. In this way a very close approach to the animal could be made. Candles were subsequently used in place of torches. Lockwood,[43] when on the lower Wisconsin in 1827, gave the Indians some candles with which to hunt.

A method of hunting deer on Lake Winnebago has been described by J. G. Thompson, who came to Neenah in 1846.[44] When a deer was driven into the lake by wolves, the Indians would pursue in a canoe. A loop, bent on the end of a hickory pole, was slipped over the deer's head and the canoe drawn sufficiently close that the animal could be despatched with a tomahawk.

The earliest Europeans to land in America found that the Indians hunted deer by building converging fences and driving them to a narrow aperture or pound. Morgan[45] states that the Iroquois built fences of brush in the shape of a V, each wing being two or three miles in length. The woods were fired to drive the deer to the apex. Sometimes 100 deer were taken. Usually the game was driven into the trap by beaters. Firing the woods might destroy the fence so that it could be used for only one drive.

The use of fences by the Indians for driving deer in northeastern Wisconsin was mentioned previously. It is unexpected that this method of hunting would have persisted until the 1880's. In 1883 the Indians had twelve miles of fence about six miles west of Phillips and were reported to be killing deer in large numbers.[46] At the same time the following item originated at Iron River: "At Big Trout Lake [Vilas County] there is what is known as a deer fence, fifteen miles long, made by felling trees in such a manner that deer cannot get through, and they travel along seeking a place to get out, when the slaughter takes place. We are told on reliable authority that three Indians killed in a few days, recently, one hundred and fifty deer for their hides only . . ."[47] The construction of fifteen miles of fence would be a Herculean task and it is doubtful if any modern Indians would have built one of this length.

An old and often described method of hunting in the southern part of the state was to fire the prairies and oak openings. Reliance was generally placed on driving the deer into lakes or stream valleys where the hunters were stationed. P. P. Crane, an early resident of Beloit, has described the procedure in that area: "Also in the fall of 1837, when the prairie grass had become old and dry, smokes were seen rising on the prairies, some days in one direction, others in a different direction. It was ascertained that these fires were started by the Indians for hunting purposes. Whenever they wanted to take a deer, a rifle party would go forward, leaving others behind. The rifle party would go to a selected point, when the party behind would start a long line of fires which soon extended for several miles, being driven by the wind, and as the flames approached, the deer would bound along to get away from the fire, and thus rush toward the riflemen and be shot down."[48]

Deer were run down in Marquette County. Muir states: "In winter, after the first snow, we frequently saw three or four Indians hunting deer in company, running like hounds on the fresh, exciting tracks. The escape of the deer from these noiseless, tireless hunters was said to be well-nigh impossible; they were followed to the death."[49]

The whites had fewer methods of hunting, still hunting and driving being the commonest. In the "Big Woods" of Dunn County, artificial salt-licks were prepared. The deer were shot on moonlight nights from a platform built in a tree 30 to 40 feet from the ground.[50] The deer was brought home in winter by fastening the head to the tail of a horse and dragging it over the snow. Occasionally two deer were fastened to the horse.

The "shining" of deer at night by means of a light was practised by many hunters. Near Hudson, in 1865, John E. Bartett killed nine deer and wounded four more in one night by "fire hunting," as "shining" was known at the time.[51]

Hunting on horseback was common. In Dunn County a bell was attached to the horse. The deer being accustomed to the bells on cattle permitted a close approach. "Atticus," who lived in Racine, wrote in 1844: "The largest and best game is the deer. These are so plenty that they were sold in our market last winter at seventy-five cents apiece. In the western part of the Territory they are hunted on horseback, with horns, and killed with shotguns instead of rifles. One individual there—a man of undoubted veracity, a lawyer who stands high in his profession, whose sporting has not interfered with his business, and who formerly resided in Illinois—says, that during his residence in that State and in this Territory, he has killed over two thousand deer."[52]

The favorite method of hunting deer on the prairies was from a sleigh. Elizabeth Baird,[53] while visiting at Delevan, Walworth County, in February, 1842, was taken on a hunt. Every person was dressed in white. After driving a short distance, a large herd of deer was sighted and it seemed to her that there were hundreds of them.

The method of hunting in the town of Christiana, Dane County, has been described as follows: "Previous to its settlement, this was a favorite hunting ground with the settlers in the adjoining towns. Deer were then very plenty, and one of the favorite methods of hunting them in winter was to get what was called a 'drive' on them. Taking advantage of their curiosity, and knowing they could be easily approached with a team, several men in a sleigh followed their trail until within rifle shot, when the team was turned and driven around the deer, the men jump-ing out behind trees at convenient intervals. As soon as they were well surrounded, the firing commenced, and the deer were driven from one side of the circle to the other, a large number frequently being killed before the herd succeeded in making its escape."[54]

The pernicious use of set-guns was very widespread and continued through the period covered by this paper, to 1900, in spite of a prohibitory law. Only a few examples will be given. A farmer living in the Peshtigo Sugar Bush, Marinette County, visited his set-guns in November, 1874. At one a deer was found. He accidentally walked against the string of the second gun and was critically wounded.[55] In Taylor County, a homesteader, Anton Kuehrt, was killed on October 28, 1885, when he walked into his own set-gun.[56] Usually the victim was an innocent hunter. Richard Purkiss of Chelsea, Taylor County, sprung a set-gun in November, 1893, and was killed.[57]

MIGRATION

A century ago the belief existed that deer migrated southward in winter from northern Wisconsin. Cram[23] states that the Indians of the Lac Vieux Desert region moved southward "following the deer for the winter hunt." Dart[58] came to Green Lake County in 1840 at which time "deer were plentiful, except when they went south in winter to escape the cold." If this were the case, hunters would not have gone northward. Muir[49] came to the adjoining county of Marquette in 1849. He mentions that some of his enterprising neighbors went every fall with their teams to the pine regions in the northern part of the state to hunt and returned with half a dozen deer, one or two bears, and fifteen to twenty bushels of cranberries. A doubt might be raised that the trips were made mainly to kill deer when they were so plentiful locally. The deer in fall were very fond of winter wheat after it had grown for about a month and were easily killed by the hunter, lying in wait for them at night. Muir states that one man in this manner killed 30 or 40 in one small field.

A note from Oshkosh for the year 1881 states: "Bears and deer are very plenty in Wisconsin this fall, as the acorn crop is immense, and it is bringing the deer down from the Lake Superior region in large numbers."[59] It was stated in the same year that the tracks of deer could be seen everywhere at Phillips, Price County, in summer, but in fall the deer migrated. Subsequently it was also said that the deer moved southward on the approach of winter.[60]

At Glidden, Ashland County, the majority of the deer were believed to migrate about the middle of September, but three weeks later they were, inconsistently, "very numerous."[61] An old hunter thought that the scarcity of deer at Hayward in 1885 was due to a movement southward where there were more acorns.[62]

Old hunters informed Shiras[6] that an extensive fall and spring migration formerly took place in all of northern Michigan and Wisconsin. Since he believed that there were very few deer on the southern shore of Lake Superior prior to 1870, any noticeable movement must have taken place since that date. He states: "Early in May, as soon as the depth of the snow permitted travel, thousands of does worked their way north traveling alone in a broad belt along the south shore of Lake Superior, where a few weeks later the fawns were born. The bucks came more leisurely, but by early June the migration was over." The return movement began the middle of August and was in full swing by September. It has also been stated that local and migratory deer occur in Michigan.[63] The migratory deer passed through a certain section in fall and returned in spring. Local people claimed that they could distinguish between the residents and migrants.

There is no authentic information to support the statements that formerly there was a migration of deer, using the word in its commonly accepted sense. All the accounts were obtained from hunters and may be set down as folklore. There are similar traditional beliefs. For example, in the fall of 1912, I shot a large buck near Herbster, Wisconsin. An old resident insisted that it was a "swamp" buck and readily distinguishable from a "hill" buck. The latter part of December, 1873, old hunters reported that the deer in Jackson County had been moving northward for a week or two. Opinions were divided on whether this meant that mild or severe weather was approaching.[64]

The year (1895) that "Julian" wrote on migratory deer, Hough[65] was in Vilas County, Wisconsin. A trapper told him that there were few better deer areas than that in the vicinity of Big St. Germain Lake where the deer wintered in a "heavy thicket." The local disappearance of deer was usually due to yarding. Even in the southern part of the state they concentrated in winter in swamps, thickets, or heavy timber.

Commerce

In the days of the fur trade deer contributed meat, tallow, and hides. The trading post, depending upon its location, obtained its fresh meat, venison, from the Indians. The daily ration of the Canadian canoeman consisted of a quart of hulled corn, or peas, and two ounces of tallow. On this diet he performed the hardest kind of physical labor to the despair of the modern dietitian. Grignon[39] and his associate, Jacob Franks, about 1806, shipped from Green Bay to Mackinac 120 kegs of deer tallow weighing about 10,000 pounds.

The traffic in venison became enormous in the latter part of the nineteenth century. The lumber camps bought deer carcasses directly from professional hunters, or hired men to shoot for the camp mess. For example, the winter of 1868–69, James Terry engaged to hunt for John Sterling who had two camps on the North Fork of the Eau Claire River.[66] He received his board and $4.00 per deer. Up to the first of January of this winter, he killed 38 deer and two bears; and up to the first of January the following winter, 47 deer. These were moderate bags. Further data on the numbers killed by professional hunters will be found in the section on the histories of deer in the various counties.

The local consumption of deer was comparatively small until the construction of railroads provided easy transportation to the large cities within and without the state. Scarcely a newspaper failed to comment on the scarcity or abundance of deer and the price of venison. In December, 1850, a load of 22 deer was brought to Milwaukee and the lot purchased by the Plankinton Hotel.[67] A quarter of a century later, the following comment was made in Milwaukee: "Venison is so plenty in this market that the pedestrians wish there was some public park for the deer instead of having them occupy the sidewalks."[68]

It was stated in January, 1866, that 3,000 deer had been brought into Eau Claire over a period of three months. Many of these were hauled to Sparta to be shipped by rail to Milwaukee.[69] The deer season of 1879 at the village of Colby was considered only fair, but there were shipped from that station fifty whole deer weighing 6,334 pounds, and 1,860 pounds of saddles making a total of 8,194 pounds.[70] There were shipped from Peshtigo during the season of 1882, 1,047 saddles of venison. The total weight of saddles, hams, and carcasses shipped was 61,726 pounds.[71] The aggregate annual shipments from the various railway stations must have been enormous.

The trade in deerskins from the Upper Great Lakes was extensive by 1700, indicating that the valuable furs were no longer easily obtainable. The Sansquartier[72] inventory made at Detroit in 1709 contains a large percentage of deerskins. The skins were sold under several classifications: bucks, does, fawn, red *(rouge)*, blue *(bleu)*, grey *(gris)*, shaved *(rasee)*, and dressed. Red refers to the summer pelage. During the fall molt the hairs for a time have a bluish cast before attaining the full gray of the winter coat.

Lists of skins collected at various posts are numerous, but frequently it is impossible to determine the locality, or even the state, of their origin. In December, 1820, the Indian Office at Washington offered at auction 32,200 pounds of deerskins, most of them shaved. These were obtained principally at Fort Orange, on the Missouri, and at Prairie du Chien, Wisconsin.[73] Most of the records of the American Fur Company, and other companies, are equally vague on origin since the data from the individual posts have been lost.

There are many records of the number of deerskins handled by the Green Bay traders, but there is no assurance that all of the skins were obtained in the Green Bay region. The Menominees might make their winter hunt on the Upper Mississippi and trade their skins at Green Bay. In August, 1811, the South West Fur Company gave credit to Pierre Grignon, Green Bay, for 891 deerskins; and a year later for 74 deerskins. Jacob Franks, Green Bay, turned over to the South West Fur Company 265 deerskins in July, 1813, and 131 a year later.[74] Jacques Porlier, another Green Bay trader, received credit from the American Fur Company for 2,468 skins in August, 1821.

An invoice of furs received at Mackinac from Porlier and Grignon, Green Bay, in June, 1832, contains the following items:[75]

Skins	Pounds	Price per lb.
869 shaved deer, heavy	2640	$0.28
1824 shaved deer, light	3120	
140 red bucks	360	0.26
682 red does	1200	
66 badly shaved deer	99	0.20
65 grey shaved deer	193	0.125

In 1833 Porlier and Grignon sold 2,499 deerskins, and in 1834, 2,058 skins.

The deerskins collected by the American Fur Company at two Wisconsin posts for the years 1835 and 1836 are:[75]

	Green Bay Outfit		Milwaukee Outfit	
	1835	1836	1835	1836
Deerskins undressed, pounds	7,610	8,817	3,232	1,307

The average deerskin weighed about two pounds.

Trade in deerskins was appreciable until towards the end of the nineteenth century. Two men, Carr and Rand, in January, 1882, brought to Sparta 100 deerskins, the result of their hunt.[76]

In 1883, John Carlson, of Trade Lake, Burnett County, obtained 1400 pounds of "buckskin" from the Indians.[77]

Large Deer

The weights of a large number of deer are recorded in the newspapers. Wisconsin hunters considered any deer large that weighed over 200 pounds, and if over 250 pounds, exceptionally large. Schoonmaker[78] gives the weight of two New York deer entire at 390 and 397 pounds. A close approximation of the live weight of a deer is obtained by dividing the dressed weight by 80 and multiplying the quotient by 100. Scott[79] gives the calculated live weight of nine Wisconsin deer as ranging from 312 to 383 pounds.

The weights of some Wisconsin deer are given below:

County	Year	Stated Weight	Calculated Live Weight	Reference No.
Grant	1851	254*	317	80
Clark	1867	338†	...	81
Clark	1867	320*	400	82
Ashland	1878	400**	400	83
Door	1884	296*	370	84
Burnett	1890	337†	...	85
Florence	1890	343*	428	86
Marinette	1893	384†	...	87
Door	1902	340†	...	88

* Dressed.
** Not dressed.
† Condition not stated.

Factors Affecting the Population

There were many winters when the deer suffered severely. Marquette[4] spent the hard winter of 1674–75 at the present site of Chicago. On January 24 he mentioned that all the wild animals felt the bad weather; and on March 20, that the deer were so lean that some of those killed were abandoned.

A crust on deep snow was one of the worst conditions that the deer could meet. Then they were an easy prey to wolves and to hunters on snowshoes. Anderson[89] had a trading post on the Minnesota River the winter of 1806–07. In March a crust formed on the snow and the Indians tomahawked every deer that could be found for sheer amusement. The winter following not a deer could be found.

There are many references to the effect of the winter of 1856–57 on Wisconsin deer. Joseph V. Jones came to Durand, Pepin County, in 1856. That winter the snow was six feet deep on the level so that the deer were unable to travel. Many were killed with clubs and hundreds starved.[90] The situation was equally bad in Grant County where the deep, crusted snow permitted a great slaughter. The deer were killed by simply knocking them on their heads. By January they were so lean from starvation that the venison was not marketable.[91] In November, 1857, deer, though formerly abundant in Richland County, were reported scarce. The deep snow of the previous winter led to their easy destruction by wolves and to wanton killing by hunters.[92]

A report from Prairie du Chien reads: "The market was never so plentifully supplied with venison as at present. It is selling at wholesale from $3 to $5 per hundred. A friend of ours killed a drove of seven last week in one day. He followed the path made through the hard crust, until they could scarcely walk and then with a Sharpe's rifle shot them down one after the other. We thought last summer, when noticing some Frenchmen bringing home each morning from 5 to 8 deer, obtained by Fire Hunting on the Wisconsin and Paint Creek, that they would soon kill off all the Deer; but we are now convinced that deer hunting in December exceeds Fire Hunting five hundred per cent, for the very reason that the animals are now rendered helpless by the deep snows, and are murdered by every farmer's boy in the country. Some three sleigh loads of venison passed our office every day last week and as many more this week."[93]

It is stated by Harvey Brown[94] that about Christmas, 1857, a crust about one-half inch in thickness formed on the deep snow in Buffalo County, and that nearly every deer perished. Following the spring thaw, their bodies were found in nearly every coulee. Deer were stated to be abundant near New London, Waupaca County, in February, 1857, but owing to the crust on the snow the Indians were killing them off with clubs and hatchets.[95] Large numbers were also killed in Outagamie County at the same time.[96]

An experienced hunter, Jonathan Cartwright, hunted in the Menomonie woods, Dunn County, at this time and states: "This winter was the hardest on deer of any I have ever known. White men and Indians slaughtered them in great numbers. They would put on snow-shoes, and taking a hatchet, but no gun, would strike them down. . . . One man told me that he killed ten in one day, and that in some places the Indians had taken them by hundreds."[14] They were very scarce the following two years.

Similar weather conditions prevailed the winter of 1868–69. A crust formed on the snow in Door County in February and deer were slaughtered in wholesale fashion.[97] As an indication, Ambrose Hummel of Green Bay killed 88 deer that season along the Menominee River.[98]

The winter of 1887–88 produced great hardship for the deer in northeastern Wisconsin. Two hunters at Bryant, Langlade County, caught a herd of 17 deer in the deep snow and killed all of them.[99] The effect of this winter on the deer is clearly shown by the following account from Florence: "A fear prevails among hunters that deer will be considerably scarcer than usual next fall. There is no doubt that the severe weather of the past winter has played havoc with the noble game. The deep snow not only placed the deer at the mercy of their enemies, especially the wolves, but covered up all kinds of vegetation so much as to create a sort of famine among the animals. The capture of dozens of live deer by men during the past two or three months, is due almost as much to exhaustion produced among them by lack of food as to the deep snow in which they foundered. The animals would have been more successful in getting away from both men and wolves if they had been in better condition physically. Gaunt as rails, nearly starved and pitiably weak, thousands of them have undoubtedly been killed by wolves in Northern Wisconsin and Michigan during the winter, and it is possible that many have been starved to death. Men who worked in the woods during the latter part of the winter tell some almost incredible stories concerning the poor animals. The deer have sought refuge, presumably from wolves, in lumber camps, and have devoured the boughs of pine trees almost as soon as the men felled them, and while the latter were working near at hand. That their condition is very poor is shown by the experience of some lumbermen engaged in driving logs on the Popple River. A few days since, while working, these men saw a large buck trying to cross the river on some logs ahead of them. The animal, who did not see the men, succeeded, by dint of hard labor, in getting about half way across the river and then fell down, exhausted, on the logs. When the men reached him, a few moments later, he did not make the slightest attempt to get away. They took pity on his weak condition, and, with great care and kindness, carried him over the logs and into the woods, where they left him. They say the animal was hardly able to stand up and that he was so poor that his bones protruded through his hide."[100]

The above conditions prevailed when the state deer population was small in comparison with that in recent years. The necessity for controlling the number of deer by shooting when the population exceeds the carrying capacity of the land is beyond question. The effect of overbrowsing on forest reproduction is also very important. Sentiment on the deer problem may be sadly misplaced.

There is little information on the killing of deer outright by forest fires. The Peshtigo fire in the fall of 1871 was one of the worst on record in Wisconsin. L. D. Gray, who hunted along the Menominee River that fall stated that large numbers of deer were killed by the fires. Eight deer were found burned to death at one place.[101] Less than a year later deer returned to the burned regions around Peshtigo.[102] In the fall of 1894, 25 deer were found dead on a knoll near Black River Falls where they were surrounded by fire.[103]

Despite the numerous old claims of heavy destruction of deer by wolves, bobcats, and lynx, no data are available to show that these predators ever had more than a minor effect on the deer population. The long-standing bounties on these carnivores has led to the near extinction of the timber wolf and lynx. A recent study by Thompson[104] reveals that the timber wolves remaining in Wisconsin, in the territories over which they ranged, were ineffectual in preventing an over-population of deer.

The ecological changes produced by extensive lumbering in Wisconsin after 1850 led to a great increase in the deer population. The cutting of the coniferous forests was especially important since the land was soon covered by young hardwoods and forage plants, thereby creating a favorable deer habitat. A low point in the state's deer population was reached about 1890. This resulted almost entirely from over-shooting. The game laws were largely ignored and frequently flouted. Jackson, in 1908, in discussing the gradual decrease in the number of deer stated: "The cause of this decrease is not inefficient legislation, but it is because of inefficient protection from wolves and law-breakers."[105] It is certain, however, that prior to 1899, when venison could be sold, the gun was largely to blame.

Under the game laws of 1897, the following were considered "deer counties": Adams, Ashland, Barron, Bayfield, Buffalo, Burnett, Brown, Chippewa, Clark, Door, Douglas, Dunn, Eau Claire, Florence, Forest, Iron, Jackson, Juneau, Langlade, Kewaunee, Lincoln, Marathon, Marinette, Marquette, Oconto, Oneida, Pepin, Pierce, Polk, Portage, Price, Sauk, Sawyer, Shawano, Taylor, Trempealeau, Vilas, Washburn, and Wood. A distributional map, rating deer common, scarce, and doubtful, was published by Cory[106] in 1912.

Legislation for the Protection of Deer

1851. First law. The killing of deer was prohibited from February 1 to July 1.
1858. The open season remained unchanged.
1860. The open season was reduced two months, and ran from August 1 to January 1.
1867. The hunting season was increased by one-half month: August 1 to January 15.
1869. The use of set-guns was prohibited.
1875. It was forbidden to "ensnare or trap" any deer. Hunting with dogs in Kewaunee County was prohibited.
1876. The use of dogs in hunting was prohibited throughout the state.
1877. The open season was reduced and ran from September 15 to January 1. The use of dogs was permitted in Ashland, Douglas, and Bayfield counties. The deer season in Burnett County was reduced to 15 days until 1883.
1879. The killing of deer in Door County except for personal use as food was prohibited and no deer could be exported from the county.
1880. The shining of deer in Door County was prohibited. The open season in Douglas, Bayfield, and Ashland counties ran from August 15 to November 30. Elsewhere north of Vernon, Sauk, Columbia, Dodge, Washington, and Ozaukee counties, the open season was one-half month shorter: September 1 to November 30.
1881. The open season throughout the state ran from September 15 to January 1.
1883. The exportation of venison from the state was prohibited. The open season was reduced and ran from November 1 to December 15. Hunting of deer at night with lights was made illegal.
1885. The open season was changed to cover the period October 1 to November 30. Deer could be killed only for food.
1887. The open season was shortened and ran from October 1 to November 10.
1889. The act permitting the use of dogs in Ashland, Douglas, and Bayfield counties was repealed. The open season was increased by five days and ran from October 15 to December 1.
1891. The open season was reduced by 15 days: November 1 to December 1. The sale of venison was made illegal if done eight days after the season closed.
1895. Each hunter could transport but two deer. The open season ran from November 1 to 20. Sheboygan County was closed to deer hunting for five years.
1897. The open season ran from November 1 to 20. The killing of deer on ice or in the water was prohibited. Sheboygan and Fond du Lac counties were closed for five years. The bag limit was two deer of any kind. Settlers could kill deer for the use of their families. The sale, transportation, or trading of venison five days after the close of the season was prohibited. The first licenses were issued. The fee was $1.00 for a resident and $30.00 for a non-resident.
1899. The length of the open season was unchanged. It was made illegal to sell venison during the first six days of the season or ship or sell six days after the close of the season.

HISTORIES OF DEER IN THE COUNTIES

Adams. Deer were killed formerly in large numbers. In February, 1857, S. U. Hamilton arrived in Sheboygan with a load of 26 deer that he and his father had killed in Adams County. He estimated that over 1000 deer were shot in the county during the season.[1] A party of hunters from the vicinity of Beaver Dam arrived in that town on December 25, 1861, with a load of deer that had been killed in Adams County.[2] Deer were plentiful in 1867,[3] and so common the following year that hams were sold by the Indians at six cents per pound.[4] The year 1872 was not a successful season; however one hunter killed four deer in one day.[5] Venison was quite common in 1873 when the saddles sold at six cents per pound.[6] In 1874 venison was virtually a drug on the market. Carcasses brought only four to five cents a pound in Kilbourn.[7] There were killed in the town of Quincy in November, 1894, three "antelope,"[8] a term occasionally used for a spike buck.

[1] Sheboygan *Times,* Feb. 7, 1857. [2] Beaver Dam *Argus,* Dec. 27, 1861. [3] Friendship *Press,* Nov. 29, 1867. [4] *Ibid.,* Dec. 4, 1868. [5] *Ibid.,* Nov. 30, Dec. 7, 1872. [6] *Ibid.,* Jan. 3, 1874. [7] *Ibid.,* Dec. 12, 1874. [8] *Ibid.,* Nov. 17, 1894.

Ashland. Lapham[1] in 1858 listed the deer as one of the mammals of the Penokee Range southeast of Ashland. Apparently they did not become common in the Ashland region until the late 1870's. When a deer was caught in Chequamegon Bay in September, 1872, it was considered a stray.[2] On October 23, 1875, it was stated that the fifth deer for the season had been brought into Ashland, so that they were still not very common.[3] In the fall of 1880, deer were reported plentiful and in excellent condition. Two men killed 15 by the end of September.[4] One hunter at Glidden, in November, 1884, killed seven deer in one week.[5] In 1885 deer were reported rather scarce around Ashland,[6] but around Glidden they were numerous in 1885 and 1886.[7] Two hunters from Medford killed 20 deer in the county in the season of 1892.[8]

[1] Lapham, I. A. *Original diary,* Aug. 24–Sept. 23, 1858. Wis. Hist. Soc.; *Trans. Wis. State Agr. Soc.* for 1858–59. 5 (1860) 399. [2] Ashland *Press,* Sept. 21, 1872. [3] *Ibid.,* Oct. 23, 1875. [4] *Ibid.,* Aug. 28, Oct. 2, 1880. [5] Glidden *Pioneer,* Nov. 26, 1884. [6] Ashland *Press,* Nov. 14, 1885. [7] Glidden *Pioneer,* Oct. 29, Nov. 5, 12, 1885; June 3, Sept. 23, 1886. [8] Medford *Star* and *News,* Dec. 3, 1892.

Barron. In December, 1872, three sleds arrived in Menomonie with 65 deer that had been killed in the vicinity of Rice Lake.[1] Deer were shot in great numbers in the fall of 1875. Two Chetek hunters killed "some forty" deer and several bears.[2] Hunters reported deer and bear more plentiful in the fall of 1877 than for a number of years.[3] Many were shot in 1879. Hunters from Pierce County killed large numbers near Cumberland. By early

December a hunter at Barron had killed and shipped 23 deer.[4] Elijah Haines, of Clinton, also shot 23.[5] Many deer were killed at Rice Lake the following year.[6]

The Eau Claire markets received large quantities of venison from Barron and other northern counties in 1883.[7] B. L. Eighmy killed 16 deer the season of 1884.[8] They were unusually numerous in 1886. Two Chetek hunters killed over 30 deer. About 75 deer were shipped from Cameron.[9] Large numbers were killed in 1889 and 1892.[10] There was a decided decline in the deer population at this time. By 1897 venison was scarce and expensive at Rice Lake.[11] Considerable venison was reported shipped from Rice Lake the following year.[12]

[1] Menomonie *News,* Dec. 21, 1872. [2] Rice Lake *Chronotype,* Nov. 20, Dec. 25, 1875. [3] *Ibid.,* Nov. 28, 1877. [4] Rice Lake *Chronotype,* Nov. 13, Dec. 4; Barron *Shield,* Dec. 4, 1879. [5] Barron *Shield,* Jan. 1, 1880. [6] Rice Lake *Chronotype,* Oct. 21, Nov. 11, 1880. [7] Eau Claire (w) *Free Press,* Nov. 8, 1883. [8] Chetek *Alert,* Nov. 29, 1884. [9] Chetek *Alert,* Nov. 6, Dec. 4; Barron *Shield,* Dec. 3, 1886. [10] Chetek *Alert,* Nov. 15, 28, 1889; Nov. 18, 1892. [11] Rice Lake *Chronotype,* Nov. 5, 12, 1897. [12] *Ibid.,* Nov. 4, 1898.

Bayfield. Shields,[1] while at Bayfield, was informed that the previous September three Indians killed 14 deer within twenty miles of town. Three hunters from Waupaca, after an absence of two weeks in November, 1883, returned with 11 deer and two bears killed near Bayfield.[2] In the late fall of 1883, David Downer, while hunting at Cable, killed 19 deer, the two largest weighing 225 and 240 pounds, respectively.[3] During the season of 1884, a Bayfield hunter is reputed to have killed 75 deer, 5 moose, and one bear in Bayfield and Douglas Counties.[4] A. Angus in November, 1885, sold in Ashland ten deer killed in the vicinity of Pike Lake, Bayfield County.[5] Four Neillsville hunters killed 16 deer in the county in the season of 1887.[6] A party of five hunters from Appleton spent six weeks in the fall of 1892 on Pike River and averaged seven deer per week. The station agent at Pike River stated that 600 deer had been shipped from that place, the maximum for any season.[7]

[1] Shields, G. O. *Rustlings in the Rockies.* Chicago (1883) 281. [2] Waupaca *Post,* Nov. 29, 1883. [3] Durand *Courier,* Nov. 9, 1883. [4] Madison *State Journal,* Jan. 20, 1885. [5] Ashland *Press,* Nov. 7, 1885. [6] Neillsville *Republican* and *Press,* Nov. 3, 1887. [7] Appleton *Crescent,* Dec. 3, 1892.

Brown. When Ellis[1] arrived at Green Bay in 1822, game, including deer, was abundant. In July, 1834, Bishop Kemper[2] saw a "place where they shoot deer" within a mile of town. This was probably a tree-platform. Deer were killed in abundance in 1853 and 1854.[3] They were considered more plentiful in 1868 than for many years. One was caught in the city of Green Bay, from which place carcasses were shipped southward daily by express.[4] A Green Bay hunter, Ambrose Hummel, killed 88 deer in the season of 1868.[5] The early spring of 1869, there was deep snow with a heavy crust. Deer appeared to be especially numerous and they came into the settlements. The Indians at Little Kaukauna (Little Rapids) are said to have killed 15 in two days.[6]

This statement appeared in 1870: "We notice that the usual winter supply of venison is beginning to come in. Last season vast numbers of deer were slaughtered within a circuit of fifty miles from this city. We have known one hunter to bring in thirty at one time. They are shipped by express to the Chicago and Milwaukee markets. During the hunting season many who make a business of trapping and hunting come to this region as offering superior advantages for their avocation."[7]

Venison was so cheap in Green Bay in 1873 that it was considered as not covering the cost of the ammunition.[8] At about this time the county no longer furnished many deer for domestic use. In 1876 the statement was made that deer are particularly plentiful "north of us."[9] A few deer continued to be killed in the county. A deer ran through the main streets of Green Bay on November 28, 1892;[10] and three appeared within the city limits in September, 1901.[11]

[1] Ellis, A. G. *Recollections. Wis. Hist. Colls.*, 7 (1876) 240. [2] Kemper, Bishop Jackson. *Wis. Hist. Colls.*, 14 (1898) 429. [3] Green Bay *Advocate*, Oct. 13, 20; Nov. 30, 1854. [4] Green Bay *Advocate*, Nov. 19, Dec. 3; *Gazette*, Nov. 21, 1868. [5] Green Bay *Advocate*, Oct. 28, 1869. [6] Green Bay *Gazette*, March 13, 1869. [7] Green Bay *Advocate*, Nov. 10, 1870. *Ibid.*, Dec. 11, 1873. [9] *Ibid.*, Oct. 19, 1876. [10] *Ibid.*, Dec. 1, 1892. [11] *Ibid.*, Sept. 21, 1901.

Buffalo. Deer were plentiful about 1855. The county was a favorite hunting ground for the Indians. Cooke states: "The Sioux, whose tribal home grounds were west of the Mississippi, found that in our part of Wisconsin there were more elk, deer and bear than in Minnesota along the Mississippi."[1] The Cookes could see deer and elk crossing their valley almost daily. Deer were never again as plentiful after the winter of 1856–57, with its deep snow, as they died in large numbers.[2]

The effect of the deep snow seems to have been overcome within a decade. In 1865, a Mr. Bump of Mondovi killed 11 deer in three days of hunting, while two other men killed six in one day. In the town of Belvidere, forty deer were seen in one day, one herd containing 18.[3] In 1869 deer were reported not as plentiful as the previous year; however, two men killed 12 in two weeks near Gilmanton.[4] A hunter in the town of Modena killed five fine deer within an hour.[5] Many deer were reported killed in the county in 1878. Two hunters shot six to seven deer in one week near Gilmanton.[6]

[1] Cooke, W. W. *A frontiersman in northwestern Wisconsin*. Wis. Mag. Hist., 23 (1940) 288, 290, 297. [2] Curtiss-Wedge, F. *History of Buffalo and Pepin Counties*,

Wisconsin. Winona (1919) 953. [3] West Eau Claire *Argus,* Dec. 28, 1865. [4] Alma *Express,* Dec. 16, 1869. [5] *Ibid.,* Jan. 6, 1870. [6] Madison *State Journal,* Nov. 15, 1878; Mondovi *Herald,* Dec. 28, 1878.

Burnett. Large numbers of deer were killed in this county. In February, 1876, George Matwawos, of Yellow Lake, arrived in Ashland with a load of venison. He and ten other hunters killed 165 deer during the winter of 1875–76.[1] Over 500 saddles of venison were shipped from Rush City, Minnesota, in one week in December, 1877. Most of these deer were killed in Chisago County, Minnesota, and Burnett County.[2] Deer were stated to be so plentiful in the vicinity of Grantsburg in 1878 that two or three would be seen by going five miles from town in any direction.[3] The season of 1885, two camps containing seven hunters killed 41 deer up to the latter part of November.[4] Deer were abundant in 1886. Two hunters killed 40 during the season. Thoreson and Johnson, of Grantsburg, shipped nearly 500 saddles of venison to St. Paul up to December 10, and expected to handle several hundred more.[5] It was estimated that at least 1000 deer were killed during the seasons of 1895 and 1896. The complaint was made that many hunters, particularly the Indians, pay little attention to the laws regulating the closed and open seasons.[6]

[1] Ashland *Press,* Feb. 19, 1876. [2] Grantsburg *Sentinel,* Dec. 21, 1877. [3] *Ibid.,* Nov. 8, 1878. [4] *Ibid.,* Dec. 4, 1885. [5] *Ibid.,* Dec. 3, 10, 24, 1886. [6] *Ibid.,* Feb. 4, 1897.

Calumet. The county does not appear to have contained many deer within recorded time, due presumably to the Indians on the reservations. The population in 1840 consisted of 530 Stockbridge and Brothertown Indians, and three whites.[1] In October, 1866, seven does shot along the eastern shore of Lake Winnebago were brought into Appleton.[2] Deer were reported in 1868 as "never so plenty,"[3] but all subsequent information indicates that the number was quite small. Two deer were killed near Chilton in 1871.[4] The following season five men took five deer in a day's hunt on Killsnake Creek.[5] This creek was a favorite place for hunting. John Mayer, town of Charlestown, killed six deer in the season of 1876.[6] The two hunters who killed a large doe at the mouth of the Killsnake in 1877 were envied.[7] A hunting party that tracked a buck along this creek in 1880 failed to capture it.[8]

[1] Cammuck, T. *Wis. Hist. Colls.,* 1 (1855) 104. [2] Appleton *Post,* Oct. 25, 1866. [3] Chilton *Times,* Dec. 26, 1868. [4] *Ibid.,* Nov. 4, 11, 1871. [5] *Ibid.,* Nov. 16, 1872. [6] *Ibid.,* Dec. 9, 1876. [7] *Ibid.,* Oct. 6, 1877. [8] *Ibid.,* Dec. 4, 1880.

Chippewa. Formerly one of the best deer counties in the state. Grignon[1] relates that in the days of the fur trade the Chippewas at the Falls of the Chippewa River were given ammunition by a trader and told to bring in as many deer as they could kill. The following night they brought in thirty. It was stated in November, 1877, that venison was never more plentiful and that about 50 carcasses were shipped from Chippewa Falls to the Chicago market every week.[2] Deer were quite plentiful in 1878, and 22 were shipped from the Falls on one day.[3] It was feared in 1882 that deer would approach extinction at the rate at which they were being killed.[4] Two years later three men killed 22 deer in the town of Big Bend.[5] In 1885 one hunter, Sebe Miles, returned to Chippewa Falls with 20 "very nice" deer.[6] A buck stated to weigh 300 pounds was on exhibition.[7]

One hunter reported deer very scarce in 1888. However, Dan Scommon killed 19 deer up to November 1, principally along the Jump River.[8] It was reported in 1890 that more deer were killed that season on the Chippewa waters than ever before, and that they were increasing in number.[9] Two years later they were again reported plentiful and it was estimated that during the month of November 200 carcasses were sold in Chippewa Falls.[10] By 1900 deer were reduced to modest numbers. At Stanley only a small number were killed during the season of 1898 in comparison with the previous year.[11]

[1] Grignon, Augustin. *Wis. Hist. Colls.,* 3 (1857) 240. [2] Chippewa Falls *Herald,* Nov. 23; *Times,* Nov. 21, 1877. [3] Chippewa Falls *Times,* Oct. 2, 1878. [4] Chippewa Falls *Herald,* Dec. 22, 1882. [5] *Ibid.,* Nov. 21, 1884. [6] Chippewa Falls *Times,* Nov. 25, 1885. [7] Chippewa Falls *Herald,* Oct. 23, 1885. [8] Chippewa Falls *Times,* Nov. 14, 1888. [9] Chippewa Falls *Herald,* Dec. 5, 1890. [10] *Ibid.,* Dec. 2, 1892. [11] Stanley *Republican,* Nov. 19, 1898.

Clark. A lady who cooked for a boarding house at Neillsville during the winter of 1851–52, prepared 21 deer that season.[1] During one week in November, 1864, Theodore Davis killed 14 deer and 4 bears in the town of Weston.[2] Deer were reported very plentiful in 1869, one hunter killing five in three days.[3] A squaw, Kate Scott, killed about 20 deer in the county during the season of 1870.[4] There was a protest from the village of Greenwood on the slaughter of deer during the season of 1873: "It has been no uncommon thing for the last eight or ten days to see deer passing down the road by the score and we might say by the hundred."[5] Hundreds were hauled through Neillsville.[6]

Deer continued abundant for many years. A hunter in the town of Thorp killed 35 deer during the season of 1881.[7] In 1887 deer were reported "very thick" on the North Fork of the Eau Claire River. Large numbers were killed in the county and shipped from Neillsville to Chicago during the last week of October.[8]

In 1889 it was said that Neillsville hunters seldom found any deer to kill; but at the same time loads of venison passed through

Thorp.[9] It is probable that this venison originated in Taylor County. Deer were scarce in the town of Longwood in 1890.[10] A considerable number of deer and bear were shipped from Granton during the season of 1893.[11] Hunters at Humbird had very poor success in 1897.[12] The following statement was made at Neillsville for the season of 1898: "We are unable to ascertain the number killed in this county during the twenty days' hunt but judging from the number shipped from this city alone the slaughter was great."[13]

[1] Neillsville *Republican* and *Press*, Dec. 15, 1910; *Proc. Wis. Hist. Soc.* for 1913. (1914) 126. [2] Neillsville *Advocate*, Nov. 21, 1864; Madison *State Journal*, Nov. 29, 1864. [3] Neillsville *Republican:* Madison *State Journal*, Dec. 6, 1869. [4] Black River Falls *Banner*, Dec. 24, 1870. [5] Neillsville *Republican*, Nov. 15, 1873. [6] Neillsville *Press*, Nov. 14, 1873. [7] Colby *Phonograph*, Feb. 15, 1882. [8] Neillsville *True Republican*, Oct. 27, 1887; *Times*, Nov. 3, 1887. [9] Neillsville *Republican* and *Press*, Oct. 26, Nov. 23, 1889. [10] *Ibid.*, Oct. 23, 1890. [11] *Ibid.*, Oct. 19, 1893. [12] *Ibid.*, Nov. 11, 1897. [13] *Ibid.*, Nov. 24, 1898.

Columbia. The information on deer in this county is limited. A few deer were seen near Kilbourn (Wisconsin Dells) the winter of 1857–58, but none were known to have been killed: "Mr. Prentis, who lives near here, and who has killed a number every season, informs us that he has not seen one this winter. A great many were destroyed last winter."[1] (The winter of 1856–57 was marked by deep snow.) Deer hunters at Portage were said to have had unusual success in 1866.[2] The fall of 1868, Joe Brickwell, town of Lewiston, killed five deer. He then went to the town of Lemonweir, Juneau County, and killed an additional 17 deer.[3] In March, 1869, the tracks of three deer and six wolves led to the Wisconsin River near Kilbourn.[4] In September, 1890, a deer was shot at Wyocena by Dick Lobdell.[5] Deer were never exterminated in this county, a few persisting along the Wisconsin River.

[1] Kilbourn *Mirror*, Jan. 19, 1858. [2] Portage *Reporter:* Madison *State Journal*, Dec. 3, 1866. [3] Portage *Register*, Feb. 6, 1869. [4] Kilbourn *Mirror*, March 24, 1869. [5] Portage *Register*, Sept. 27, 1890.

Crawford. This county had a large deer population and was a favorite hunting area until the latter part of the 19th century. An army officer stationed at Prairie du Chien wrote on Aug. 23, 1847: "Turkeys and deer are plenty in the woods."[1] Large numbers were reported killed in 1864 and 1868.[2] Many of the Boscobel gunners hunted in this county.[3] Local venison sold in Prairie du Chien in December, 1882, at ten cents a pound.[4] In the winter of 1882–83, Amos De Voe of Boscobel shot 12 deer in the county.[5]

[1] H., A. S. *Sport in the West. Porter's Spirit of the Times*, 17 (Sept. 11, 1847) 33. [2] Prairie du Chien *Courier:* Madison *State Journal*, Nov. 29, 1864; Dec. 21, 1868. [3] Boscobel *Dial*, Dec. 4, 1874; Oct. 31, 1879; Dec. 3, 1880; Nov. 11, 1881. [4] Prairie du Chien *Courier*, Dec. 12, 1882. [5] Boscobel *Dial*, Jan. 5, 1883.

Dane. Jefferson Davis in 1829 camped on the site of Madison, where "Fish and water-fowl were abundant; deer and pheasants less plentiful."[1] In 1836, Featherstonhaugh[2] had occasional glimpses of deer with their fawns.

Deer must have increased greatly during the next few years for by 1847 the hunting was excellent. At this time about 100 Indians camped in the timber on the north side of Lake Mendota for some weeks and made a great slaughter of deer.[3] A year later so many deer were offered for sale in Madison that the extermination of the species was feared.[4] There may have been two "raids" by the Indians, or a confusion in dates. H. A. Tenney wrote: "The way they were slaughtered at times in mere sport, was a wicked waste. In 1849 the Winnebagoes camped near the present Insane Hospital. Spreading over the country, they drove all the deer of all kinds towards the center and killed all—sparing none. They had over 500 carcasses, when a band of citizens went over and drove them off, but the deer never recovered from that fatal raid."[5]

Good data on the abundance of deer in the county in the 1840's are given by Park.[6] It was not uncommon in spring to see 20 to 30 deer in a herd at Blue Mounds. George Dow saw as many as 200 in a herd in the town of Cambridge, and often 75 to 100. The town of Deerfield was so named on account of the excellent hunting. The firing of the prairies by the Indians to drive out the deer was an event much dreaded by the settlers in the town of Burke. An early settler in the town of Berry wrote: "In those early times there were plenty of deer, and often as many as twenty-four head at a time were seen feeding upon the fields of winter wheat sown by the early settlers. The town was a favorite resort with the Indians . . . In the fall of 1848, about sixty-five of them and their families remained near my land, on section 27, for about six weeks, killing deer. When they prepared to depart, they loaded each of their ponies with a fresh killed deer, which they purposed carrying to Milwaukee to sell . . . The deer continued plentiful for a number of years, but the constant settling up of the Town, and the killing of them, made their appearance very scarce, so that the last deer known to have been killed in the town was by myself in 1856."

The winter of 1847–48, Mahlen Hasbrock and brother killed 103 deer in the town of Vermont.[7] There was very little timber in the town at this time, the growth being chiefly brush and saplings.

The last deer was killed on the site of Madison in 1847. It was an old buck that had a trail over University Hill.[8] Few deer appear to have been killed in the county between 1850 and 1900. Local sportsmen went a distance to hunt. Two deer, seen at Arlington on August 28, 1881, were considered a rare sight.[9] One was also seen in June of this year in the town of Westport.[10] In December, 1884, no deer were known to have been killed in the county during the season.[11] An unusual event was the killing of a deer in Lake Mendota by Charles Freeman, of Madison, in November, 1889.[12] On November 13, 1897, a large deer was shot in the town of Verona by John Anderson.[13] Another was killed in this town in November, 1898. It was stated to have weighed 340 pounds when killed and 220 pounds dressed. One of the weights, probably the former, must be incorrect. A herd of 22 deer in the town was believed to have descended from the two deer that escaped from a deer farm that Otto Tupfer kept in the town of Middleton several years previously.[14] This is an unnecessary assumption as the deer may well have wandered in from the Wisconsin River bottoms as they do today.

[1] Butler, J. D. *Taychoperah, the Four Lakes country. Wis. Hist. Colls.*, 10 (1888) 75. [2] Featherstonhaugh, G. W. *A canoe voyage up the Minnay Sotor.* London, 2 (1847) 89. [3] Madison *Argus*, Nov. 23, Dec. 24, 1847. [4] *Ibid.*, Dec. 19, 1848. [5] Durrie, D. S. *A history of Madison.* Madison, (1874) 163; *cf.* W. J. Park, p. 394. [6] Park, W. J. *Madison, Dane County and surrounding towns.* Madison, (1877) 238, 269–70, 354, 369, 394, 432, 477, 489. [7] Butterfield, C. W. *History of Dane County, Wisconsin.* Madison, (1880) 934. [8] Durrie, *l.c.* [9] Madison *State Journal*, Sept. 5, 1881. [10] Madison *Democrat*, June 14, 1881. [11] Madison *State Journal*, Dec. 18, 1884. [12] Milwaukee *Journal*, Nov. 19, 1889. [13] Madison *State Journal*, Nov. 15, 1897. [14] *Ibid.*, Nov. 5, 1898.

Dodge. There is so little information for this county that deer must have been exterminated rather early. A hunter from Fox Lake shot a buck at Lost Lake in December, 1854.[1] A buck and two does were shot near Beaver Dam Pond at this time.[2] The following season deer were brought into Fox Lake almost daily.[3]

[1] Fox Lake *Times:* Milwaukee (d) *Democrat*, Dec. 22, 1854. [2] Fox Lake *Times:* Milwaukee (d) *Democrat*, Jan. 9, 1855. [3] Fox Lake *Journal:* Milwaukee (w) *Wisconsin*, Dec. 23, 1856.

Door. The northern part of the peninsula was especially good for deer. Three hunters from Racine killed 50 deer during the season of 1873 at North Bay.[1] In 1874 two men from Racine killed 43 deer in the county in about a month's time.[2] There was an abundant crop of acorns the fall of 1877 and deer were unusually fat. An "immense number" were killed, an estimated 1500 for the county. The use of dogs was widespread in defiance of the law.[3] Large quantities of venison from the county were shipped south through Kewaunee in 1880.[4] In 1883 deer were considered more abundant than for several years. At North Bay they were found in the swamps. When driven from the latter, they took to the water and generally escaped.[5] Five years later deer were considered scarce.[6] Subsequently they were killed in limited numbers. In 1891 it was said that, "at the present rate of extermination there will not be a solitary one left in this region five years from now."[7] The shooting of three deer on Chamber's Island is mentioned. A "large number" were killed in the northern part of the county in the fall of 1895.[8] It was estimated that not over 25 were killed in the county in 1897, up to the middle of November.[9]

[1] Sturgeon Bay *Advocate,* Dec. 25, 1873. [2] Kewaunee *Enterprise:* Racine *Advocate,* Jan. 16, 1875. [3] Sturgeon Bay *Advocate,* Nov. 29, Dec. 13, 1877. [4] Kewaunee *Enterprise,* Dec. 3, 1880. [5] Sturgeon Bay *Advocate,* Dec. 6, 1883. [6] *Ibid.,* Nov. 17, 1888. [7] *Ibid.,* Nov. 7, 14, 1891. [8] *Ibid.,* Nov. 9, 1895. [9] *Ibid.,* Nov. 13, 1897.

Douglas. Many years elapsed before deer were common on the Brule River. In May, 1856, a deer was reported seen on the Nemadji River, about eight miles south of Superior. The comment was made that the animal seldom comes so close to Lake Superior.[1] At this time hunters went to the upper St. Croix for deer.[2] A few deer were seen on the headwaters of the Nemadji River in October, 1858,[3] and a year later they were reported quite common a few miles west of Superior.[4] In 1867 it was stated that deer were numerous, but that few were killed;[5] however, when a deer was killed on the Nemadji River on January 1, 1874, it was still considered comparatively uncommon near Superior.[6]

Deer were uncommon until about 1875, after which date the increase was quite rapid. In December, 1876, one hunter killed twelve deer in a short time;[7] and eleven years later the slaughter was "immense."[8] In the fall of 1890 deer were reported plentiful due to the light snowfall of the last winter.[9] During the hunting season of this year, N. Lucius and Company shipped about 200 saddles of venison from White Birch and Gordon.[10] The following year it was estimated that 2800 deer were killed in the county, 2000 of which were shipped from three points.[11] A contemporary estimate placed the number of deer killed at the more probable figure of 1000.[12] Verwyst,[13] writing in 1895, states that he was informed that 2500 deer were killed in one season in the county a few years previously. It was estimated that 1000 deer would be shipped from the county during the hunting season of 1897.[14]

[1] Superior *Chronicle,* May 13, 1856. [2] *Ibid.,* Nov. 17, 1857. [3] *Ibid.,* Oct. 5, 1858. [4] *Ibid.,* Oct. 1, 22, 1859. [5] Superior *Gazette:* Madison *State Journal,* Jan. 7, 1868. [6] Superior *Times,* Jan. 3, 1874. [7] *Ibid.,* Dec. 15, 1876. [8] *Ibid.,* Nov. 5, 1887. [9] B. *Shooting and Fishing,* 9 (2), (Nov. 6, 1890) 16. [10] Superior *Times,* Nov. 1, Dec. 13, 1890. [11] Baraboo *Republic,* Dec. 10, 1891. [12] Superior *Times,* Nov. 28, 1891. [13] Verwyst, C. *Wis. Hist. Colls.,* 13 (1895) 428. [14] Shell Lake *Watchman,* Nov. 6, 1897.

Dunn. The early abundance of deer in the "Big Woods" is discussed by Gibbs.[1] Deer were reported quite plentiful around Menomonie in 1872.[2] In 1873 deer were more plentiful than for many years past and large quantities were brought to town; however, deer were reported scarce the following year.[3] It was estimated that between 150 and 200 deer were killed in the winter of 1874–75 in the town of Tiffany, and only about 100 in the following season.[4] In 1877, one hunter in the town of Knapp killed about 12 deer, and another in the town of Tiffany 21.[5] A. H. Best and sons killed 57 deer in the town of Tiffany, and the Whisler brothers of the town of New Haven, 29, of which 16 were lost due to the warm weather.[6] A total of 64 deer were killed in the town of Tiffany in the season of 1878.[7] There is recorded the killing of 38 deer in the towns of Tiffany and Knapp in 1879.[8] The seasons of 1880 and 1881 were poor.[9] The fall of 1882, Josiah and Joshua Hicks of the town of Colfax killed 47 deer; Edwin Best of the town of New Haven, 37; and O. E. and C. M. Best of the town of Tiffany, 44.[10] The season of 1883 was very poor.[11] Subsequently deer were killed in only modest numbers.[12]

In February, 1870, a lynx killed a deer near Menomonie. Undersheriff Doolittle set a trap and caught the lynx.[13]

[1] Gibbs, O. *Lake Pepin Fish-Chowder.* N. Y., (1869) 93–94. [2] Menomonie *News,* Nov. 16, 1872. [3] *Ibid.,* Dec. 13, 1873; Oct. 24, 1874. [4] *Ibid.,* March 6, 1875; Jan. 1, 1876. [5] *Ibid.,* Dec. 15, 22, 1877. [6] *Ibid.,* Jan. 5, 19, 1878. [7] *Ibid.,* Feb. 1, 1879. [8] *Ibid.,* Nov. 29, Dec. 20, 1879. [9] *Ibid.,* Nov. 27, 1880; Dec. 17, 1881. [10] *Ibid.,* Dec. 23, 1882; Jan. 6, 1883. [11] *Ibid.,* Dec. 15, 22, 1883. [12] *Ibid.,* Nov. 11, 1887; Nov. 20, 1890. [13] Menomonie *News:* Chippewa Falls *Herald,* Feb. 26, 1870.

Eau Claire. On December 10, 1860, a lot of 31 deer were brought to Eau Claire. About 50 were received within three days.[1] Five years later it was estimated that 3000 deer were brought to town over a period of three months.[2] Large loads of venison arrived in Eau Claire in 1867 and 1868.[3] In 1870, a hunting party of four men secured one bear and 9 large deer in nine days.[4] Two professional Augusta hunters, S. Hoag and Charles Martin, killed 102 deer in the season of 1871.[5] A party hunting near Augusta in 1878 killed 18 deer.[6] Deer were scarce and shy at Sumner, presumably in Barron County, in 1884.[7] On December 12 of this year a band of forty Indians disposed of 35 saddles of venison obtained along the South Fork of the Eau Claire River.[8]

An old experienced hunter of Eau Claire, D. P. Graves, is credited with shooting three tons of venison "in the woods toward the Superior region" in 1886.[9] The killing of deer in small numbers continued, but the county was no longer attractive to professional hunters.

[1] Eau Claire *Free Press,* Dec. 13, 1860. [2] Eau Claire *Free Press:* La Crosse *Democrat,* Jan. 22, 1866. [3] Eau Claire (w) *Free Press,* Dec. 19, 1867; Dec. 3, 1868.

[4] *Ibid.,* Dec. 22, 1870. [5] Augusta *Herald,* Jan. 6, 1872. [6] Menomonie *News,* Nov. 9, 1878. [7] Eau Claire (d) *Free Press,* Nov. 25, 1884. [8] Eau Claire (d) *Leader,* Dec. 14, 1884. [9] Chippewa Falls *Times,* Nov. 24, 1886.

Florence. Objections were made in 1882 to the presence of so many hunters from Ohio. Venison was being brought to Florence by the ton.[1] Deer were comparatively scarce in 1883, and it was thought that Florence might no longer be so extensive a "deer port" owing to the law prohibiting the shipping of venison from the state.[2] Fine hunting was reported for 1884.[3] Foreign hunters were reported not as successful as usual in 1885; however, a party of five Ohio hunters within a month killed 25 deer at Patton Lake.[4] The following year a party of four Ohio hunters killed 34 deer on the Little Popple River.[5] C. S. Osborn killed 18 deer in 25 days on the Popple River in 1888.[6] Venison was plentiful at the beginning of the season but later there was great scarcity.[7] Deer were considered scarce in 1889 and it was estimated that only about 500 were killed.[8]

Only about one-half of the usual number of deer were killed in 1890;[9] and they were scarce during the years following.[10] The kill in 1897 was only about one-third of the usual number.[11] They were so scarce in 1898 that it was believed doubtful if more than 50 were killed in the county.[12] Comparatively few were killed in 1899 at the opening of the season.[13]

[1] Florence *Mining News,* Nov. 25, 1882. [2] *Ibid.,* Nov. 3, 24, 1883. [3] *Ibid.,* Dec. 13, 1884. [4] *Ibid.,* Nov. 14, 21, 1885. [5] *Ibid.,* Nov. 20, Dec. 4, 1886. [6] *Ibid.,* Nov. 3, 1888. [7] *Ibid.,* Oct. 13, 20, 27, 1888. [8] *Ibid.,* Aug. 24, Nov. 30, 1889. [9] *Ibid.,* Oct. 11, Nov. 22, 1890. [10] *Ibid.,* Oct. 24, 1891; Oct. 15, 29, Nov. 26, Dec. 3, 1892; Oct. 28, 1893; Oct. 20, 1894. [11] *Ibid.,* Nov. 6, 20, 1897. [12] *Ibid.,* Nov. 12, 19, 1898. [13] *Ibid.,* Nov. 11, 1899.

Fond du Lac. Deer were comparatively scarce by 1865 and confined largely to the eastern edge of the county. A small number of deer were brought into Fond du Lac in the late fall of 1867. A load of eight deer was considered very unusual.[1] Venison was scarce and expensive in 1868 though a man in the town of Empire is stated to have killed 16 deer after a snowstorm.[2] Venison was plentiful in 1869 due to importation from the Black River, Outagamie County.[3] Late in December of this year a considerable number of deer drifted into the towns of Forest and Marshfield but were soon killed.[4]

Deer were more numerous in the eastern part of the county during the season of 1870 than for some years.[5] Venison, obtained locally, was also abundant in 1871.[6]

Hunters complained of scarcity of deer in 1872.[7] From this date on only an occasional deer was reported killed. Venison was being received by express in 1872, the source of which is in doubt. Five men hunting in the "north" for five weeks killed 34 deer.[8] Hunters were stated to have sent in "more than the usual supply of venison" during the season of 1873. This is meaningless without further information.[9] Venison at this time was being imported from Marinette.[10]

[1] Fond du Lac (w) *Reporter*, Nov. 30, Dec. 21, 28, 1867. [2] Fond du Lac *Reporter*, Nov. 28; *Commonwealth*, Nov. 25, 1868. [3] Fond du Lac *Reporter*, Dec. 4, 1869. [4] *Ibid.*, Jan. 1, 1870. [5] Fond du Lac (w) *Commonwealth*, Nov. 19, 1870. [6] Fond du Lac *Reporter*, Dec. 9; *Commonwealth*, Dec. 23, 1871. [7] Fond du Lac (w) *Commonwealth*, Nov. 23, 1872. [8] Fond du Lac *Reporter*, Nov. 30, Dec. 28, 1872. [9] *Ibid.*, Nov. 8, 1873. [10] *Ibid.*, Nov. 15, 1873.

Forest. There is no early information. Much game, including deer, was obtained by hunters in 1888.[1] Indians bringing venison to Crandon in 1889 reported that there was not much game.[2] Deer was scarce the following season.[3] Indians had only fair success with deer in 1892; however, M. S. Barker bought 1000 pounds of venison from them at Armstrong.[4] On October 26, 1893, John Bowers brought to Eagle River ten deer that were killed in the northern part of Forest County.[5] The complaint was made that deer were being exterminated by market hunters so that few were left for the local people. Very few were killed at Three Lakes.[6]

[1] Crandon *Republican*, Oct. 23, 1888. [2] Crandon *Forest Leaves*, Nov. 28, 1889. [3] Crandon *Forest Leaves*, Nov. 6, 13; *Republican*, Nov. 26, 1890. [4] Crandon *Republican*, Nov. 24, 1892. [5] Eagle River *Democrat*, Oct. 28, 1893. [6] Crandon *Forest Leaves*, Nov. 2, 23, 1893.

Grant. When Hollman[1] settled at Platteville in 1828, deer, elk and other game were to be found in "astonishing quantities." Rev. Brunson[2] estimated that in the course of a ride of ten miles near Platteville on November 25, 1835, he saw the tracks of 50 deer. James Grushong, who arrived in 1832, often saw droves of thirty to forty running through the woods; and Daniel R. Burt saw herds of thirty feeding at one time.[3] Concerning his arrival at Platteville, Evans wrote: "The first winter [1846–47] we were here there was a great snow, and deer were plentiful. Hunters brought venison into Platteville, and so great was the supply that they never thought of bringing the forequarters. Generally, they brought only the saddles, and sold these for two or three cents a pound."[4] In October, 1877, David Connelley, living at Woodman, killed a buck weighing 220 pounds.[5]

[1] Hollman, F. G. *Auto-biography*. Platteville, n.d., p.3. (MS prepared in 1870). [2] Brunson, A. *Wis. Hist. Colls.*, 15 (1900) 264. [3] Anon. *History of Grant County, Wisconsin*. Chicago, (1881) 552, 575. [4] Evans, J. H. *Proc. Wis. Hist. Soc. for 1909.* (1910) 240. [5] Boscobel *Dial*, Oct. 12, 1877.

Green. There is little information on the status of deer in this county. In 1845, Duerst[1] found at the site of New Glarus much game, including deer. Monroe sportsmen were hunting deer in the late fall of 1857, but their success was not stated.[2]

[1] Duerst, M. *Diary, 1845, of New Glarus Colony. Wis. Hist. Colls.*, 15 (1900) 333. [2] Monroe *Sentinel*, Nov. 25, 1857.

Green Lake. Richard Dart settled in the county in 1840, when: "Deer were plentiful, except when they went south in winter to escape the cold."[1] This belief arose because the deer wintered in swamps and other sheltered places. Deer seem to have been exterminated at a relatively early date. The venison in the market at Princeton in 1873 was evidently brought in from abroad[2] as there are several references to hunters going north for deer. It is impossible to determine if the deer brought into Berlin in 1872 were killed locally or elsewhere.[3]

[1] Dart, Richard. *Proc. Wis. Hist. Soc. for 1909.* (1910) 260. [2] Princeton *Republic,* Dec. 6, 1873. [3] Berlin *Courant,* Dec. 19, 1872.

Iowa. This was a good county for deer. Mrs. Daniel Ruggles, who came to Ridgeway in 1841, stated that during the first few years of her residence, hunters from Mineral Point, Madison, and Janesville came there to hunt for weeks at a time. In one season there were 17 dressed deer hanging in trees near the house.[1]

Deer continued plentiful for many years. In 1852, C. A. Desilva, of Dodgeville, killed 23 in six days.[2] Two men, the winter of 1854–55, in a hunt of three or four days, killed 11 deer within a few miles of Mineral Point.[3] They were reported plentiful as late as December, 1869.[4] The origin of a load of venison sold in Mineral Point is not given.[5] Four deer were seen at Avoca in December, 1871.[6]

[1] Anon. *History of Iowa County, Wisconsin.* Chicago, (1881) 602. [2] Mineral Point *Tribune:* Milwaukee *Sentinel,* Dec. 9, 1852. [3] Mineral Point *Tribune,* Jan. 10, 1855. [4] Lancaster *Herald,* Dec. 21, 1869. [5] Mineral Point *Democrat,* Dec. 29, 1869. [6] Black Earth *Advertiser,* Dec. 14, 1871.

Iron. This county was late in acquiring deer in abundance. In 1874, Joe Current and his uncle killed about 20 deer at Moose Lake in a period of two weeks.[1] A drowned doe was found in Lake Lavina in May, 1886. During the open season deer were reported plentiful north of Hurley.[2] They were reported scarce before the opening of the season of 1889, but later plentiful around Hurley.[3] Deer were unusually plentiful in 1890.[4] It was stated in 1892 that deer were unknown at Hurley seven years previously[5] (1885). One hundred deer hunters from Ohio and Indiana were reported living in special cars on the branch line of the Wisconsin Central in 1895.[6]

[1] Ashland *Press,* Dec. 5, 1874. [2] Hurley *Miner,* May 13 ; Nov. 13, 1886. [3] *Ibid.,* Aug. 29, Nov. 7, 14, 1889. [4] *Ibid.,* Oct. 30, Nov. 20, 1890. [5] *Ibid.,* Dec. 3, 1892. [6] *Ibid.,* Nov. 2, 1895.

Jackson. In one week in January, 1856, 200 deer were hauled into Sparta for shipment to New York City. They were purchased at four cents a pound from two men who killed them a short distance north of Black River Falls.[1] At the same time a farmer living near Sparta returned with his second load of twenty deer that he had secured near Black River Falls.[2] In the fall of 1867, E. G. Slayton and brother of the town of Leon, Monroe County, killed 86 deer.[3] These were probably shot in Jackson County.

Large quantities of venison were sold at Black River Falls in 1866 at six to eight cents a pound.[4] Some deer were killed in 1868, but for some unexpressed reason there were fewer deer hunters in Jackson and Clark counties than for a number of years.[5] Deer were reported "not very plenty"during the season of 1870.[6] Three years later G. M. Bowman killed 17 deer in six to seven weeks within two to six miles of Black River Falls.[7] A modest number was shot near Merrillan in 1882, and two were killed by a train.[8]

The season of 1893 was very poor at Merrillan.[9] The deer population at this time was very low. Deer were unusually scarce in 1894 near Merrillan where only three or four deer were killed.[10] The following season was equally poor.[11] Thirteen hunters from Baraboo spent a week at City Point and killed but two deer.[12] Only one deer was killed at Melrose during the season.[13] Very few were killed in 1896.[14] A total of 373 deer licenses was issued in the county in 1897, and somewhat over 10,000 for the state. There was complaint of illegal shipment of venison.[15]

[1] Sparta *Watchman:* Milwaukee (d) *Sentinel,* Jan. 16, 1856. [2] Sparta *Watchman:* Milwaukee (d) *Sentinel,* Feb. 1, 1856. [3] Sparta *Eagle,* Jan. 23, 1867. [4] Black River Falls *Banner:* Madison *State Journal,* Dec. 6, 1866. [5] Black River Falls *Banner,* Nov. 21, Dec. 5, 1868. [6] *Ibid.,* Dec. 24, 1870. [7] *Ibid.,* Dec. 6, 1873. [8] Merrillan *Leader,* Dec. 1, 15, 1882. [9] *Ibid.,* Oct. 13, 20, 1893. [10] *Ibid.,* Oct. 12, 26, Nov. 2, 1894. [11] *Ibid.,* Nov. 15, 1895. [12] *Ibid.,* Nov. 8, 1895. [13] Black River Falls *Banner,* Nov. 28, 1895. [14] Merrillan *Leader,* Oct. 23, 30, Nov. 13, 1896. [15] *Ibid.,* Nov. 5, 12, 26, Dec. 10, 1897.

Jefferson, Deer were abundant at the time of settlement.[1] Cravath[2] refers to deer repeatedly. Caswell[3] settled near Lake Koshkonong in 1837 and states: "Deer were rarely found on the prairie. They naturally took to the woods in fall and to the oak openings in the winter, for there they could always find acorns by pawing the snow for them. They would in winter herd together, and seek the oaks, sometimes in droves of fifty or more." Actually the deer used the prairies extensively in summer and fall. In winter the cover of tall grass and forbs was destroyed by burning or snow. Caton[4] gives a long account of methods of hunting deer on the Illinois prairies.

In the fall of 1847, deer were uncommonly numerous.[5] A hunter frequently returned with a deer after an absence of an hour or two. Venison sold in Watertown in the fall of 1849 at $2.00 per 100 pounds.[6] The Rock River woods were full of deer during the winter of 1853–54, and hunters brought them in by the sleigh load.[7]

A good knowledge of the abundance of deer is obtained from Cartwright[8] who settled in the Bark River Woods, town of Sullivan, Jefferson County, in 1842. The winter of 1842–43 he and a companion killed about 75 deer. He states: "The deer used to go into the oak openings at night to get acorns to eat. In the morning they would go into the swamps and stay during the day. We used to go out very early in the morning, and watch upon the runways. One time I killed four before sunrise.

"In one hunt I caught thirteen deer in three days. I have quite a number of times caught five in a single day. Once I got six in one day . . . In 1855, when I did some of my last hunting in Jefferson County, the deer were very scarce. There have, probably, not been a half dozen killed there since that time."

The date for the sharp decline of deer in Jefferson County given by Cartwright is approximately correct. In the fall of 1855 they were reported scarce in regions where they were quite numerous the year previously.[9] Later it was reported that a Mr. Johnson had killed 40 during the season.[10] In 1857, "Weasel"[11] reported deer so scarce around Watertown that it was not worth while hunting them. The shooting of a young deer at Watertown in November, 1856, is recorded.[12] During the winter of 1856–57, E. H. Pearse killed 30 deer in the woods between Watertown and Jefferson.[13] Two deer were seen by Fred Seaver on the west shore of Rock Lake in the spring of 1867.[14]

[1] Keyes, Elisha W. *Early days in Jefferson County. Wis. Hist. Colls.*, 11 (1888) 416. [2] Cravath, P. *Early annals of Whitewater, 1837–1867.* Whitewater, (1906) 18, 40, 49, 61, 84, 178, 189. [3] Caswell, Lucien B. *Reminiscenses.* MS Wis. Hist. Soc. Lib. pp. 19, 20. [4] Caton, J. D. *The antelope and deer of America.* N. Y. (1877) 388–97. [5] Watertown *Pilot,* Dec. 8, 1847. [6] Watertown *Chronicle,* Sept. 5, 1849. [7] Watertown *Register,* Jan. 21, 1854. [8] Cartwright, David W. *Natural history of western wild animals.* Toledo (1875) 159, 161. [9] Jefferson *Jeffersonian,* Oct. 25, 1855. [10] *Ibid.,* Feb. 14, 1856. [11] "Weasel". *Porter's Spirit of the Times,* N.S. 3 (Nov. 28, 1857) 202. [12] Watertown *Democrat,* Nov. 8, 1856. [13] *Ibid.,* Feb. 5, 1857. [14] Hawkins, A. S. *Trans. Wis. Acad. Sci.,* 32 (1940) 57.

Juneau. Game was abundant prior to 1850.[1] In 1859 deer were plentiful on Bear Creek where the Indians killed seven in one day; and a Mr. Hurd, town of Clearfield, brought a load of venison to New Lisbon.[2] Deer abounded in 1869 and sold at five cents a pound.[3] The number killed the following year was considerably lower owing to absence of snow and the low price of venison.[4] They were considered plentiful in 1871, a dozen being brought into Mauston within a week.[5] Few were killed in 1872 and 1873.[6] In 1874 there was fine deer hunting at the "ranch" of Hon. T. McConnell in this county.[7] Hunting, however, was not considered profitable.[8]

The hunting was moderately good in 1876 and 1877, quantities of venison being shipped by express.[9] There was a decided drop in the amount of venison marketed in 1878.[10] Up to the first week of December, 1882, 25 carcasses were brought to Mauston.[11] In November, 1887, a wagon load of deer passed through New Lisbon, where hunters were considered particularly successful; but game was scarce at Mauston.[12] In succeeding years deer were killed in only small numbers. Six deer were killed by Frank Allen, town of Lemonweir, in the season of 1889.[13]

[1] Kingston, J. T. *Wis. Hist. Colls.*, 8 (1879) 383, 397. [2] Mauston *Star*, Sept. 28; New Lisbon *Argus*, Nov. 26, 1859. [3] New Lisbon *Argus*, Nov. 18, 25, 1869. [4] Mauston *Star*, Dec. 15, 1870; New Lisbon *Argus*, Jan. 12, 1871. [5] Mauston *Star*, Nov. 2, 30, 1871. [6] New Lisbon *Argus*, Nov. 21, 1872; Nov. 6, 13, Dec. 18, 1873. [7] Princeton *Republic*, Dec. 19, 1874. [8] New Lisbon *Argus*, Jan. 7. 1875. [9] *Ibid.*, Nov. 2, 23, 30, Dec. 14, 1876; Nov. 15, 1877. [10] *Ibid.*, Dec. 26, 1878. [11] Mauston *Star*, Dec. 7, 1882. [12] New Lisbon *Argus*, Nov. 3, 10; Mauston *Star*, Nov. 17, 1887. [13] Mauston *Star*, Dec. 5, 1889.

Kenosha. This county comprised mainly prairie and oak openings. Lothrop[1] found deer so numerous in 1835 that in making a survey of twenty miles, 50 or more might be seen; occasionally as many as 20 in a herd. The letters of Quarles, written from Kenosha, have some interesting information:

November 7, 1837. "I am anticipating rare sport in shape of occational deer hunting this winter—they are very plenty—I have seen a large number—Last Wednesday saw seven in one drove 75 yards from me & discharged my shot gun but did not so much as friten them."

February 14, 1839. "Deer are very plenty. I have seen from 30 to 40 in a day Their meat is fat & much better flavour than at the east their food being different."[2]

[1] Lothrop, J. *Historical sketch of Kenosha County. Wis. Hist. Colls.*, 2 (1856) 462. [2] Quarles, J. V. *Letters. Wis. Mag. Hist.* 16 (1933) 299, 310.

Kewaunee. Deer were common to abundant until about 1878. In January, 1874, venison continued to arrive in Ahnapee in abundance.[1] The winter of 1874–75 "John Feezier's boys" killed 40 deer and the winter previous 38.[2] In December, 1875, deer were numerous in the town of Montpelier and many were killed.[3] They continued numerous in 1876 and 1877.[4] Hunters were now going to Door County. One hunter from the town of Carlton brought home nine deer in 1878;[5] and the following year a party of hunters from Kewaunee killed a deer at Whitefish Bay.[6]

Deer were reported very scarce in the towns of Carlton and Casco in 1881.[7] In 1889 it was said that there were no deer in the county to kill.[8] The sight of a deer in the town of Red River in December, 1894, was worthy of comment.[9] In the fall of 1896 a large number of deer was reported seen in the town of Gardner.[10]

[1] Ahnapee *Record,* Jan. 8, 1874. [2] Kewaunee *Enterprise,* Jan. 26, 1875. [3] *Ibid.,* Dec. 4, 1875. [4] *Ibid.,* Dec. 9, 1876; Nov. 9, 1877. [5] *Ibid.,* Dec. 20, 1878. [6] *Ibid.,* Oct. 24, 1879. [7] *Ibid.,* Nov. 4, 18, 1881. [8] *Ibid.,* Oct. 18, 1889. [9] *Ibid.,* Dec. 28, 1894. [10] Ahnapee *Record,* Nov. 19, 1896.

La Crosse. One of the famous deer hunters of this county was Jack Rand. In December, 1862, he brought into La Crosse a load of 25 deer and reported that they were scarce and wild.[1] The following winter he killed and marketed 55 deer. Had it not been for the deep snow, he thought that he would have killed 100.[2] As late as 1871 many deer were killed within eight miles of La Crosse, chiefly in the Mormon Coulee. One deer was killed with a pistol within the city limits.[3]

[1] La Crosse *Democrat,* Dec. 24, 1862. [2] *Ibid.,* Jan. 15, 1864. [3] La Crosse (d) *Democrat,* Dec. 21, 1871.

Lafayette. The spring of 1834, when Rodolph[1] arrived at the present site of Darlington, he counted more than fifty deer in a herd. In 1853, when W. M. Curry arrived, deer were still abundant.[2] Several deer were killed in the fall of 1868 north of Darlington.[3] Venison was plentiful in this village the following season.[4]

[1] Rodolf, T. *Pioneering in the Wisconsin Lead Region. Wis. Hist. Colls.,* 15 (1900) 353. [2] Curry, W. F. In *Commemorative biographical record of the counties of Rock, . . . and Lafayette, Wisconsin.* Chicago, (1901) 292. [3] Darlington *Democrat,* Dec. 11, 1868. [4] *Ibid.,* Dec. 3, 1869.

Langlade. There is little information on this county. The end of November, 1883, three Shiocton hunters returned through Shawano with 9 deer obtained during a hunt of about a week's duration at Lily.[1] Another party passed through Shawano on November 30, 1886, with a wagon-load of deer shot in the neighborhood of Lily.[2] Venison was plentiful in the market at Antigo in October, 1889.[3] A party of hunters from Manitowoc County secured 9 deer near Antigo, and found a set-gun, in the season of 1895.[4] Alvin Smith of Antigo shot three deer in one day in the fall of 1897.[5] Hunters managed to have venison on sale in Antigo by noon of the opening day in 1898.[6]

[1] Shawano *Journal,* Nov. 30, 1883. [2] *Ibid.,* Dec. 3, 1886. [3] Antigo *Republican,* Oct. 31, 1889. [4] Manitowoc *Pilot,* Nov. 21, 1895. [5] Antigo *Republican,* Nov. 11, 1897. [6] Antigo *Item,* Nov. 5, 1898.

Lincoln. David Finn homesteaded between Wausau and Merrill in 1860 and found deer very numerous.[1] In 1877 Hank Sails killed 9 deer up to the last week of November.[2] Deer were considered more abundant in the spring of 1879 than ever before.[3] They were so abundant in 1882 that the statement was made that a person could not go more than 80 rods without seeing two or three.[4] There was an apparent scarcity for a number of years. In 1896 deer hunters had good success. Four hunters left Spirit Falls with 11 deer; however two good hunters living at Bay Mill did not get one.[5] They were numerous at Spirit Falls in 1897,[6] and especially plentiful in 1898.[7] There were issued this season 361 deer licenses in comparison with 427 for 1897. Large shipments of venison were made from Tomahawk in 1900. It was estimated that 50 deer were killed within a radius of five or six miles of Heafford Junction.[8]

[1] Merrill *Herald,* Feb. 22, 1921. [2] Merrill *Advocate,* Nov. 24, 1877. [3] *Ibid.,* June 16, 1879. [4] *Ibid.,* June 26, Nov. 20, 1882. [5] Tomahawk *Tomahawk,* Oct. 31, Nov. 7, 1896. [6] *Ibid.,* Oct. 30, 1897. [7] *Ibid.,* Nov. 5, 26, Dec. 3, 1898. [8] *Ibid.,* Nov. 10, 17, 1900.

Manitowoc. Deer were numerous in 1859 and for some years afterwards.[1] In 1876 they were reported more numerous than for some years.[2] The next year several deer were shipped from Two Rivers.[3] They were hunted at New Denmark (Cooperstown) in 1879.[4] Great numbers were shipped through Manitowoc from the north in 1885.[5] In 1887 deer were found close to the city limits of Manitowoc. One was shot in the swamp south of the city. Dogs chased a deer through the streets of Mishicot, and five deer were seen in the town of Liberty.[6] Deer became rare before the end of the century. One was killed at English Lake in November, 1898: "There are said to be a number of deer in this county this year."[7]

[1] Plumb, R. G. *A history of Manitowoc County.* Manitowoc, (1904) 6. [2] Two Rivers *Chronicle,* Oct. 24, 1876. [3] *Ibid.,* Nov. 13, 1877. [4] *Ibid.,* Nov. 19, 1879. [5] Manitowoc *Times,* Dec. 1, 1885. [6] Manitowoc *Times,* Oct. 27; *Pilot,* Oct. 29; Two Rivers *Chronicle,* Nov. 1, 26, 1887. [7] Manitowoc *Pilot,* Nov. 10, 1898.

Marathon. David Finn settled between Wausau and Merrill in 1860 when deer were very numerous.[1] They remained numerous for many years afterwards.[2] It was stated in 1881 that the wolf had nearly disappeared while deer were becoming more numerous.[3] Deer were unusually plentiful in the fall of 1887 and many were killed.[4] The large number killed in 1899 was attributed to the fact that they were more numerous than usual.[5]

[1] Merrill *Herald,* Feb. 22, 1921. [2] Wausau *Pilot,* May 29, 1874; Nov. 18, 1876; Nov. 24, 1877; *Torch of Liberty,* Dec. 12, 1878. [3] Wausau *Torch of Liberty,* Jan. 13, 1881. [4] Wausau *Wisconsin,* Oct. 29, *Pilot* and *Review,* Oct. 18, 1887. [5] Wausau *Wisconsin,* Nov. 25, 1899.

Marinette. Within historic time the valley of the Menominee was excellent deer territory. In 1869 they were reported unusually plentiful on the headwaters of the Peshtigo.[1] L. D. Gray, a professional hunter of Green Bay, killed 26 deer along the Menominee during the season of 1871. He killed 68 deer in each of the years 1869 and 1870.[2] A party of five men from Appleton and Neenah killed 48 deer in the same region in the fall of 1872.[3] The same year three hunters from De Pere killed 23 large deer along the Menominee.[4] They were killed in large numbers in 1874.[5] A protest arose in 1886 against the wholesale slaughter of deer and the shipment of the carcasses to Chicago.[6] Two years later hunters had poor success and venison was scarce in the Marinette markets.[7] Opinions differed on the season of 1889. At Marinette the kill was the smallest ever known. It was claimed that Peshtigo hunters killed more deer than were reported for any other section of the state.[8] Three hunters killed 15 deer in the vicinity of the Peshtigo River.[9]

Deer were killed in only modest numbers during the next decade. They were reported scarce in 1891, 1893 and 1895.[10] The shooting was better in 1896. A party of Peshtigo hunters shot about 15 deer on the headwaters of the Thunder and Peshtigo rivers and seven were displayed in a Marinette market. A farmer at Pound killed five deer but other hunters from this village had very poor success.[11] They were reported plentiful in 1900,[12] probably in contrast with recent years.

[1] Oconto *Lumberman:* Madison *State Journal,* Nov. 25, 1869. [2] Green Bay *Advocate,* Jan. 4, 1872. [3] Appleton *Crescent,* Dec. 14, 1872. [4] De Pere *News,* Jan. 11, 1873. [5] Marinette and Peshtigo *Eagle,* Oct. 17, 1874. [6] Marinette *Eagle,* Nov. 27, 1886. [7] *Ibid.,* Oct. 27, Nov. 3, 1888. [8] *Ibid.,* Nov. 16, 30, 1889. [9] Green Bay *Gazette,* Nov. 21, 1889. [10] Marinette *Eagle,* Nov. 7, 1891; Oct. 14, 1893; Nov. 9, 16, 30. 1895. [11] *Ibid.,* Oct. 3, Nov. 7, 1896. [12] *Ibid.,* Oct. 27, 1900.

Marquette. John Muir was cited previously on the early abundance of deer in this county. On November 25, 1876, Fred Pond, who subsequently became a noted writer on sports, and a companion went on their first deer hunt. A deer that was shot eight miles northwest of Westfield was not recovered until the next day, by which time it had been nearly consumed by wolves.[1] A doe was shot and another deer wounded in the town of Springfield on November 21, 1877.[2] Deer were killed also in 1879.[3] In 1882, "quite a number" were shot west of Westfield and shipped from that village.[4] The following season five deer were brought into Westfield and several were seen between Westfield and Lawrence on December 18.[5] In the fall of 1889 a butcher at Montello purchased a deer from Chippewa Falls since venison "is a scarce article in this section."[6] It is doubtful if the county was ever without deer as these animals would drift in from Adams County.

[1] Montello *Express,* Dec. 9, 1876. [2] *Ibid.,* Nov. 24, 1877. [3] *Ibid.,* Dec. 20, 1879. [4] *Ibid.,* Nov. 4, Dec. 9, 1882. [5] *Ibid.,* Nov. 24, Dec. 22, 1883. [6] *Ibid.,* Nov. 9, 1889.

Milwaukee. Deer persisted in the Milwaukee area for a long time. In 1839 they were still so common that they could be seen almost daily: "How plainly I can see, after all these years, the beautiful young mother and the fine looking father coming through the big trees on their horses, just as the sun was going down, each with a gun across the front of the saddle and each with a deer strapped at the back of the saddle with its legs hanging down and its horns standing out—for the little mother was a fine shot and could bring down her own game on earth or in the air as well as any man could."[1]

The severe winter of 1842–43, venison was so plentiful in Milwaukee that it was difficult to give it away.[2] A marked scarcity might have been expected afterwards, but in January, 1844, a Capt. Sanderson secured six deer within ten to twelve miles of the city.[3] They continued to be common until 1852. In December of this year several were shot near town.[4] On about November 4, 1858, a deer was driven into the old Milwaukee harbor and killed.[5]

[1] Fitch, Martha E. *Wis. Mag. Hist.*, 9 (1925) 81. [2] Milwaukee *Sentinel*, Feb. 15, 1843. [3] *Ibid.*, Jan. 20, 1844. [4] *Ibid.*, Dec. 11, 28, 30, 1852. [5] Milwaukee (d) *Wisconsin*, Nov. 4; *Sentinel*, Nov. 5, 1858.

Monroe. There is no information showing that Monroe County was especially good for deer. Even in the 1850's the hunters from this county went mainly to Jackson County as will be observed under Jackson County.

Oconto. In 1863 deer were so plentiful as to appear at the edge of the village of Oconto.[1] They were reported plentiful in 1874 and 1875.[2] Deer were plentiful in 1876 but hunters had poor success in the absence of snow.[3] Many were killed in 1877.[4] Considerable venison was shipped from Oconto in 1878. The party of Pensaukee hunters who "came down" with 23 deer after a hunt of three weeks may have shot them in Marinette County.[5] Hunting was good the year following.[6] The reports for 1881 were mixed. Three men in killing three deer had "remarkable success"; yet, a party of five hunters brought in 22 deer.[7] Large numbers were killed in 1886 and 1889.[8] The shooting appears to have been overdone in the latter year, for in 1891 the number killed was only one-half that of two years previously.[9] A further decrease was recorded for 1893.[10]

[1] Oconto *Pioneer*, Nov. 6, 1863. [2] Oconto *Reporter*, Feb. 7, 1874; Oct. 16, Dec. 18, 1875. [3] *Ibid.*, Nov. 25, Dec. 9, 1876. [4] *Ibid.*, Jan. 5, 1878. [5] *Ibid.*, Nov. 23, 30, 1878. [6] *Ibid.*, Dec. 13, 1879. [7] *Ibid.*, Oct. 22, Dec. 10, 1881. [8] *Ibid.*, Oct. 2, Nov. 20, 1886; Oct. 19, Nov. 2, 23, 1889. [9] *Ibid.*, Dec. 4, 1891. [10] *Ibid.*, Nov. 11, 1893.

Oneida. Deer do not appear to have become numerous until the latter part of the 19th century. A large number were brought into Rhinelander in 1892.[1] The poor season of 1893 was attributed to a change in the game laws, forest fires in September, and the depredations of wolves.[2] Due to the local low price of five to six cents per pound on carcasses, many deer were shipped out of

Rhinelander in 1894.[3] Deer were "quite plentiful" in 1895.[4] In 1897 only a few were killed at Pratt Junction,[5] but they were considered more plentiful at Minocqua than for some years.[6] Deer were plentiful around Minocqua in 1898 and a large number was killed.[7] Though numerous at Rhinelander, but few were killed due to the absence of snow.[8] Large numbers were shot at Minocqua in 1899 and 1901.[9]

[1] Rhinelander *Herald,* Nov. 19, 1892. [2] *Ibid.,* Nov. 4, 1893. [3] *Ibid.,* Oct. 27, 1894. [4] *Ibid.,* Oct. 26, 1895. [5] *Ibid.,* Nov. 13, 1897. [6] Minocqua *Times,* Nov. 11, 1897. [7] *Ibid.,* Nov. 17, 24, 1898. [8] Rhinelander *Herald,* Nov. 12, 1898; Two Rivers *Chronicle,* Nov. 15, 1898. [9] Minocqua *Times,* Nov. 16, 1899; Nov. 21, 28, 1901.

Outagamie. Mrs. M. A. Bristol[1] attended a wedding at Grand Kaukaulin in 1829, when, among other meats, venison was served. Following a light snowfall in November, 1854, many deer were killed within one to two miles of Appleton.[2] An immense number was killed in February, 1857, when the snow was crusted. Two Indians killed 14 deer in the town of Center on February 14.[3] So many deer were killed in 1860 that venison sold for four cents per pound.[4] They were numerous again in 1861,[5] and unusually so in 1868, when the slaughter had not been equalled since the crusted snow of 1857. Set-guns were reported in use in the northern part of the county.[6]

Deer were quite plentiful in 1869, one hunter killing four in one day.[7] They were reported unusually numerous around Shiocton in 1870.[8] They were reported plentiful again in 1871 and 1872.[9] More deer than usual were killed in the county in 1875.[10] In 1876 they were exceptionally plentiful at Seymour and a large number was killed in February, 1857, when the snow was crusted. that 150 deer were killed within a radius of five miles from Shiocton.[12] Appleton hunters returning from the "north" in 1888 reported deer very scarce.[13] Only a few deer were killed at Shiocton in 1897, due to the dryness of the woods.[14]

[1] Bristol, Mrs. M. A. *Wis. Hist. Colls.,* 8 (1879) 303. [2] Appleton *Crescent,* Nov. 18, 1854. [3] *Ibid.,* Feb. 21, 1857. [4] *Ibid.,* Dec. 1, 22, 1860. [5] *Ibid.,* Nov. 30, 1861. [6] *Ibid.,* Dec. 12, 19, 26, 1868. [7] *Ibid.,* Nov. 27, 1869. [8] *Ibid.,* Nov. 19, 1870. [9] *Ibid.,* Dec. 16, 1871; Nov. 16, 1872. [10] *Ibid.,* Dec. 9, 1875. [11] *Ibid.,* Dec. 7, 1876. [12] Milwaukee (d) *Sentinel,* Dec. 12, 1878. [13] Appleton *Crescent,* Nov. 10, 1888. [14] Shiocton *News,* Nov. 26, 1897.

Ozaukee. The winter of 1838–39 was spent by Vieau[1] at what is now the site of Port Washington. He took to Milwaukee by ox-team loads of venison and wild turkeys. Ficker[2] settled in the town of Mequon while deer were still plentiful. He states that during the winter of 1852–53 there were 80 to 90 deer along Lake Michigan, about five miles east of his place, and that more than 50 were killed in one small area.

[1] Vieau, Sr., A. J. *Narrative. Wis. Hist. Colls.,* 11 (1888) 231. [2] Ficker, C. T. *Wis. Mag. Hist.,* 25 (1942) 348.

Pepin. This small county is situated at the mouth of the Chippewa River, which was known to the early French as Bon Secours, or Good Succor, from the abundance of deer and other large game animals. Prior to the winter of 1856–57, deer still occurred in large numbers. The snow was four feet deep on the level that winter and the deer population never recouped its losses.[1]

[1] Curtiss-Wedge, F. *History of Buffalo and Pepin Counties, Wisconsin.* Winona, (1919) 1004.

Pierce. Deer hunting was very rewarding. In the winter of 1856–57, three men killed over 200 deer and several elk in the region between the Trimbelle and Rush rivers.[1] Many were killed in the county in 1868 and in 1872.[2] In the latter year deer were plentiful and in excellent condition at Bay City where one herd of 15 was seen.[3] The population dwindled gradually to a small number. A deer seen in the town of El Paso on November 18, 1900, was believed to be the only one seen in the county for several years.[4]

[1] Prescott *Transcript,* Feb. 14, 1857. [2] Prescott *Journal,* Dec. 11, 1868; Ellsworth *Herald,* Nov. 20, 1872. [3] Prescott *Transcript,* Dec. 12, 1872. [4] Ellsworth *Herald,* Nov. 22, 1900.

Polk. Deer were fat and abundant in 1865.[1] A great number were killed in the last two weeks of October, 1866. Two of the deer weighed 229¾ and 245 pounds respectively.[2] The scarcity of deer in 1867 was blamed on the Indians.[3] James Bailey, town of Farmington, rode a belled horse in hunting and sometimes shot five to eight deer in one day.[4] Deer were plentiful in 1873. Z. M. Frasier of Clam Falls came into St. Croix Falls with 20 deer that he sold at five cents per pound. The following report on this season appeared from the town of Lincoln: "Worthy Prentice and a partner have killed 75 deer during the winter; W. D. Thompson, 40; J. Tomkins, 30; and George Dunham about the same number."[5] A dealer in Osceola purchased about 75 deer at seven cents a pound, and shipped them to T. D. Randall, Chicago, receiving 12½ cents a pound.[6]

George Reed, of Clear Lake, killed 25 deer and one bear in the season of 1877 up to December 1.[7] During the same season Matt Young, town of Eureka, killed six deer in one day; and H. F. Muzzey, town of Luck, shot 26 deer from November 6 to December 1.[8] During the season of 1879, one hunter killed 35, and another 25 deer at Clear Lake.[9] The shooting was good at this place in 1880.[10] A hunting party from Osceola returned with 15 deer.[11] Messrs. Grimes and Muzzey of Clear Lake killed 84 deer in 1882.[12] The following year deer were scarce.[13] In 1884, a hunting party that spent a month in the woods returned with only 14 deer.[14] Subsequently deer were killed in only limited numbers.[15]

[1] Osceola *Press,* Aug. 16, 1865. [2] *Ibid.,* Nov. 3, 1866. [3] *Ibid.,* Nov. 27, 1867. [4] *Ibid.,* Dec. 24, 1869. [5] *Ibid.,* Nov. 1, Dec. 27, 1873. [6] *Ibid.,* Jan. 10, 1874. [7] *Ibid.,* Dec. 8, 1877. [8] *Ibid.,* Dec. 22, 29, 1877. [9] Clear Lake *News,* Jan. 30, 1880. [10] *Ibid.,* Nov. 20, 1880. [11] Osceola *Press,* Dec. 11, 1880. [12] Clear Lake *News,* Nov. 3, Dec. 29, 1882. [13] Osceola *Press,* Dec. 1, 1883. [14] *Ibid.,* Dec. 6, 1884. [15] Osceola *Press,* Nov. 29, 1890; St. Croix Falls *Standard,* Nov. 21, 1895; Osceola *Press,* Nov. 13, 1897.

Portage. During the first four days of December, 1855, T. J. Townsend killed 17 deer in the town of Amherst.[1] Deer were so plentiful at Plover in 1864 that a dozen was killed by each of two hunters.[2] In December, 1874, a Fond du Lac hunter returned with seven deer shot near Stevens Point.[3] Two hunters killed "some thirty deer" and three bears near Junction City in 1875.[4] In 1877 deer were reported quite numerous near Stevens Point.[5] A large number of deer were killed in 1879. One Asa Mathewson was reputed to be particularly skillful at this business. He killed 10 in one week.[6] On Nov. 6, 1881, W. G. Bailey shot a lynx while it was eating a deer. The lynx had evidently killed the deer as the latter was still warm.[7] Deer were shot in numbers along the Plover River in 1882, 1883, 1884, 1885, and 1886.[8] On November 7, 1887, Frank Slusser, town of Linwood, brought to Stevens Point seven deer killed a few miles north of the city. Deer were reported plentiful in 1887.[9] Some deer were killed in 1888, but the county had ceased to be an attractive hunting area. On November 17, 1889, four men hunted a day on White River without seeing a deer.[10]

[1] Waupaca *Spirit:* Milwaukee (d) *Democrat,* Dec. 28, 1855. [2] Plover *Times:* Madison *State Journal,* Dec. 15, 1864. [3] Fond du Lac *Reporter,* Dec. 12, 1874. [4] Grand Rapids *Reporter,* Dec. 9, 1875. [5] Fond du Lac *Commonwealth,* Nov. 17, 1877. [6] Stevens Point *Gazette,* Oct. 22, Nov. 5, 12, 26, 1879. [7] Stevens Point *Democrat,* Nov. 12, 1881. [8] Stevens Point *Gazette,* Oct. 25, 1882; *Democrat,* Nov. 3, 1883; *Democrat,* Nov. 22, 1884; *Gazette,* Nov. 18, 1885; *Gazette,* Nov. 10, 1886. [9] Stevens Point *Gazette,* Nov. 9, 1887. [10] *Ibid.,* Nov. 20, 1889.

Price. Information on deer in this county is limited. Shields[1] states that a Mr. Fewell shipped over 3000 pounds of venison from Phillips about 1880. Deer were reported abundant in 1881 and 1882;[2] then the statement was made that not a single deer track was reported the winter of 1883–84.[3] Small numbers of deer were reported killed up to 1888. This year they were stated to be plentiful but that few had been brought to Phillips.[4] They were scarce around Prentice in 1896.[5]

[1] Shields, G. O. *Rustlings in the Rockies.* Chicago, (1883) 282. [2] Phillips *Badger,* Aug. 31, 1881; Dec. 6, 1882. [3] *Ibid.,* Feb. 13, 1884. [4] Phillips *Times,* Oct. 20, 1888. [5] Prentice *Calumet,* Oct. 30, 1896.

Racine. Dyer, who lived in the town of Burlington, wrote: "In the winter of 1839, one hundred and five deer, by actual count, were seen to ford Fox River near the claim of Mr. [David] Bushnell."[1] A few years later Bottomley,[2] who settled near Rochester, did not report deer plentiful. In the spring of 1847, he and two other hunters succeeded in killing three deer. A note from Racine, dated July 18, 1849, reads: "There are deer here, but not so abundant as they once were."[3] A deer was seen in the northern outskirts of Racine in January, 1872.[4] In December, 1887, a wolf hunter found the tracks of a deer in the western part of the county along the Fox River. This deer was reported killed later at Burlington.[5]

[1] Dyer, C. E. *Official record of the Old Settlers Society of Racine County.* (1871) 61. [2] Quaife, Milo M. *An English settler in pioneer Wisconsin: the letters of Edwin Bottomley.* Madison, (1918) 70, 152. [3] B. and S. *Sporting in Wisconsin. Porter's Spirit of the Times,* 19 (Aug. 11, 1849) 295. [4] Racine *Argus:* Madison *State Journal,* Jan. 13, 1872. [5] Racine *Journal,* Dec. 21, 1887.

Richland. A party of hunters from Mineral Point returned from Richland County early in January, 1855, with between 30 and 40 deer, and 10 bears.[1] The county contributed many deer to the market. An article, dated January 5, 1857, in a Madison paper states: "A hunter in town today says the woods are full of slain deer, and that they will be brought to town with a perfect rush as soon as the snow will permit. The snow is so very deep that the deer are easily hunted down and captured, but it is difficult to get them out of the woods. He states that himself and one or two others have about forty hung up on trees awaiting an opportunity to get them to market."[2]

It is doubtful if the above pertains to Dane County at this date. Furthermore, four days later an item referring to the slaughter of deer states that 108 deer arrived in the city from Richland County for shipment east by rail.[3] The lot weighed ten tons, giving an average of 185 pounds. Apparently only the largest deer were brought in for shipment.

Market hunting reduced the number of deer rather rapidly. In January, 1856, it was stated: "Richland County, we will venture to say, has furnished more venison for the eastern markets this winter, than has any other county in the State. Every few days, wagon loads of whole deer pass through this village for Madison and Milwaukee. We fear that our forest will soon be stripped of this kind of game."[4]

A year later few deer were brought to market and most of these were consumed locally.[5] They were considered quite plentiful up to 1868.[6] In December, 1881, none was known to have been killed in the county.[7] The DeVoe brothers of Boscobel shot four deer at Lone Rock in October, 1884.[8]

[1] Mineral Point *Tribune,* Jan. 10, 1855. [2] Madison *Argus* and *Democrat,* Jan. 5, 1857. [3] *Ibid.,* Jan. 9, 1857. [4] Richland Center *Observer,* Jan. 29, 1856. [5] *Ibid.,* Dec. 23, 1856. [6] *Ibid.,* Nov. 19, 1868. [7] Richland Center *Republican* and *Observer,* Dec. 1, 1881. [8] Boscobel *Dial,* Oct. 28, 1884.

Rock. In December, 1852, two Milwaukee men hunted two days on Rock Prairie and killed five deer and seven wild turkeys.[1] Deer are stated to have disappeared from the vicinity of Janesville by 1856;[2] however, a farmer on January 7, 1875, brought to this city three deer that he had shot two days previously.[3]

[1] Milwaukee *Sentinel,* Dec. 30, 1852. [2] Guernsey, O. *History of Rock County.* Janesville, (1856) 173. [3] Janesville *Gazette,* Jan. 7, 1875.

Rusk. A deer weighing 276 pounds dressed was killed on Deer Tail Creek in the fall of 1885.[1] Two men hunted on this creek for ten days in 1887 and returned with eight deer.[2] A load of 19 deer, killed near Bruce, passed through Chippewa Falls, in November, 1889.[3] In November, 1897, it was stated that 25 to 30 deer, shipped from Bruce, passed nightly through Rhinelander.[4]

[1] Chippewa Falls *Times,* Oct. 7, 1885. [2] Chippewa Falls *Herald,* Nov. 11, 1887. [3] Chippewa Falls *Times,* Nov. 20, 1889. [4] Rhinelander *Herald,* Nov. 13, 1897.

Saint Croix. The number of deer killed in the 1850's was very impressive. The winter of 1854–55 a farmer up the St. Croix killed about fifty deer, and two other men 30 within ten days.[1] The following season a company under Joseph Lagrue of Hudson killed 76 deer and five bears in ten days. Guy Salisbury and a companion shot 26 deer in five days, and other hunters did nearly as well.[2] Four men killed 133 deer on Apple River.[3] In February, 1856, a man from Apple River brought to Prescott a load of 16 deer, the last of 200 that he had transported during the winter.[4] There seemed no end to the deer brought into Hudson during the winter of 1858–59. A lot of 60 to 70 deer was awaiting shipment to St. Paul.[5] In January, 1860, a hunter killed 11 deer in a week within five miles of Hudson.[6]

Deer were abundant in 1863.[7] The season following one hunter shot five deer in one forenoon.[8] In the fall of 1865, J. E. Bartlett of Hudson killed 9 deer in one night by fire-hunting.[9] Elias Grimes, town of Emerald, killed 8 deer in one day in the season of 1869.[10] At this time a Mr. Bailey, town of Knapp, shot 31 deer up to December 1; and W. Briggs, town of Eau Galle, in one day killed 11 deer and wounded three others which were secured the following morning.[11] In the winter of 1871–72, George Reed killed 91 deer, eleven of which were secured in a single day.[12] The Bailey family, of the town of Knapp, "shot or otherwise got in their possession" 68 deer in the fall of 1875. Nearly 100 deer were shipped from Baldwin.[13] Only a few deer were killed at New Richmond during this season.[14] The locality from which H. F. Muzzy, of Star Prairie, returned after killing 42 deer is not stated.[15]

The year 1880 appears to have been the last when deer were killed in quantity. In general, hunters were not very successful; however, George Reed, town of Cylon, killed about 30 deer.[16] There was a scarcity of venison in the Baldwin markets in 1889.[17]

[1] Hudson *Star,* April 11, 1855. [2] *Ibid.,* Dec. 12, 1855. [3] *Ibid.,* Feb. 6, 1856. [4] Prescott *Transcript,* Feb. 8, 1856. [5] Hudson *Star:* Milwaukee (d) *Sentinel,* Feb. 22, 1859. [6] Hudson *Star:* Milwaukee (d) *Sentinel,* Jan. 31, 1860. [7] Hudson *Star:* Madison *State Journal,* Nov. 17, 1863. [8] Hudson *Star:* Madison *State Journal,* Dec. 8, 1864. [9] Madison *Capitol,* Sept. 5, 1865. [10] Osceola *Press,* Dec. 31, 1869; Hudson *Star,* Jan. 5, 1870. [11] Hudson *Star* and *Times,* Dec. 1, 1869; Jan. 21, 1870. [12] New Richmond *Republican:* Milwaukee (d) *Sentinel,* Jan. 16, 1872. [13] Hudson *Star* and *Times,* Dec. 17, 1875. [14] New Richmond *Republican,* Dec. 1, 1875. [15] New Richmond *Democrat,* Jan. 22, 1880. [16] Hudson *Star* and *Times,* Nov. 19, Dec. 3, 1880. [17] Baldwin *Bulletin,* Nov. 29, 1889.

Sauk. In 1854, three men hunting for five days killed 16 deer and 2 bears north of the Baraboo River.[1] The last week in December, 1856, A. Lezert, of Baraboo, shot five deer.[2] A herd of 11 deer was seen at Marble Ridge, near Reedsburg, in April, 1875.[3] The following year deer were reported more numerous than for several years, and it was estimated that thirty were killed in the county in one week.[4] The county has an area of 840 square miles and in 1889 the deer population was estimated at 200.[5] Hunters were attracted from a distance. In 1889 and 1892, Pearl De Voe of Boscobel killed deer near Spring Green.[6] At no times have the deer been exterminated in this county.

[1] Milwaukee (d) *Democrat,* Dec. 19, 1854. [2] Baraboo *Republic,* Jan. 3, 1857. [3] Reedsburg *Free Press,* April 15, 1875. [4] Baraboo *Republic,* Nov. 29, 1876. [5] *Ibid.,* Nov. 13, 1889. [6] Boscobel *Dial,* Dec. 12, 1889; Dec. 1, 1892.

Sawyer. The early history is unknown. Deer were plentiful in 1884 and a considerable number was killed.[1] The following season they were very scarce.[2] The fall of 1886, Milo Russell killed 12 deer.[3] Many deer were killed in the fall of 1892: "Henry Belden, George Moore and Sebe Brown killed twenty-six large deer last month. They made a business of it and sent them to Milwaukee."[4]

[1] Hayward *News,* Nov. 15, Dec. 27, 1884. [2] *Ibid.,* Oct. 24, 1885. [3] Hayward *Journal-News,* Nov. 6, 1891. [4] *Ibid.,* Nov. 12, Dec. 9, 1892.

Shawano. Early accounts are wanting. Deer were abundant in the fall of 1873 and again in 1874.[1] During the next decade there were many accounts of deer killed but nothing on their abundance. In the fall of 1877, A. K. Porter killed a deer in the town of Waukechon that weighed 285 pounds dressed.[2] Sixteen deer were brought into Tigerton in one day during the first week of December, 1881.[3] They were quite numerous in the town of Angelica in 1882, and large numbers were killed along the Lake Shore Railroad.[4] Large numbers were killed in the fall of 1884, several parties returning with 20 to 30 deer.[5] In the fall of 1885 a party of three hunters returned from "the up country" with

29 deer.[6] It is to be assumed that the large kills were made in the counties to the north. A man named Lucia found a herd of seven deer in the Indian reservation in the fall of 1887 and killed three of them. At this time three deer that had been feeding in a wheatfield at the edge of Shawano were shot.[7] Deer were reported scarce in 1889.[8] They were plentiful "up north" in 1890, a party shooting 13 in two days.[9] In November, 1892, the hunting was poor in the town of Almon, but many deer were "sent down from the woods."[10]

[1] Shawano *Journal,* Nov. 8, 1873; Nov. 28, 1874. [2] *Ibid.,* Nov. 3, 1877. [3] Oshkosh *Times,* Dec. 10, 1881. [4] Shawano *Journal,* Dec. 1; *Advocate,* Nov. 9, 1882. [5] Shawano *Advocate,* Dec. 11, 1884. [6] Shawano *Journal,* Nov. 27, 1885. [7] Shawano *Advocate,* Nov. 3, 10, 1887. [8] *Ibid.,* Oct. 24, 1889. [9] *Ibid.,* Nov. 20, 1890. [10] *Ibid.,* Nov. 17, 24, 1892.

Sheboygan. Deer were reported more plentiful in the fall of 1868 than for several years.[1] There is no information that deer were at all abundant at this time. In 1870 venison was on sale in Sheboygan, to which place were brought five deer killed in the northern part of the county.[2] The killing of a deer at Elkhart Lake on November 3, 1873,[3] is followed by a long silence. In 1892, an "unusual event" was the killing of a deer in the town of Greenbush. Shortly afterwards another was wounded but not secured.[4] In 1895 the hunting of deer in the county was prohibited for five years. Nevertheless, in the fall of 1895 a large deer was killed illegally by Louis Reiss.[5] A herd of four deer was seen in the town of Greenbush in October, 1896.[6]

[1] Sheboygan *Herald:* Madison *State Journal,* Dec. 16, 1868. [2] Sheboygan *Herald,* Dec. 16, 23, 1870. [3] Plymouth *Reporter,* Nov. 6, 1873. [4] Sheboygan *Times,* Nov. 19, 26, 1892. [5] Plymouth *Review,* Dec. 4, 1895. [6] *Ibid.,* Oct. 14, 1896.

Taylor. Apparently this was a good county for deer but there is no information that they were killed in large numbers. Several were seen near Medford in November, 1875.[1] They were reported plentiful and being killed in every direction in 1877.[2] The hunting was good in 1881.[3] Venison was a drug on the market in the season of 1883. At a price of five cents a pound, there was little inducement to ship many.[4] Hunters were not very successful in 1885, deer being scarce and the woods noisy. Hunters northward on the Penokee Range were reported having good success.[5] The following season was no better.[6] In the years 1887 to 1889, hunters were very successful.[7]

Hunters were reported more numerous than deer in 1890.[8] The killing of eight deer by Adam Christman in the season of 1891 may be considered a feat.[9] Venison was plentiful the year following. On November 23 a load of 20 deer shot by four Indians was brought to Medford.[10] The poor success in the season of 1893 was attributed to lack of snow and noisy woods.[11] The Stratton brothers from Jackson County hunted near Medford in 1895 and reported deer plentiful.[12] In 1897 deer were shipped daily from Medford the first week of the season. There were 440 hunting licenses issued in the county.[13] A party of five men hunted a week to obtain seven deer in 1898.[14] In 1899 deer were reported plentiful throughout the county.[15]

[1] Medford *News,* Nov. 25, 1875. [2] *Ibid.,* Nov. 24, 1877. [3] Medford *Star* and *News,* Nov. 5, 1881. [4] *Ibid.,* Nov. 17, 24, 1883. [5] *Ibid.,* Oct. 31, 1885. [6] *Ibid.,* Nov. 13, 1886. [7] *Ibid.,* Nov. 5, 1887; Nov. 3, 1888; Nov. 9, 23, 1889. [8] *Ibid.,* Nov. 15, 1890. [9] *Ibid.,* Nov. 28, 1891. [10] *Ibid.,* Nov. 12, 26, 1892. [11] *Ibid.,* Oct. 28, 1893. [12] Black River Falls *Banner,* Nov. 21, 1895. [13] Medford *Star* and *News,* Nov. 6, 27, 1897. [14] *Ibid.,* Nov. 12, 1898. [15] *Ibid.,* Oct. 28, 1899.

Trempealeau. When Bunnell[1] came to Trempealeau in June, 1842, deer were abundant. James Reed took his rifle and was gone from the cabin only a few minutes before he returned with a deer. Reed remarked that, "the bluffs are full of deer; though they hide at this season of the year." Fire-hunting was much in vogue. Four deer spent a forenoon in the outskirts of Arcadia in December, 1877.[2] A few remained in the county in the 1890's.

[1] Bunnell, L. H. *Winona and its environs.* Winona, (1897) 185, 195, 330. [2] Arcadia *Republican:* Merrillan *Leader,* Dec. 29, 1877.

Vernon. Information on deer in this county is meager, but there is reason to believe that the early population was as high as in the other counties bordering the Mississippi. In November, 1873, they were reported more numerous than at any time since the "winter of the deep snow."[1] One deer was reported killed in the vicinity of Viroqua in December, 1875.[2]

[1] Viroqua *Censor:* Madison *State Journal,* Nov. 11, 1873. [2] Viroqua *Censor,* Dec. 15, 1875.

Vilas. In the early days deer were not common. Only a few appear to have been killed in 1893.[1] Deputy Game Warden Mackie thought that the bounty on the wolf and lynx should be increased as they were making a great slaughter of the deer.[2] This was one of the recurring obsessions. Deer were plentiful in 1895. There was protest against non-state hunters and a stringent license law was suggested. Ninety-three deer were shipped out of Eagle River in one day, and it was stated that nearly as many were shipped from Conover, State Line, Star Lake, Woodruff, and Minocqua. Shipment of 700 to 1000 deer was believed to be a fair estimate for the season, and exceeding probably the number left alive.[3] Hough,[4] having noticed much sign of deer, was informed by Joe Blair that there were few better localities for deer than that around Big St. Germaine Lake.

The scarcity of deer in the fall of 1896 was attributed to the "army" of Indiana and Illinois hunters in the area the previous year.[5] Deer were reported plentiful in 1899.[6] During the season of 1900, three men killed five deer in four days at Black Oak Lake.[7] It was stated that 750 deer licenses were issued in the county in 1901.[8] Cory[9] was informed that 300 deer were shipped from Eagle River in November, 1906.

[1] Eagle River *Democrat,* Oct. 7, 21, 1893. [2] *Ibid.,* Oct. 14, 1893. [3] *Ibid.,* Oct. 21, Nov. 4, 18, 25, 1895. [4] Hough, E. *Forest and Stream,* 45 (Dec. 28, 1895) 558. [5] Eagle River *News,* Oct. 26, 1896. [6] *Ibid.,* Oct. 23, 1899. [7] Minocqua *Times,* Nov. 22, 1900. [8] Eagle River *News,* Dec. 2, 1901. [9] Cory, C. B. *The mammals of Illinois and Wisconsin.* Chicago, (1912) 64.

Walworth. This county abounded in deer in 1838. "Herds of from ten to twenty were frequently seen."[1] According to Hollister,[2] the last deer was killed near Delavan in 1846, and the last seen in 1852.

[1] Baker, Charles M. *Pioneer history of Walworth County. Wis. Hist. Colls.,* 6 (1872) 466. [2] Hollister, N. *The last records of deer in Walworth County, Wisconsin. Bull. Wis. Nat. Hist. Soc.,* 6 (1908) 143–44.

Washburn. The early history of deer in this county is a blank. Deer were plentiful in the fall of 1891. One hunting camp contained 11 deer, some of which were believed to have been killed illegally. One hunter reported having killed 20 deer in nine days of hunting at Shell Lake. Hunters at Spooner had only fair success.[1] The number killed in the fall of 1892 was small due to the "slaughter" the year previous.[2] A hunter at Minong killed 10 deer in the fall of 1894.[3] The following year it was stated that deer were becoming scarcer yearly.[4] The 1897 season was poor. Many of the "foreign" hunters at Minong neither shot nor saw a deer.[5] Only a few deer were killed in 1898. They were quite plentiful at White Birch but the brush was too thick for successful hunting. After the game wardens had confiscated two loads of venison, 18 saddles were stolen.[6] A large amount of venison was shipped from Spooner.[7] Scarcity of deer was the comment for 1899. It was said that it no longer paid to hunt them at Mills.[8]

[1] Shell Lake *Watchman,* Nov. 12, 19, 26, Dec. 3, 1891. [2] *Ibid.,* Nov. 17, 1892. [3] *Ibid.,* Nov. 8, 1894. [4] *Ibid.,* Nov. 28, 1895. [5] *Ibid.,* Nov. 27, 1897. [6] *Ibid.,* Nov. 17, 24, Dec. 8, 1898. [7] *Ibid.,* Nov. 12, 1898. [8] *Ibid.,* Nov. 23, 1899.

Washington. Information on deer in this county is almost a blank. Elizabeth Maxon was married in 1846 and settled on Cedar Creek with her husband. During the first years they were bountifully supplied by the Indians with "venison, fish, wild turkey . . . ."[1] According to the accounts of the early settlers, game, including deer, was incredibly abundant.[2]

[1] West Bend *News,* March 6, 1907. [2] Quickert, Carl. *The story of Washington County.* West Bend, (1923) 23.

Waukesha. John Olin[1] arrived in Waukesha in May, 1836. Near the White Rock Spring at Pewaukee, he saw "as many as eighty deer in a drove." The winter of 1841–42, when Unonius[2] settled at Pine Lake, the deer appeared in the timber in large numbers. On one occasion an Indian drove four deer to the smooth ice of the lake and hamstrung them with a tomahawk. When the snow became deep, Unonius went on a hunt with the Indians who with snowshoes ran down the deer. An English settler who came to Mukwonago the fall of 1843 wrote that deer were sometimes seen but he had seen only one.[3] They were reported scarce in the county in 1857.[4]

[1] Olin, C. C. *The complete record of the John Olin family.* Indianapolis, (1893) p. iv. [2] Unonius, G. *New Upsala. Wis. Mag. Hist.,* 19 (1936) 295, 308, 309. [3] Milwaukee *Courier,* June 26, 1844, 2. [4] Madison *State Journal,* Dec. 24, 1857.

Waupaca. Large numbers of deer were killed near New London in the fall of 1856.[1] The crust on the snow in February, 1857, permitted the Indians to slaughter them with clubs and hatchets.[2] Deer were scarce in the fall of this year.[3] In 1866 they were reported plentiful throughout the county.[4] A wholesale slaughter of deer was reported for the neighborhood of Ogdensburg the winter of 1868–69 when they collected in droves on account of the deep, crusted snow.[5] In October, 1876, a hunting party returned with seven deer.[6]

Deer were not killed in large numbers after 1875. The end of October, 1877, five deer were shipped to Milwaukee from Weyauwega, but not all of the hunters from this place were successful.[7] A party of five hunters from Weyauwega, hunting "north of here," in two weeks killed only seven deer.[8] On November 4, 1879, four deer were shot at Rural.[9] The killing of six deer on the headwaters of the Little Wolf River by one hunter in two days was considered exceptional success.[10] In November, 1880, a load of eight deer passed through Ogdensburg.[11] A party of four hunters from Weyauwega, away for twelve days, killed only one deer.[12] During the season of 1881 local hunters killed seven deer in the northern part of the county.[13] The locality where two men shot 12 deer in the fall of 1883 is not given.[14] Seven deer were killed by four hunters on the headwaters of the Little Wolf in October, 1885.[15] In October, 1887, five hunters shot seven deer in town Twenty-Five.[16] Three deer were killed by two men on their hunting expedition in October, 1890.[17]

[1] New London *Times,* Nov. 14, 1856. [2] *Ibid.,* Feb. 27, 1857. [3] Weyauwega *Weyauwegan,* Nov. 15, 1857. [4] Waupaca *Criterion:* Madison *State Journal,* Dec. 11, 1866. [5] Waupaca *Criterion:* Madison *State Journal,* March 11, 1869. [6] Weyauwega *Times,* Oct. 28, 1876. [7] Weyauwega *Chronicle,* Oct. 27; *Times,* Nov. 24, 1877. [8] Weyauwega *Chronicle,* Dec. 1, 1877. [9] Waupaca *Post,* Nov. 8, 1879. [10] *Ibid.,* Dec. 6, 1879. [11] *Ibid.,* Nov. 4, 1880. [12] Weyauwega *Chronicle,* Nov. 27, 1880. [13] *Ibid.,* Dec. 10, 1881. [14] *Ibid.,* Nov. 17, 1883. [15] Waupaca *Post,* Oct. 29, 1885. [16] *Ibid.,* Oct. 20, 1887. [17] Weyauwega *Chronicle,* Oct. 29, 1890.

Waushara. Deer were so common in the fall of 1865 that nearly everyone spoke of seeing or shooting one.[1] The deer population seems, however, to have been of a modest number. Deer were brought in almost daily in December, 1867.[2] On November 20, 1869, four deer were shot within as many miles of Wautoma.[3] A few were killed in 1871. Lorenzo Rawson, of Hancock, passed through Wautoma with a "load" of deer for the eastern market.[4] A few deer were shot annually in succeeding years. In 1877, deer were reported quite plentiful in the hills north and west of Wautoma, and some were killed.[5] A hunter from Montello shot two deer at Coloma in November, 1880.[6] Though many hunters were in the field the end of November, 1882, only one deer was reported shot. Subsequently two were killed in the town of Richford.[7]

[1] Wautoma *Argus,* Oct. 27, 1865. [2] *Ibid.,* Nov. 28, Dec. 12, 1867. [3] *Ibid.,* Nov. 25, 1869. [4] *Ibid.,* Nov. 16, 23, Dec. 28, 1871. [5] *Ibid.,* Nov. 2, 16, 1877. [6] Montello *Express,* Nov. 27, 1880. [7] Wautoma *Argus,* Dec. 1, 15, 1882.

Winnebago. In June, 1856, Walter James went "night-hunting" in his canoe on a small lake near Muckwa and found deer plentiful.[1] They were abundant in 1868 and large numbers were brought into Oshkosh.[2] In 1873 only a small number of deer appeared in the Oshkosh market where they sold at 6 cents per pound by the carcass. The 81 deer killed and shipped to New York were certainly not shot in the county.[3] Venison was a drug on the market at Oshkosh in 1875 due to the warm weather and: "The crop of old bucks must have been immense this year, as we have noticed about four bucks to one doe make their appearance in this market."[4] Venison was plentiful and cheap in 1878.[5] Large numbers of deer were killed in the vicinity of Norrie in 1881.[6] Considerable venison appeared in the Oshkosh market in 1882 and sold at 12½ cents per pound.[7]

[1] Harney, R. J. *History of Winnebago County.* Oshkosh, (1880) 112. [2] Oshkosh *Journal,* Nov. 21; *Times,* Nov. 24; *Northwestern:* Madison *State Journal,* Nov. 28, 1868. [3] Oshkosh *Times,* Nov. 5, Dec. 31; Neenah *Gazette:* Madison *State Journal,* Jan. 5, 1874. [4] Oshkosh *Times,* Dec. 11, 1875. [5] *Ibid.,* Nov. 16, 1878. [6] *Ibid.,* Nov. 26, 1881. [7] *Ibid.,* Nov. 25, 1882.

Wood. Deer were plentiful in the fall of 1873. A load of 14 was brought into Grand (Wisconsin) Rapids.[1] About 20 deer were killed in the neighborhood of Centralia within a period of two weeks in 1875.[2] In October, 1887, seven deer were shot by the Searles brothers in two days.[3] Following a snowfall at this time, 32 deer were killed within a radius of four miles of Grand Rapids.[4] Deer were killed yearly. As late as 1895, venison sold for 8 cents per pound in Marshfield. The fall of this year two deer were brought into Marshfield before 9:00 o'clock on the morning that the season opened, the claim being made that they were tame deer. That fall the Dupee brothers, living near Pittsville, killed nine deer and four bears. The last deer killed, a buck, weighed 315 pounds.[5] In 1896, 22 deer were killed in the vicinity of Grand Rapids the last two weeks of October.[6] Deer were plentiful in 1897. About 600 licenses were sold.[7] Hunters had a successful season in 1898 also.[8]

[1] Grand Rapids *Reporter*, Dec. 18, 1873. [2] *Ibid.*, Dec. 2, 1875. [3] *Ibid.*, Oct. 27, 1887. [4] Wausau *Central Wisconsin*, Oct. 29; Milwaukee *Journal*, Nov. 7, 1887. [5] Marshfield *Times*, Nov. 8, 29, 1895. [6] Grand Rapids *Reporter*, Oct. 29, 1896. [7] Marshfield *Times*, Nov. 5, 19, 26, 1897. [8] *Ibid.*, Nov. 4, 18, 1898.

REFERENCES

1. RADISSON, PIERRE. Fourth voyage. *Wis. Hist. Colls.*, 11 (1888) 82.
2. ALLOUEZ, CLAUDE J. Relation of 1669–70. Jesuit Relations, 54 (1899) 219.
3. MARQUETTE, JACQUES. First voyage, 1673. Jesuit Relations, 59 (1900) 107.
4. KELLOGG, LOUISE P. Early narratives of the Northwest. N. Y., (1917) 263–64.
5. HUBBARD, BELA. Memorials of a half-century. N. Y., (1887) 356.
6. SHIRAS, GEORGE. The wild life of Lake Superior, past and present. Nat. Geog. Mag., 40 (Aug., 1921) 130–34.
7. HENRY, ALEXANDER. Travels, 1760–1776. Chicago, (1921) 188, 190.
8. FOSTER, J. W. and WHITNEY, J. D. Report on the geology and topography of a portion of the Lake Superior Land District. Part I (1850) 29, 158, 161.
9. ALLEN, LT. J. Journal of an expedition into the Indian country . . . in 1832. Doc. 323, House of Rep. 23rd Congress. Washington, (1834) 12, 15, 17.
10. MCKENNEY, THOMAS L. Sketches of a tour of the Lakes. Baltimore, (1827) 255.
11. PITEZEL, J. H. Lights and shades of missionary life. Cincinnati, (1860) 69.
12. KOHL, J. G. Kitchi-Gami. Wanderings round Lake Superior. London, (1860) 134.
13. Marquette (Mich.) *Mining Journal:* Janesville (Wis.) (d) *Gazette*, Feb. 4, 1862.
14. CARTWRIGHT, DAVID W. Natural history of western wild animals. Toledo, (1875) 239–41, 273, 274, 280.
15. Oshkosh (Wis.) *Times*, Jan. 14, 1874.
16. WOODCOCK, E. N. Fifty years a hunter and trapper. Columbus, [c. 1913] 131.
17. ANDREWS, I. D. Report on trade and commerce of British . . . Colonies and of Great Lakes. Senate Doc. 112, 32d Congress. Washington, (1853) 234.
18. DOTY, JAMES D. Northern Wisconsin in 1820. *Wis. Hist. Colls.*, 7 (1876) 201; *cf.* C. C. Trowbridge, Minn. Hist., 23 (1942) 329.
19. ELY, REV. EDMUND F. Journals, 1833–54. Typed copy, Wis. Hist. Soc.
20. PEYTON, JOHN L. Over the Alleghanies and across the prairies. 2nd ed., London, (1870) 221.
21. SCHOOLCRAFT, HENRY R. Narrative of an expedition through the Upper Mississippi to Itasca Lake . . . in 1832. N. Y., (1834) 138.

22. MALHIOT, FRANCOIS V. Journal, 1804–05. *Wis. Hist. Colls.*, 19 (1910) 225.
23. CRAM, CAPT. T. J. Report on the survey of the boundary between the State of Michigan and the Territory of Wiskonsin. Senate Doc. 151, 26th Congress, 2nd Session. Washington, (1841) 10, 12, 14, 15.
24. CUROT, MICHEL. Journal, 1803–04. *Wis. Hist. Colls.*, 20 (1911) 448.
25. SCHOOLCRAFT, H. R. Personal memoirs. Philadelphia, (1851) 370.
26. BRUNSON, REV. ALFRED. Lancaster *Herald*, July 15, 1843.
27. SCHOOLCRAFT, H. R. Summary narrative of an exploratory expedition to the sources of the Mississippi River in 1820: Resumed . . . in 1832. Philadelphia, (1855), 543.
28. DE LIGNERY, CONSTANT M. *Wis. Hist. Colls.*, 5 (1868) 89.
29. LONG, JOHN. Voyages and travels in the years 1768–1788. Chicago, (1922) 186.
30. LAHONTAN, BARON DE. New voyages to North America. Chicago, 1 (1905) 174–75.
31. MARRYAT, F. Diary in America. Philadelphia, 1 (1839) 186.
32. FONDA, JOHN H. *Wis. Hist. Colls.*, 5 (1868) 229, 231.
33. LE CLAIRE, ANTOINE. *Wis. Hist. Colls.*, 11 (1888) 240.
34. KEATING, W. H. Narrative of an expedition to the source of St. Peter's River . . . 1823. Philadelphia, 1 (1824) 193, 233.
35. Prairie du Chien *Patriot*, Dec. 6, 1848.
36. MCLEOD, D. History of Wiskonsan. Buffalo, (1846) 143.
37. HOFFMAN, C. F. A winter in the far west. London, 2 (1835) 39.
38. [SMITH, W. R.]. Observations on the Wisconsin Territory. Philadelphia, (1838) 23.
39. GRIGNON, AUGUSTIN. *Wis. Hist. Colls.*, 3 (1857) 255, 267.
40. LE SUEUR, PIERRE. In Pierre Margry, Découvertes et établissements des francais (1614–1754). Paris, 6 (1886) 74.
41. GUIGNAS, FATHER MICHEL. In Margry, 6 (1886) 557.
42. COPWAY, GEORGE. The traditional history of the Ojibway nation. London, (1850) 26–28.
43. LOCKWOOD, JAMES H. *Wis. Hist. Colls.*, 2 (1856) 159.
44. Neenah (d) *News*, April 11, 1922.
45. MORGAN, LEWIS H. League of the . . . Iroquois. Rochester, (1851) 345.
46. Phillips *Badger*, Sept. 5, 1883.
47. Marinette *Star*, Sept. 14, 1883, 8.
48. Beloit *Free Press*, Jan. 24, 1878.
49. MUIR, JOHN. The story of my boyhood and youth. Boston, (1913) 169–74.
50. "Pioneer". Menomonie *News*, March 1, 1884, 5.
51. Hudson *Star:* Madison *State Journal*, Sept. 5, 1865.
52. "Atticus". Racine *Advocate*, Jan. 23, 1844.
53. BAIRD, ELIZABETH. *Wis. Hist. Colls.*, 15 (1900) 205.
54. PARK, W. J. Madison, Dane County and surrounding towns. Madison, (1877) 354.
55. Oconto *Reporter*, Nov. 28, 1874.
56. Medford *Star* and *News*, Oct. 31, 1885.
57. *Ibid.*, Nov. 19, 1892.
58. DART, RICHARD. *Proc. Wis. Hist. Soc. for 1909.* (1910) 260, 268.
59. B., C. M. *American Field*, 16 (Oct. 22, 1881) 265.
60. Phillips *Badger*, July 6, 1881; Nov. 7, 1885.
61. Glidden *Pioneer*, Oct. 22, Nov. 12, 1885.
62. Hayward *News*, Oct. 24, 1885.

63. "Julian". *Forest and Stream,* 45 (Dec. 21, 1895) 535.
64. Black River Falls *Banner,* Dec. 20, 1873.
65. HOUGH, E. *Forest and Stream,* 45 (Dec. 28, 1895) 558.
66. BARTLETT, W. W. History, tradition and adventure in the Chippewa Valley. Chippewa Falls, [1929] 207.
67. Milwaukee (d) *Democrat,* Dec. 30, 1850.
68. Milwaukee (d) *Advertiser,* Dec. 5, 1874.
69. Eau Claire *Free Press:* Milwaukee (d) *Wisconsin,* Jan. 20, 1866.
70. Colby *Phonograph,* Jan. 7, 1880.
71. Marinette and Peshtigo *Eagle,* Jan. 6, 1883.
72. Sansquartier *Inventory,* June 10, 1709; photostat from Quebec.
73. M'KENNEY, T. L. *Wis. Hist. Colls.,* 20 (1911) 187.
74. Green Bay and Prairie du Chien Papers. *Wis. Hist. Soc.*
75. American Fur Co. Papers; *New-York Hist. Soc.*
76. Sparta *Democrat,* Jan. 14, 1882.
77. Grantsburg *Sentinel,* Aug. 3, 1883.
78. SCHOONMAKER, W. J. *Jour. Mam.* 17 (1936) 67–68.
79. SCOTT, W. E. *Wis. Cons. Bull.* 3 (11), (Nov., 1938) 3–4.
80. Lancaster *Herald:* Milwaukee (w) *Wisconsin,* Nov. 5, 1851.
81. Neillsville *Republican:* Madison *State Journal,* Dec. 12, 1867.
82. La Crosse *Republican:* Madison *State Journal,* Dec. 27, 1867.
83. Hudson *Star* and *Times,* Oct. 25, 1878.
84. Sturgeon Bay *Advocate,* Nov. 27, 1884.
85. Grantsburg *Sentinel,* Oct. 31, 1890.
86. Florence *Mining News,* Dec. 13, 1890.
87. Marinette *North Star:* Florence *Mining News,* Oct. 21, 1893.
88. Sturgeon Bay *Democrat,* Nov. 29, 1902.
89. ANDERSON, T. G. *Wis. Hist. Colls.,* 9 (1882) 159.
90. Durand *News,* March 15, 1905.
91. Lancaster *Herald:* Madison *Argus* and *Democrat,* Feb. 6, 1857.
92. Richland Center *Observer,* Nov. 3, 1857.
93. Prairie du Chien *Courier:* Madison *State Journal,* Jan. 6, 1857.
94. BROWN, HARVEY. *Wis. Cons. Bull.,* 8 (5), (May, 1943) 19.
95. New London *Times,* Feb. 27, 1857.
96. Appleton *Crescent,* Feb. 21, 1857.
97. Sturgeon Bay *Advocate,* Feb. 25, March 25, 1869.
98. Green Bay *Advocate,* Oct. 28, 1869.
99. Madison *State Journal,* April 13, 1888.
100. Florence *Mining News,* May 5, 1888, p. 5.
101. Green Bay *Advocate,* Jan. 4, 1872.
102. Marinette and Peshtigo *Eagle,* July 20, 1872.
103. Baraboo *Republic,* Sept. 5, 1894, 2.
104. THOMPSON, D. Q. Travel, range and food habits of timber wolves in Wisconsin. *Jour. Mam.,* 33 (1952) 429–42.
105. JACKSON, H. H. T. *Bull. Wis. Nat. Hist. Soc.,* 6 (1908) 14.
106. CORY, C. B. The mammals of Illinois and Wisconsin. Chicago, (1912) 65.

MEMORY AND DESIRE AND TENNESSEE WILLIAMS' PLAYS

JOHN JACOB ENCK

Against not particularly keen competition, Tennessee Williams incites and sustains more comment in the United States than any other writer largely unknown a decade ago. Interim reports must always qualify their generalizations, but a few notes may point up what his achievements are and, incidentally, why others accomplish less. Williams' fame derives from his plays. The first acclaimed success, *The Glass Menagerie,* appeared on Broadway in 1945; earlier ones had folded in Boston or gone begging for attention when produced by little theatre groups. Since then three more, *A Streetcar Named Desire, Summer and Smoke,* and *The Rose Tattoo,* have boosted his reputation. London, Paris, Vienna, and other European capitals have seen *A Streetcar Named Desire.* When intimate reviews parody the contemporary stage, they turn to Williams as automatically as they once did to O'Neill, e.g. *Touch and Go* (1950) in New York and London and *The Globe Review* (1952) in London. Although he has published in a variety of genres: poetry, short stories, one-act plays, and a novel, the professional theatre remains the area where his talents flourish. Flourish may exaggerate the condition.

That the four hits resemble each other strikingly has been observed. Their extensive similarities have eluded precise definition. Williams, a peculiarly honest writer, himself supplies the key. In prefaces and postscripts tacked on to editions he explains the circumstances under which he composed and his reactions to the results. A discussion of the road fiasco, *Battle of Angels,* includes a childhood scene when he accompanied his grandfather, a clergyman, on visits:

> I remember a lady named Laura Young. She was dressed in checkered silk. She had a high, clear voice: a cataract of water. Something about her made me think of cherries and she was very beautiful. She was something cool and green in a sulphurous landscape. But there was a shadow upon her. There was something the matter with her. For that reason we called upon her more frequently than anyone else. She loved me. I adored her. She lived in a white house near an orchard and in an arch between two rooms were hung

> some pendants of glass that were a thousand colors. "This is a prism," she said. She lifted me and told me to shake them. When I did they made a delicate music.
>
> This prism became a play.[1]

Crucial events, experienced or dreamed, frequently fuse primal images so neatly that no detail is accidental and all is charged with meaning. To consider the four plays as emanations from the matrix of this passage illustrates their affinities.

All the leading characters are women who are not well and who, withdrawn from society, seek variegated illusions of happiness. The cripple Laura in *The Glass Menagerie* collects glass figurines over the protests of her mother, Amanda, who in the St. Louis slum nourishes herself on phantasies from romantic southern flirtations. Laura's animals, of which she prefers a unicorn distinguished by its prismatic single horn, receive all her affections. Once a "gentleman caller" is lured to the house, but he already is engaged. Amanda and Laura are left with the transparent zoo. *A Streetcar Named Desire* opens when Blanche DuBois arrives for a vacation with her sister, Stella, in the New Orleans Vieux Carré. Blanche has been a high school teacher, of English inevitably, who, after her young husband killed himself, finds satisfaction only by giving herself to, presumably, any man passing by. She also seeks a delicate beauty: "I bought this adorable little colored paper lantern at a Chinese shop on Bourbon. Put it over the light bulb. . . . I can't stand a naked light bulb, any more than I can a rude remark or a vulgar action."[2] Her sister's aggressively vulgar husband rudely forces himself on her. The violence precipitates a breakdown, and she is led away to an asylum. *Summer and Smoke* opposes Alma, a minister's daughter identified with the purity of the soul, and John, a doctor's son whose nature is projected by an anatomy chart of the human body in his father's office. A heavily ironic twist exchanges their views. He marries a younger girl while Alma, embarking on the route whose terminus Blanche reaches, strikes up an acquaintance with a travelling salesman. All the action occurs near the statue of an angel named Eternity. If ponderously gauche to regard so trivial an event sub specie aeternitatis, it is moderately indicative to remember, "Life, like a dome of many-coloured glass,/Stains the white radiance of Eternity." *The Rose Tattoo* promised innovations, but it merely turns the others upside down or, to keep the prism metaphor, concentrates on the red band of the spectrum, to which its symbols refer. The death of Serafina's husband, a truck driver, ends an ecstatic marriage. She retires in mourning and attempts to sequester her daughter:

the familiar configuration. When Serafina meets another truck driver who has another tattooed rose, she accepts life again for herself and allows her daughter, Rosa, to marry a sailor.

All these women, then, are exiles in the world which they inhabit, but their heritages drape them, like a Byronic hero, with a superiority to their milieu: the landed southern families of Amanda and Blanche, Alma's father who was a Rhodes scholar, a trifling anachronism for she was born at least five years before the scholarships were endowed, and Serafina's husband, a Sicilian baron, a dubious pedigree which, nevertheless, bases her pride in the actual. Their names as well, with the emphases upon the soft *a* sound, imply distinction. Just as the prism held by Laura tinkled, so mood music, a blue piano or the "Varsouviana," off stage moans their isolation.

The décor of the plays differs, but a formal resemblance links the four. Parts of the settings may be blacked out, but the initial scene never changes. In both *The Glass Menagerie* and *A Streetcar Named Desire* action drifts inside from an alley on the right, and scrims further expose the surrounding neighborhood. *Summer and Smoke,* the most contrived, reveals the minister's parlor on the right and the doctor's office on the left. Between these two is a park with the statue of the angel. *The Rose Tattoo* shows the porch, front rooms, and the yard of Serafina's home; at the rear is an embankment on which the highway runs. Such devices do not root the women in any context, but, on the contrary, make more graphic their separation. For realistic plays one conventionally assumes one sees a space somewhat related to the world as one knows it; here, by bringing a piece of that world onto the stage and by stressing its remoteness, the space behind the proscenium arch loses intensity. The Hollywood versions of both *The Glass Menagerie* and *A Streetcar Named Desire* are revealing contrasts with the theatre. When in the film the trolley becomes literal as well as figurative, it is crude and clumsy. (The pun translates more neatly into German, where the actual title is *Endstation Sehnsucht,* but the Viennese refer to it as *Der Triebwagen.*) Outside the houses the camera moves awkwardly. These women have no friends; they go to only public places. Laura Young also stood alone and green in a sultry landscape.

Each of the settings has at least two rooms, dramatically a sound practice; action so constrained demands the possibility of movement back and forth for the fluidity to prevent the passions' becoming uncomfortably claustrophobic. If this effect undercuts, it also dissipates the forcefulness of the conflicts when compared with the writhings of alienation which Ibsen can unleash in confined quarters. It is perhaps not necessary to mention that the prisms hung in an arch between rooms of the remembered house.

Granted, then, a rigidity so repetitious, what merits have these plays which enjoy profitable runs, have foreign productions, win prizes, and become seemingly permanent contributions to the theatre? Primarily, in a period of sloppy dramaturgy which settles for momentary impacts, William is a careful craftsman. Quite apart from subject, his talent can immediately initiate the muted struggle of tranquility recalled in emotion and accelerate the pace steadily. Constant application must have taught him this skill; one has only to compare the disjointed *Battle of Angels* with any of the four later works to be convinced of the increasing technical virtuosity he commands. He keeps revising, not just during the pre-Broadway tours, as expected, but after the New York openings as well. Indeed, the texts of *The Glass Menagerie* and *A Streetcar Named Desire* have been printed in several versions.[3] In the basic, but theatrically essential, quality of narrative rhythm they possess a certain merit always at a premium on Broadway, and anywhere, for the stage needs an economical construction, however nebulous thought and language may be. Williams has also been uniformly fortunate in his producers, directors, casts, and translators. Both in the United States and abroad the performances have enhanced his scripts. Competent technique, anything this side of prestidigitation, cannot satisfy, especially where a lack of wit argues that the author is trying to communicate what, for want of a more precise word, may be termed ideas. Three fundamental explorations lend Williams' plays substance.

The Glass Menagerie is classified as a memory play, and, although not so designated, the rest are cloaked in a similar atmosphere, the name of the DuBois plantation being, for example, Belle Reve. Memory, perhaps more accurately reverie, implies for Williams that small events, of no intrinsic importance, are resurrected and treasured because through their theatrical magic they illuminate basic experiences.[4] In the introduction to *The Glass Menagerie* he says that originally a number of non-realistic motifs scored the tones of reminiscence,[5] but a scattered few of these were retained, notably a narrator, Amanda's son, who introduces, then joins, the action. Touches of the cut whimsey now and then intrude: the father's flickering picture, Laura's final pantomime, the scrims, and the music. In the main their full impact cannot be divorced from that of realistic drama. Through this manner he claims a double effect. He can drag out his eclectic devices from old experiments in expressionism and constructionism, which destroy the stage as a representation of life, but he does not have to beg the predisposed tolerance which imaginative drama frequently asks. Twentieth-century literature at its most impressive always impinges upon reverie, to range through genres and languages at random: Proust searches the devious disappearances of lost time; Pirandello exploits discrepancies between the interpretations of the present and the ambiguity of the past; Joyce concentrates all history as a night's dream in Dublin; and Faulkner's ante-bellum ghosts spin the southern fabric of an imaginary Yoknapatawpha county. For these writers the paths of the past do not twist a maze in a vacuum, but their symbolic resemblances culminate in the central design. Williams, perhaps unintentionally, though by his compromises inescapably, sentences his dreamers to live on a dead end street. The narrator dismisses *The Glass Menagerie* audience, a line deleted from some texts, with, "And there my memory ends and your imagination begins."[6] Anyone not already pursuing his after theatre plans might well wonder what fare the imagination has been provided and, such are the standards of entertainment, conclude gratefully, none at all.

If the nimbus enveloping the plays is memory, the force driving the characters through them is desire for love or sex. This subject also has been widely exploited by twentieth-century writers, but seldom with such dogged, yet polite, insistence as Williams. Much descends from D. H. Lawrence, one of whose stories he dramatized and who is the hero of the short play, *I Rise in Flame, Cried the Phoenix.*[7] The sole standard guiding these women is not the wish to be loved but the desire to know a man, or indeed object, who wants their love. Within the cocoon of memory this bent, which might become engrossing, disturbing, terrifying, or ludicrous, looks instead almost pretty. The characters themselves are too special, and, were they not, in their lives they are already buried. They are not made credible in themselves, a minor blemish, and, more damaging, they exist on no formulated level. Their desire thrashes around in a second solitary cell: no moral judgment can be made of it, for it is inevitable, if at times a little silly. Overtones of the Lawrence credo resound fitfully, but none of Lawrence's puritanical moral bias injects strength or coherence into the rationale. The waifs float by as pitiful specimens of what women can suffer.

The third distinctive attribute rests on the diction, which has been called poetic. If audiences were enchanted by *The Cocktail*

Party because, since they knew a major poet wrote it, its language sounded like prose, then Williams' vocabulary is decked out in affectations vague enough to be popularly associated with "poetry," while it traffics strictly with a prosaic idiom. The heroines, granted their pretensions and propensities, can without strain on probability indulge themselves in a fancy rhetoric which further sets them off from their surroundings. To stress the authenticity of language, in every play cumbersome exposition pointedly catalogues the formal education each major character has had, and school stories keep intruding with a frequency rarely encountered outside class reunions. The men, generally less trained, sullenly speak a cadenced slang which passes at present for sensitive realism. Williams has elsewhere experimented to shape folk argot as poetry; a group of lyrics set to music by Paul Bowles succeeds moderately. So far he has failed to sustain a single authentic style, the sort which distinguishes the poetic dramas of Eliot or Christopher Fry.

These observations are not to imply that Williams ought to obey standards continuing the dreary realistic stage. The objections are that he bases his chief assumptions on its familiar picture-frame and that other efforts are injected for decoration or relief, not for the main substance. One wishes to be sympathetic with him because, after a generation of great literary innovators, to consolidate and refine is a tedious task. Also, he sporadically strives to attain what any future drama nearly demands: new techniques for exploiting the stage, less rigorous concepts of character, and a language to draw upon all modern resources. His repetitious theme might in itself serve a purpose, if he could relate it to a centrally controlled mythos. Unfortunately, the genuinely creative elements crop up erratically; so far they have not fused organically. They remain glancing touches, like blobs of color from a gyrating spectrum which no informing line controls or defines.

The problems confronting Williams are identical with those every intelligent young author in the United States must wrestle against. For a variety of sociological factors, the writer's position has grown more marginal. The present climate of opinion, which condones when it does not encourage a rampant limiting of expression, denies the romantic ideal of freedom still dominant in creative literature. Any appeal, therefore, to mass standards is rendered hypocritical. During the period of comparative naiveté shortly after World War II Williams linked urban bohemian groups with any quest for independence,[8] but the plea made tangential associations which are now quite unsupportable. On the other hand, if resolute negation is not to claim all, the writer must address himself to some faith. Today that belief assumes the guise of love: the memory of having been loved and the desire to love someone. The drive to relive or experience the emotion becomes so dominant that its direction toward any object and its outlet in any physical expression are celebrated. This subject and its treatment project the writer's divided loyalties. A materialistic society counts love as a means to another end or as one possession among many. In the writer's world, where nothing is stable, it can easily, and logically, head all values. In proclaiming its worth the manifestations have become so special that the more conservative critics berate new writers for ignoring love, but, nevertheless, its rites pushed even to perversions link talents otherwise as distinctive as Carson McCullers, Flannery O'Connor, Frederick Buechner, Truman Capote, Paul Griffith, William Goyen, John Hawkes, Wright Morris, and Williams. The potential achievements of this credo lie beyond profitable speculation. It may be observed that almost all interesting titles invoke a sentimentalism which five years ago would have been dismissed as Saroyanesque.

Williams, then, faces a triple hazard: his own tendency to vary one theme, the practical demands of a commercial theatre, and the time in which he is writing. Because he is an industrious craftsman, he may be able to extricate himself. To his credit he anticipated the turn post war literature has taken and skirted its greater excesses. An indicative sign of his own awareness is the conclusion of *The Rose Tattoo*, where the red shirt Serafina has sewn for the truck driver is snatched by a group of women. A stage direction depicts:

> *Peppina flourishes the shirt in the air like a banner and tosses it to Giuseppina, who is now on the embankment. Giuseppina tosses it on to Mariella, and she in her turn to Violetta, who is above her, so that the brilliantly colored shirt moves in a zig-zag course through the pampas grass to the very top of the embankment, like a streak of flame shooting up a dry hill.*[9]

Serafina, alone of these women, escapes from her house of memory into the outside, the symbolic highway, where desire can be fulfilled. The metaphor of the flame is important. A prism refracts the sun's rays, but a burning glass concentrates them. If Williams can bend his talents into the lens which will focus his not inconsiderable perceptions, then from the same materials a new drama may emerge which will, in spite of being

> composed like them
> Of Eros and of dust,
> Beleaguered by the same
> Negation and despair,
> Show an affirming flame.

NOTES

1. TENNESSEE WILLIAMS, *Battle of Angels, Pharos* I & II (1945), p. 112. Acknowledgment is gratefully made to Liebling–Wood, the agents of Tennessee Williams, for their kind permission to quote from his works.
2. TENNESSEE WILLIAMS, *A Streetcar Named Desire* (New Directions, New York, 1947), p. 62.
3. An attempt at a full bibliographical compilation here would be pompously disproportionate. Williams' future editors, if there are any, will not lack variants. According to Barrett H. Clark and William H. Davenport, edd., *Nine Modern American Plays* (Appleton–Century–Crofts, Inc., New York, 1951), p. 341, three copyrights are held by Williams on *The Glass Menagerie,* two in 1945 and one in 1948. One 1945 draft remains in manuscript, presumably. The other 1945 version appears under the imprint Random House, New York, 1945, and republished later by New Directions, New York, 1949, in the New Classics Series, but with added prefatory matter. The 1948 copy has been widely anthologized, such as the Clark and Davenport volume. Their text cuts some directions included in the otherwise similar version given by Harlan Hatcher, ed., *Modern American Dramas* (Harcourt, Brace & Co., New York, 1949). On the other hand, Paul M. Cubeta, ed., *Modern Drama for Analysis* (William Sloane Associates, Inc., New York, 1950) prints the 1945 text. *A Streetcar Named Desire* has been published not only by New Directions but also by the New American Library, New York, 1951, as a Signet Book. Although the blurb on the paper binding of the latter claims it is "complete and unabridged," considerable cuts have abbreviated the script, and a preface has been added. One is not reassured about future works by a note in *The Rose Tattoo* (New Directions, New York, 1951), [p. iv]: *"The Author and Publisher express their thanks to Mr. Paul Bigelow for valuable assistance in organizing the script of the play for book publication."*
4. "The Timeless World of a Play," in *The Rose Tattoo,* pp. vi–xi.
5. "Production Notes," in *The Glass Menagerie* (Random House, the 1945 text), pp. ix–xii.
6. Not in the 1945 version. See Clark and Davenport, *op. cit.,* p. 379.
7. Until recently this play was available only in a deluxe edition. The text appears in *New World Writing* (The New American Library, New York, 1952), pp. 46–67.
8. " 'Something wild . . . [sic]'," in Tennessee Williams, *27 Wagons Full of Cotton* (New Directions, New York, 1945), unpaginated.
9. *The Rose Tattoo,* p. 142.

ARTHUR MILLER: AN ATTEMPT AT MODERN TRAGEDY

ALVIN WHITLEY

The two highly successful plays of Arthur Miller, *All My Sons* (1947) and *Death of a Salesman* (1949), have been frequently characterized as "unforgettable," "shattering," "devastating," "overpowering," "poignant," but reviewers have rarely considered them, as I propose to do, as examples of one of the oldest and most respected of literary forms—dramatic tragedy. Nor is this approach a novel critical fetish. The plays themselves have in them certain elements which demand that they be judged as studies in the tragic mode—that is to say, as something more than realistic reproductions, however searching, of a gloomier side of modern American life—and Miller himself has written an informal critical manifesto, propounding his own particular theory of tragedy and asking that his plays be referred to it. To fail to do so is to rob the plays of their intended and, I think, essential meaning.

But before analyzing Miller's view of tragedy one must reconsider the traditional view, originally formulated by Aristotle and his critics, which Miller has adapted and reinterpreted. In the very broadest terms, then, the Aristotelian tradition defined tragedy as the imitation in prescribed dramatic form of a serious, complete human action, of great enough significance to be worthy of representation, which will strike the audience with pity and fear, two emotions far removed from sentimental tears. The hero of such a piece must be neither perfectly virtuous nor completely base but rather a man, great yet humanly fallible, who is preordained to suffer because of the fate of his inward character and a catastrophic series of events in the outward world. Also, he must never die ignorant of the circumstances of his fall; at some point in the course of the action, usually just before his death, he must undergo the painful process of discovery or revelation through which he will come to understand the reasons for and the significance of his role and thus may make the so-called "tragic reconciliation" with life. Tragedy must always, Aristotle specified, be idealized, both in the sense that the poet as philosopher deals with ideal and universal truth and also in the sense that he portrays his characters as men far above the average in social standing and intellectual and spiritual power.

This last point hints at a basis of tragedy which Aristotle doubtless considered too obvious to elaborate—that classical tragedy embodied a fundamental belief in the dignity and inherent nobility of man. Only if man was great and his moral choices and ethical convictions of vast importance to the universe as a whole, could the story of his fall be made marvelous and arouse the requisite emotions of pity *and* fear. The fall of a noble man was worthy of the highest forms of poetry and was calculated, through its very magnitude, to strike the audience dumb not to reduce it to tears of maudlin sympathy. The classical tragedian was at heart an optimist, his ultimate exclamation being not the pity but the wonder of it all, and it was not empty literary convention which led him to conceive of man as most fittingly portrayed as a king whose crowns and robes were symbolic of inward greatness.

Accepting these standards, some modern writers have claimed that tragedy can no longer be written and, indeed, only imperfectly understood because the one absolute requirement, a belief in the dignity of man, is no longer possible.[1] The reasons usually given for this decline (a general loss of religious faith, the questioning skepticism of the scientific spirit, and so on) need not concern us, only the end result: if man does not believe in an ordered universe, he cannot assign himself a fixed place; if he has no faith in himself, he cannot echo Hamlet's description of man, "in action how like an angel! in apprehension how like a god!" Amid the growing political and economic complexities of our time, few have been able to proclaim that man is the master of things but rather their pitiful victim, and tragedy has become sentimentality. Again, it is symptomatic that the hero of a modern "tragedy" is not pictured as a king but as an average person, more often than not as a man well below average both in social and economic status and intelligence.

Miller, however, has in turn rejected this modern denial of the possibility of tragedy. In a careful article entitled "Tragedy and the Common Man," published in the *New York Times,* February 27, 1949, he has reinterpreted the traditional view. Tragedy, he begins, is not an archaic form; current ideas do not forbid it. Indeed, the common man is as proper a subject for tragedy as a king; external evidence of greatness is unimportant, for both share, after all, the same mental processes and emotional patterns. Whether the hero be king or commoner, "the tragic feeling

---

[1] See the suggestive chapter, "The Tragic Fallacy," in Joseph Wood Krutch's *The Modern Temper* (1929), to which I am greatly indebted. Quotations from the works of Arthur Miller are made with the kind permission of the publishers, The Viking Press.

is evoked in us when we are in the presence of a character who is ready to lay down his life, if need be, to secure one thing—his sense of personal dignity." The tragic struggle is one of a man attempting to assert his place in the sun and to affirm his importance, whether for the first time or to recapture something once possessed and lost. Few will rebel in such a manner, and we, the more passive onlookers, are struck with pity and fear because we so far identify ourselves with the hero to be afraid of "being torn away from our chosen image of what and who we are in this world." Some kind of enlightenment or revelation remains essential (whether on the part of the hero or the audience, Miller does not specify); otherwise we are left with mere pathos, the meaningless destruction of an unconscious animal.

In more modern times, Miller continues, tragedy is not possible if our view of life is completely psychiatric or sociological—the one posits that our indignities are all internal and thus invalidates external action; the other so far shifts our interest from individual to mass man that the tragedy of one is unbelievable and irrelevant. Miller agrees that tragedy is essentially optimistic. A creative struggle for self-realization inspires the highest opinions of mankind not the lowest. Furthermore, tragedy must always contain the possibility of success; it is only pathos when a man fights a battle lost before begun. All of this is true of the king as of the common man, and since we no longer believe in the former, the latter is the only suitable subject for tragedy in our time. Miller's own two plays are based on his precepts.

All My Sons is a remarkably successful attempt to portray the typical American: the setting, a middle class suburban home in the midwest, the characters, a selfmade business man and his unpretentious family, the moral background, belief in material success and in the immediate family as the ultimate social and moral unit—all distill the essence from many American lives. Joe Keller, the tragic hero, has attempted to assert his importance by the achievement of material success which is largely unselfish: his struggles, leading from boyhood poverty to prosperity in the ownership of a small factory, have been guided by love of his family and a desire to see his sons better off than himself. In the process, however, he has committed a crime. During the war he had deliberately permitted faulty aeronautical equipment to leave his factory, and twenty-one fliers were killed. A meek partner has been allowed to take the blame and go to prison, while he himself has gone on to greater success with peacetime conversion, the only flaw being the death of his son, a pilot in the war.

His other son, Chris, has returned from the war with a moral viewpoint as universal as his father's is provincial: the fate of mankind as a whole is the ultimate consideration, not the good of one individual and his family. The action plays itself out in the tense struggle between father and son, as the latter makes the inevitable, terrible discovery that his father stands for everything he has fought. Keller remains for a time morally unenlightened. He had merely countenanced an irregularity to keep the attainments of a lifetime, and he defends himself by an appeal to general American conduct: "It's dollars and cents, nickels and dimes; war and peace, it's nickels and dimes, what's clean?" When he tells his son that it was done for him, Chris replies:

> For me! Where do you live, where have you come from? For me!—I was dying every day and you were killing my boys and you did it for me? I was so proud you were helping us win and you did it for me? What the hell do you think I was thinking of, the goddam business? Is that as far as your mind can see, the business? What is that, the world—the business? What are you made of, dollar bills? What the hell do you mean, you did it for me? Don't you have a country? Don't you live in the world?

Enlightenment comes, however, with the discovery of a long-concealed letter from his dead son, saying that he is going to commit suicide to avoid the disgrace of being the son of such a father. At last Keller understands and is willing to go to prison to atone. When his wife says that their dead son would never tell him to suffer needlessly, he answers: "What is this [the letter] if it isn't telling me? Sure, he was my son. But I think to him they were all my sons. And I guess they were, kid . . . I guess they were." And his living son drives the lesson home, that in striving to better himself he had committed a crime against humanity: "You can be better! Once and for all you can know now that the whole earth comes in through those fences; there's a universe outside and you're responsible to it, and if you're not, you threw your son away, because that's why he died!" But his father, his life gone with the illusion that governed it, has also killed himself.

Death of a Salesman follows a remarkably similar pattern. Willy Loman has also lived by a success illusion: he has attempted to assert himself by applying a Rotarian philosophy of personality. A man is a "big shot" if he is liked by his associates ("not liked but well liked") because of his ability to talk, to joke, to know people and to have contacts, to possess a breezy, assured manner—to sell himself, in short, through surface manner and not innate worth. His belief is far less substantial than Joe Keller's, for, as a salesman not a manufacturer, he has fewer material possessions to sustain it—he can only evaluate himself through the smiles on other people's faces, and as he grows older and business methods change, the smiles are beginning to fade.

His attempt to realize his own idea of his importance has been illusory, and he is beginning, partially, to recognize it. He confesses to his wife that he talks too much, that people laugh at him and call him "the walrus." But one of his sons sees the situation more clearly, for Willy has not only lived by his philosophy himself but has also inculcated it into his sons with disastrous results—one is like his father, the other, Biff, a hopeless drifter and even a petty thief. Biff explains to his father and the audience, telling Willy that his philosophy is "hot air," that he is "a dime a dozen," "a dollar an hour," and advising, "Will you take that phony dream and burn it before something happens?" We never know whether or not this understanding extends beyond Biff and the audience to Willy. With the collapse of his illusion his mind is failing and his ability to see himself objectively seriously impaired. But he must have glimpses of the truth, for he seeks to atone for his miscomprehension of essentials by committing suicide to leave the insurance money to his sons that they may be better.

Both plays, then, are similar and represent a working out of Miller's theories: common men proclaiming their dignity by devotion to success "myths" and being cast down by the moral order of the universe (speaking through their sons) against which they have sinned, one definitely, the other perhaps realizing the significance of his story.

But has Miller been consistent to his own theory? The problem of discovery or comprehension of significance is not convincingly solved. Joe Keller seems to understand at the end, but one doubts that he is really intelligent enough to grasp the complete truth; Willy Loman's mind is at times unbalanced, a condition which surely negates the possibility of convincing enlightenment. It is strange that Miller, who warned against psychiatrics in tragedy, should have poached on his own forbidden territory. One may well ask if enlightenment on the part of the audience is an effective substitute for enlightenment on the part of the hero. Surely part of the terrible power of tragedy is sacrificed when the hero must die without understanding.

But Miller has also, it seems to me, left unheeded his own warning concerning sociological inference. In both plays there are bold hints that the system is responsible for the plight of the man. Joe Keller says that he only did what everyone did. What is individual guilt? he asks, but his question remains unanswered. Willy Loman is certainly as much the victim of an economic system as of a self-created illusion; his wife makes to her sons a speech which rings suspiciously like an indictment of society:

> I don't say he's a great man. Willy Loman never made a lot of money. His name was never in the paper. He's not the finest character that ever lived. But he's a human being, and a terrible thing is happening to him. So attention must be paid. He's not to be allowed to fall into his grave like an old dog. Attention, attention must be finally paid to such a person.

Any attempt to ascribe importance to environment must proportionally detract from the importance of the individual, and tragedy will become a pathetic case study of preordained failure.

And, finally, is Miller's theory of tragedy feasible? Surely there is a fallacy in its logic. A search for dignity cannot have the same stirring power as the use of dignity already achieved to play a great part in a significant universe. A man who possesses nobility is, in Willy's terms, "big"; a man struggling to attain it, no matter how courageous his fight or how justified his desire, will remain little in comparison. His struggles may well be affecting, but they cannot inspire in us the pity, fear, and strange exaltation which are the tragic emotions. Whether or not one wishes to broaden his definition of tragedy to include Miller's plays is a matter for personal critical canons, but I think he should realize that he is extending the traditional interpretation to embrace demonstrably different emotional effects and that, in the basic matter of personal dignity, Willy Loman may have ended where Hamlet unquestionably began.

THE ROLE OF SCIENCE IN THE THOUGHT OF W. D. HOWELLS

HARRY HAYDEN CLARK*

Although William Dean Howells (1837–1920) is generally regarded as the most comprehensive literary recorder of normal American life in the latter part of the nineteenth and early part of the twentieth centuries when the influence of science and technology were revolutionizing forces, there has been little extensive study of Howells' use of and reaction to science. Some commentators have even argued that he "hates science, or shuts his eyes to it."[1] In view of this situation it would seem that an inductive investigation of what he actually said about science might be illuminating in regard to how the implications of science were interpreted on the popular level, and how they helped to cross-fertilize ideas about literature and social criticism.

Needless to say, Howells had no technical knowledge of science and he once even said that in so far as a man "is very much of an artist he has not much philosophy"[2] in the tightly systematic sense. And as a practising journalist (editor of *The Atlantic Monthly* from 1871 to 1881 and with *Harper's* from 1886 to 1920 with an interval), Howells did not always find it necessary to make his early and his later book reviews entirely consistent. One must reconstruct his ideas from many sources, balancing one against the other when necessary, and using his non-fictional utterances as yardsticks with which to interpret the comments of his fictional characters. For obviously, if a given plot of a novel requires a character to be a villain and another a hero, one must distinguish as to which is more likely to be expressing the author's own ideas. With these considerations in mind, then, let us see to what extent Howells was indebted to science (1) in his literary theory and practice as a realistic novelist and literary critic, and (2) in his social and political attitudes which culminated in something approaching a mild socialism predominantly Christian.

---

* Grateful acknowledgment is made of the fact that I have been greatly aided in getting this study into its present form through several versions by Louis Budd and Clinton Burhans, two successive Research Assistants generously provided for this purpose by The Graduate School of the University of Wisconsin. They deserve much credit.

[1] J. C. Underwood, *Literature and Insurgency,* (1914), pp. 100, 122.

[2] "Recent Russian Fiction," *North American Review,* CXCVI, 94.

I

DARWIN "CHANGED THE THOUGTHS OF THE WORLD"

Before surveying these two major topics, let us ascertain the extent of the familiarity with scientific ideas and developments which Howells apparently derived both from his reviews of scientific books and from his acquaintance with contemporary popularizers of science. As early as 1869, Howells met the theory of natural selection directly in his reading of A. R. Wallace's *The Malay Archipelago*. Implying at least a general familiarity with Darwin's evolutionary theories, he acknowledges this book's "vast amount of information", and finds that "the author is a Darwinist, and meets everywhere abundant evidence to sustain the famous theory."[3] Thirty-five years later, referring to Wallace's *Man's Place in the Universe,* he remarks that "Dr. Wallace restores those who accept his gospel to a possible belief in the brotherhood of man."[4] Howell's interest in the scientific developments of his day and their implications is illustrated in his tenacious concern with the question treated in Wallace's book of whether the earth alone is a habitable planet. His opinion on this question varied through the years; in 1889 he remarked that "the planet Mars is known to be adapted to human life."[5] Yet in March, 1904, he devoted the "Editor's Easy Chair" to Wallace's *Man's Place in the Universe,* which contends that the earth is the only body in the solar system which is populated; such a discovery, feels Howells, will bring a new era of moral responsibility, when man realizes that "the universe, so far as it has been of any imaginable use, has been created for the behoof of his home and himself."[6] Howells returned to his earlier opinion in 1913 when E. Walter Maunder's *Are the Planets Inhabited* agreed strongly with Wallace. Discussing the question again in the "Editor's Easy Chair", he decides that "the Soul revolts against the notion that the Creator works with no more economy of means than his Creature in a universe one part life to a billion parts death."[7] Such continual and speculative interest in contemporary scientific trends was characteristic of a Howells who never lost his intellectual inquisitiveness and open-mindedness.

Howells' chief potential source of Darwinism was John Fiske, the American prophet of Darwinism and disciple of Spencer. Fiske and Howells met in 1867, and, before long, Howells "was

[3] *Atlantic Monthly*, XXIV, 256–57 (August, 1869).
[4] "Editor's Easy Chair," *Harper's,* CVIII, 641 (March, 1904).
[5] "Editor's Study," *Harper's,* LXXXIX, 481 (August, 1889).
[6] "Editor's Easy Chair," *Harper's,* CVIII, 640–44 (March, 1904).
[7] *Ibid.,* CXXVIII, 151 (December, 1913).

in raptures" (reported Fiske) over his article on popular mythology and superstition. In 1871, Fiske took over for a while "superintending the proof-reading" of the *Atlantic;* and when Howells organized an *Atlantic* department of science in 1872, Fiske was asked to be its editor. Fiske himself gives ample illustration of his intimate relationship with Howells; when considering the purchase of Howells' Cambridge house, he confided to his mother: "I am very intimate with Howells. . . . The house is a kind of old friend, and it would be pleasant to live in it for the sweet associations."[8] Howells naturally reviewed Fiske's writings with glowing approval, finding him "one of the most thorough, sincere, and cautious of inquirers"; he calls attention to "all the charm of Mr. Fiske's clear style, vast knowledge, and right perspective."[9] From him as well as from his reading, Howells acquired the main ideas of evolutionary science, and could glibly write that "the forked tail is no more to be found in the demons of our time than the like appendage which in our own race, marked a stage of progress from the Ascidian."[10]

Howells also praised and encouraged the literary efforts of Nathaniel Southgate Shaler, a Harvard geologist who broke with his teacher, Agassiz, over evolution and who taught evolution "when the dominant scientific influence in Cambridge was antagonistic to it."[11] Shaler, who met Darwin, Tyndall, and Galton while abroad, mixed socially with Howells in Cambridge and contributed liberally to the *Atlantic Monthly* during his editorship; for example, Shaler's essay in the *Atlantic Monthly* of March, 1879, attempted to analyze human civilization from the premises of evolutionary science.

The names of many great contemporary scientists are sprinkled throughout Howells' works. He writes that "Agassiz may be said to have led that movement towards the new position of science in matters of mystery which is now characteristic of it . . . . he became, by opening a summer-school of science with prayer, nearly as consolatory to the unscientific who wished to believe they had souls, as Mr. John Fiske himself."[12] Again, in *The Undiscovered Country,* Boynton, a disillusioned spiritualist, says:

> " 'I have heard a story of Agassiz . . . . . to the effect that when he had read some book wholly upsetting a theory he

---

[8] *The Letters of John Fiske,* pp. 165, 199, 205, 364, 459; for other references to Howells see pp. 197, 200, 204, 210, 214, 222, 232, 357, 362–64, 368, 372, 374, 437, 450, 460, 466, 468, 514–15.

[9] See the *Atlantic Monthly,* XXXI, 241–42 (February, 1873) and *Harper's* LXXII, 808 (April, 1886) and LXXIX, 802 (October, 1889); also see *Harper's,* CXL, 279 (January, 1920).

[10] *Atlantic Monthly,* XXXIII, 370 (March, 1874).

[11] See N. S. Shaler, *Autobiography* (1909), p. 216.

[12] Howells, *Literary Friends and Acquaintances,* Edition of 1911, p. 272.

> had labored many years to establish, he was so glad of the truth that his personal defeat was nothing to him. He exulted in his loss, because it was the gain of science.' "[13]

Referring to his friend Fiske, Howells states that "he evolved from the agnosticism of the whole contemporary thinking world a deistic belief, and established our civilization in the comfort of a credence unknown outside of his following."[14] Howells calls him "the arch-apostle of Darwinism."[15] Of Darwin himself, Howells writes that "the imagination which does not rest its hopes on faulty cords, but follows carefully on the sure and firm-set earth, in the steps of fact and then flies forward in most inspired conjecture, has its abiding in the memory of the great Darwin . . . . ."[16] "It is the statue of Darwin," writes Howells, "to which the devotees of evolution will bend their steps in Shrewsbury."[17] In Shrewsbury himself, Howells visited the building in which Darwin attended school and writes that it was the "mild, wise face"[18] of Darwin which welcomed him up the way to the building. If Howells does not consider Darwin " 'the first of those who know' "[19], he does believe that it was the studies of Darwin "which changed the thoughts of the world."[20] Howells also refers to other contemporary scientists. He remarks of Huxley that his "famous reproach of poetry . . . . . that it was mostly 'sensual caterwauling' . . . . . had a justice in it that must have stung, and made the lyrist wish to be an atomic theorist at any cost."[21] Referring to Metchnikoff as " 'the successor of Pasteur in the Pasteur Institute at Paris' "[22] Howells writes that *The Nature of Man,* which discusses the question of immortality, is " 'certainly a very important book, and it produces a reaction which may be wholesome or unwholesome as you choose to think. And no matter what we believe, we must respect the honesty of the scientific attitude in regard to a matter that has been too much abandoned to the emotions, perhaps.' "[23]

In addition to the names of great contemporary scientists, Howells' works contain numerous references to the major developments and movements of contemporary science. The tenets of

---

[13] Howells, *The Undiscovered Country,* p. 358.
[14] "Editor's Easy Chair," *Harper's Monthly,* CXL, 279, (January, 1920).
[15] Howells, *Literary Friends and Acquaintances,* p. 273.
[16] Howells, *Certain Delightful English Towns,* p. 269.
[17] *Ibid.*
[18] *Ibid.,* p. 270.
[19] *Ibid.,* p. 269.
[20] *Ibid.* See also Howells' "Minor Topics," *Nation,* II, 293 (March 8, 1866) on Darwin.
[21] Howells, *Imaginary Interviews,* (New York, 1910), p. 212.
[22] *Ibid.,* p. 196.
[23] *Ibid.,* p. 202.

his literary realism are based in a large measure on his knowledge of scientific methodology. He commends Thorstein Veblen's "methods and habits of scientific inquiry" and feels that "to translate these into dramatic terms would form the unparalleled triumph of the novelist who had the seeing eye and the thinking mind, not to mention the feeling heart."[24] He acknowledges directly the value of the scientific method, stating that "better than science seems the scientific spirit, and after many theories and hypotheses have fallen to ruin this will remain."[25] Howells had a semi-scientific conception of the function of natural laws in the affairs of men; his Altrurian traveler gives expression to this conception:

> "'. . . we profit, now and then, by the advances . . . in science, for we are passionately devoted to the study of the natural laws, open or occult, under which all men have their being.'"[26]

In *Dr. Breen's Practice,* Howells' knowledge of the movements in contemporary medical science is demonstrated in his description and satire of the internecine dispute between the allopathists and the homeopathists. He has Dr. Mulbridge say to Dr. Grace Breen:

> "'Surely, Miss—I mean Doctor Breen—you must know why I can't consult with you! We belong to two diametrically opposite schools—theories—of medicine. It would be impracticable—impossible for us to consult. We could find no common ground. Have you—never heard that the—ah—regular practice cannot meet homeopathists in this way? If you had told me—if I had known—you were a homeopathist, I couldn't have considered the matter at all.'"[27]

Howells was also aware of the development and implications of electrical science; and in the evolution of his Utopian state, "'it was with the telegraphs that the rebellion against the Accumulation began.'"[28] A close friend of William James whose *Psychology* (1890) he read and regarded as "most important,"[28a] he writes of "the superior interest of the psychology"[29] of the characters of Henry James. And, meditating on the historical excesses of the Medici during a visit to Florence, he indicates his knowledge of contemporary developments in the science of psy-

[24] "An Opportunity for American Fiction," *Literature,* IV, 580, (June 3, 1889).
[25] "Editor's Study," *Harper's,* LXXXI, 966 (November, 1890).
[26] Howells, *A Traveler from Altruria,* (New York, 1894), p. 288.
[27] Howells, *Dr. Breen's Practice,* p. 99.
[28] Howells, *A Traveler from Altruria,* pp. 270–71.
[28a] *Life in Letters of W. D. Howells,* (New York, 1928), II, 14.
[29] Howells, *Heroines of Fiction,* II, 170.

chology by concluding that "the Medici, a family of princes and criminals, may come to be studied like the Jukes, a family of paupers and criminals."[30] Throughout Howells' later works especially, one finds great interest in heredity, especially as it relates to the question of responsibility for supposed wrongdoing.

Of course the most important, and certainly the most influential, scientific development during the period in which Howells wrote was the impetus given the theory of evolution by the researches and conclusions of Charles Darwin. Howells' familiarity with the general concept of evolutionary science is illustrated in a variety of passages. Referring again to the Medici, he states that "it is hard to understand through what law of development from lower to higher, the Providence which rules the affairs of men permitted them supremacy."[31] During a visit to England, he reflects on "the slow evolution of the race out of devoted subjects into devoted citizens."[32] Howells' Utopian state would be reached by a quiet social evolution or gradualism: "it must be a natural growth from indigenous stocks, which will gradually displace individual and corporate enterprises by pushing its roots and its branches out under and over them, till they have no longer earth or air to live in."[33] This material progress would be matched by a spiritual progress: Howells, in an important passage indicating his adherence to "soft" evolution departing from mere anatomy, asserts that "there is an evolution . . . . . in the moral as well as in the material world, and good unfolds in greater good."[34] It is significant that the final development in the creation of his Utopian state is termed "the Evolution."[35]

Howells' comments on the Italians during a visit to Rome reflect his acquaintance with Darwin's theory of natural selection. Finding the contemporary Italians quite like their racial counterparts of the gladiatorial days, Howells feels "the process of the generations to be a sort of impertinence; and if Nature had been present, I might very well have asked her why, when she had once arrived at a given expression of humanity, she must go on repeating it indefinitely?"[36] His discussion of George Eliot's *Middlemarch* also reflects the principle of natural selection. Referring to Dorothea Brooke, Howells writes that "in her case, as in the case of Lydgate, we see a meaner nature making a noble

---

[30] Howells, *Tuscan Cities,* p. 87.
[31] *Ibid.,* p. 49.
[32] Howells, *Certain Delightful English Towns,* p. 277.
[33] Howells, *The World of Chance,* pp. 121–22.
[34] Part of the sermon by Rev. Peck in *Annie Kilburn* (New York, 1889). For evidence that Howells spoke through Rev. Peck see *Life in Letters,* I, 419.
[35] Howells, *A Traveler from Altruria,* p. 288.
[36] Howells, *Literature and Life,* pp. 188–89.

nature its prey, but Dorothea is more enduringly built than Lydgate, or else she is more favored by chance. Perhaps it is scientifically accurate to say this rather than the other thing . . . . .'"[37] Again, in Howells' *The World of Chance,* (1893) the radical Hughes states:

> " 'It is Nature that I accuse; not the divine nature, or even human nature, but brute nature, that commits a million blunders, and destroys myriads of types, in order to arrive at such an imperfect creature as man still physically is, after untold ages of her blind empiricism.' "[38]

In his later years, his faith in intuitive religion partially restored, Howells finds "Natural Selection entering the twilight into which the elder pagan deities have vanished," and the soul "newly warranted in claiming existence."[39] In reviewing Isaac Taylor's *The Origin of the Aryans,* part of which refuted the hypothesis (which Fiske and others held) that Aryan religious myths evolved "vertically" from an ancient race in Central Asia, Howells in 1890 took comfort in this apparent proof that scientists and "Sanskristists" could make mistakes. "The atomic theory is still a theory," he concluded, "the nebular hypothesis still a hypothesis; the missing link in the Darwinian chain is missing still."[39a] Therefore science is not infallible (at least anthropology, in which Howells had much interest as suggested by his study of D. G. Brinton's *Myths of the New World* and Edward Tylor's *Primitive Culture*) and man may well be reluctant to abandon a comforting belief because of the latest scientific hypothesis which may soon be supplanted by another.

References to the evolutionary principle of the survival of the fittest in a struggle for existence, corollary to the theory of natural selection, are found throughout Howells' works. Characters in his novels are often advised to "gather strength for the battle of life,"[40] and he deplores the condition of the "feeble nature, constantly pushed to the wall in the struggle."[41] Again, in *A Hazard of New Fortunes,* the reaction of Basil March to New York City embodies the theory of the survival of the fittest:

> "Accident and then exigency seemed the forces at work to this extraordinary effect; the play of energies as free and planless as those that force the forest from the soil to the

---

[37] Howells, *Heroines of Fiction,* II, 75.
[38] Howells, *The World of Chance,* p. 99.
[39] Howells, *Imaginary Interviews,* p. 315.
[39a] Howells, "Editor's Study," *Harper's Monthly,* LXXXI, 966 (November, 1890).
[40] Howells, *The Quality of Mercy,* p. 393.
[41] Howells, *A Woman's Reason,* p. 427.

sky; and then the fierce struggle for survival, with the stronger life persisting over the deformity, the mutilation, the destruction, the decay of the weaker."[42]

Howells' familiarity with the evolutionary theory that man is determined by the conditions of his heredity and environment is constantly reflected in his writings. During a visit to England, he remarks that an American of English descent "has that sense of having been there before . . . . . His English ancestors who really were once there stir within him, and his American forefathers, who were nourished on the history and literature of England, and were therefore intellectually English, join forces in creating an English consciousness in him."[43] English women are "wholly unlike American women. They are of the same stock racially, but ours are of a graft upon the parent stem so different that the two varieties of fruit are as little related as plums and apricots. "In the Hardy lower-class heroines we see the primitive Englishwoman before she was touched by Puritanism, and in his middle and upper-class heroines the same woman as she has grown into modern civilization unaffected by the tremendous force which has permeated and moulded the nature of the American great-great-grandnieces of that original Englishwoman."[44] In the course of "that wonderful adaptation of the human soul to any circumstances,"[45] character is formed (as Howells interprets Hardy) "by those influences from without—religious and moral—which we anxiously enough mistake for impulses."[46]

Associated with the evolutionary principle of hereditary and environmental determinism is the concept of atavism—the reversion to an earlier type or quality. His familiarity with this concept is apparent in Howells' works; he writes that "the return to barbarism is easy for human nature. The man of a race which has toiled up to civilization through ages of culture runs wild and degenerates into a savage in a single generation."[47] Again, he supposes "that the North American conscience was evolved from the rudimental European conscience during the first centuries of struggle here . . . . . The eternal-womanly continues along the old lines of housekeeping from an atavistic impulse. . . ."[48]

---

[42] Howells, *A Hazard of New Fortunes,* (Library Edition), p. 211. See also p. 259.
[43] Howells, *Certain Delightful English Towns,* p. 1.
[44] Howells, *Heroines of Fiction,* II, 179.
[45] Howells, *A Pair of Patient Lovers,* p. 54.
[46] Howells, *Heroines of Fiction,* II, 193–94.
[47] Howells, "Minor Topics," *Nation,* II, (January 18, 1866).
[48] Howells, *Literature and Life,* 241–42.

II

Having shown that Howells was familiar with many of the important developments and trends of contemporary science, let us now consider his reaction to them. In general, the development of Howells' interest in science was itself evolutionary; minimizing the importance of science in his youth, he became progressively more familiar with its developments and increasingly more aware of its implications, acclaiming it finally as "sovereign" in the "realm of thought." Having recently returned from Venice in 1865, Howells accounts science "the coldest element in our civilization,"[49] and in reviewing a book about the North Pole, he suggests that the ordinary reader "lacks perfect sympathy with the scientific purpose, and doubts if a geographical fact, as yet barren and without apparent promise of fruitfulness, be worth the sacrifices made to ascertain it."[50] Yet, in 1904, exulting over Alfred R. Wallace's *Man's Place in the Universe,* he concludes that "in the realm of thought, which is spiritual as well as mental, science is sovereign, and will probably always be so."[51] During the years between, Howells' increasing interest in the trends of contemporary science and their implications is reflected in his writings, and it will be seen that this developing interest in science parallels and influences the developments in his literary theory and practice and in his social attitudes.

Howells' belief in "natural laws . . . . . under which all men have their being,"[52] led him in *The Undiscovered Country* to explain naturally an apparently unnatural condition. Dr. Boynton, a disillusioned spiritualist whose hopes are now "futile as those of the seekers for the philosopher's stone," tells his friend that a magazine article has explained by a parallel case his daughter's temporary psychic state to which he had given spiritualistic implications. The writer " 'was not blinded by the fool's faith that lured me on. He sought a natural cause for these unnatural effects," and he found them in the use of electricity. In this story unravelling the doings of a spiritualist Howells cites and draws on the work of a British authority on that subject, William Crooks, who published several semi-scientific treatises in the *Quarterly Journal of Science* from 1870 to 1874.[53] Howells' interest in electrical science finds expression again in a humorous description of the manner in which a woman falls in love. He writes:

[49] *Atlantic Monthly,* XVIII, 128 (July, 1866).
[50] *Ibid.,* XIX, 511 (April, 1867).
[51] "Editor's Easy Chair," *Harper's Magazine,* CVIII, 642 (March, 1904).
[52] Howells, *A Traveler from Altruria,* p. 288.
[53] Howells, *The Undiscovered Country,* p. 360 and p. 57.

> " 'She is sailing through time, through useful space, with her electrical lures, the natural equipment of every charming woman, all out, and suddenly, somewhere from the unknown, she feels the shock of a response in the gulfs of air where there had been no life before.' "[54]

Again Howells regards *Jane Eyre* as "an epochal book, assembling in itself the elements of that electrical disturbance which had been gathering in the minds of women for a generation, and discharging them in a type, a character, which expressed their discontent with their helplessness, their protest against their conditions, their longing for equality with men, as from time to time some real or imaginary personality will."[55]

Howells refers to the natural and physical sciences for much of his most effective imagery. On a visit to England he uses geological analogies and finds municipal Oxford a setting for the beauty of the colleges "as a mass of common rock may shapelessly enclose a cluster of precious stones, crystals which something next to conscious life has deposited through the course of the slow ages in the rude matrix."[56] Again, despite its "prevailing impersonality," Oxford is an "incandescent mass from which nevertheless from time to time a name detaches itself and flames a separate star in the zenith."[57] In America, Howells sees the magnificence of Niagara Falls as like "a fall of lightest snow, with movement in all its atoms, and scarce so much cohesion as would hold them together."[58]

Howells' interest in the science of medicine is evident not only in his whole novel *Dr. Breen's Practice,* but also in occasional similes and metaphors. Describing the financial collapse of Silas Lapham, Howells writes:

> "The process of Lapham's financial disintegration was like the course of some chronic disorder, which has fastened itself upon the constitution, but advances with continual reliefs, with apparent ameliorations, and at times seems not to advance at all, when it gives hope of final recovery not only to the sufferer, but to the eye of science itself."[59]

Rev. Peck, in *Annie Kilburn* (1888), praises the searching scepticism of science as God-given and God-directed, and he points out the good it has done in "contemplating the disparity between the Church's profession and her performance."[60] In *The*

---

[54] Howells, *Between the Dark and the Daylight,* p. 152.
[55] Howells, *Heroines of Fiction,* I, 228.
[56] Howells, *Certain Delightful English Towns,* p. 207.
[57] *Ibid.,* p. 202.
[58] Howells, *Their Wedding Journey,* p. 126.
[59] Howells, *The Rise of Silas Lapham,* p. 319.
[60] Howells, *Annie Kilburn,* p. 242.

Minister's Charge, Bellingham calls Barker "ancestral" and states that " 'he makes me feel like a degenerate posterity. I've had the same sensation with Tom; but Barker seems to go a little further back. I suppose there's such a thing as getting too far back in these Origin of Species days . . .' "[61] Again, Barker's friend, Mr. Evans, with considerable irony, suggests that " 'if you should happen to prove to Barker that his ignominy is in accordance with the Development Theory, and is a necessary Survival . . . . . don't you see what a card it would be for us with the better classes?' "[62] Kinney, the lumber-camp cook in *A Modern Instance,* describing the French and Germans, remarks that "they're a kind of a missing link, as old Darwin says.' "[63] And Kinney remarks that hating a man whose clothes are good is "a kind of *survival,* as old [Edward] Tylor calls it,"[63a] suggesting Howells' interest in the latter's anthropological *Primitive Culture.*

Howells' familiarity with the evolutionary doctrines of the struggle for existence and the survival of the fittest led him to equate it with the evils of economic competition in society. "Wherever there is competition," he writes in 1898 "there will be the oppression of the weaker by the stronger."[64] Howells feels that "the selfish motives which underlie our economic life" and "social inequality" automatically produce "men who bully and truckle, and women who snub and crawl."[65] He declares that evolutionary science "in allying us with the brute and imbuing us, subtly and pitilessly, with the conviction that might was right through the survival of the physically fittest . . . had, in the belief of some of the wisest and best, measurably bereft us of the humanity which the ages had slowly and painfully evolved as an ideal of conduct."[66]

Recognizing the truth of the evolutionary principle of heredity and environmental determinism, Howells refers to it frequently. In *Chance Acquaintance,* even after deciding that he loves Kitty, Arbuton "could not undo his whole inherited and educated being."[67] Commenting on the differences between the American and the English personality and art, Howells remarks that "our [American] personality is the consequence of our his-

---

[61] Howells, *The Minister's Charge,* p. 387.
[62] *Ibid.,* p. 276.
[63] Howells, *A Modern Instance,* p. 122.
[63a] Howells, *Ibid.,* p. 124.
[64] *Life in Letters,* II, 86, (February 14, 1898).
[65] Howells, *My Literary Passions,* p. 98.
[66] "Editor's Easy Chair," *Harper's,* CVIII, 641 (March, 1904); see a similar statement in *Harper's,* LXXXI, 966–67 (November, 1890).
[67] Howells, *A Chance Acquaintance,* edition of 1887, p. 184.

toric sparsity."[68] He feels that "our depth was the inevitable implication of our civic and social conditions . . . . . our life is too large for our art to be broad."[69] In *The Kentons*, he writes that "Mrs. Kenton could have answered . . . that daughters, like sons, were not what their mothers but what their environment made them, and that the same environment sometimes made them different."[70] Howells most extensive treatment of heredity and racism appears in his novel *An Imperative Duty,* 1893, in which he has a young physician discuss the problem as it involves the heroine, who has a small trace of Negro blood and whom he eventually marries and takes to Italy. Her gaiety and impetuousness are traced to heredity, and Howells as a liberal blames her aunt for becoming morbid about her "duty" to reveal the heroine's background. In *Lapham* Howells explains young Corey's unexpected success in joining Silas' paint business by the fact that Corey inherits his grandfather's business sharpness as symbolized by their both having Roman noses, a feature not having been left to Corey's father who was devoted to "sterile elegance."

Howells also refers frequently to the evolutionary principle of atavism. In *The Minister's Charge,* he writes:

> "There seemed a sort of reversion in Barker's whole presence to the time when Sewell first found him in that room; and in whatever trouble he now was, the effect was that of his original rustic constraint."[71]

Howells' attitude in 1881 towards the idea of natural goodness was apparently influenced by this evolutionary principle of the reversion to a former type or quality. It is not the natural but the acquired goodness which is important, Howells feels; he believes that "the savage lurks so near the surface in every man that a constant watch must be kept upon the passions and impulses, or he leaps out in his war-paint, and the poor integument of civilization that held him is flung aside like a useless garment."[72] Atherton, in *A Modern Instance,* states:

> " 'The natural goodness doesn't count. The natural man is a wild beast, and his natural goodness is the amiability of a beast basking in the sun when his stomach is full. The Hubbards were full of natural goodness, I dare say, when they didn't happen to cross each other's wishes. No, it's the implanted goodness that saves—the seed of righteousness treasured from generation to generation, and carefully

---

68 Howells, *Heroines of Fiction,* II, 264.
69 *Ibid.,* p. 261.
70 Howells, *The Kentons,* p. 154.
71 Howells, *The Minister's Charge,* p. 437.
72 Howells, *Tuscan Cities,* p. 43.

watched and tended by disciplined fathers and mothers in the hearts where they have dropped it. The flower of this goodness is what we call civilization . . .' "[73]

Later, Howells came to believe that the bestiality as well as the goodness in human nature is implanted and determined by conditions; the savage lurking in human nature is the result of competitive conditions, Howells feels in 1895, and "when the fear, and even the imagination, of want is taken away, it is human nature to give and to help generously."[74]

An important result of Howells' familiarity with the principles of evolutionary science, which involved a transition from design to the fortuitous, was his belief in "a world of chance and change."[75] "One must hedge one's position," he contends, "with many perhapses; nothing can be affirmed with certainty . . . . ."[76] Describing P. B. S. Ray, in the novel very significantly titled *The World of Chance,* Howells writes:

"He began to wonder if life had not all been a chance with him. Nothing, not even the success of his book, in the light he now looked at it in, was the result of reasoned cause. That success had happened; it had not followed . . ."[77]

Whatever law is operative in the moral world, Howells believes, (in treating the inexplicable evil of Royal Langbrith in 1903) "is of such cosmical vastness in its operations that it is only once or twice sensible to any man's experience."[78]

Science was, almost unquestionably, an influence of major proportions on Howells. Its influence was perhaps most marked in the development of his literary theory and criticism and of his social attitudes. To these two topics we now turn.

III

The evolution of Howells' literary theory and criticism from an early romanticism to realism and objective criticism parallels and reflects to a considerable degree the development of his familiarity with the trends of contemporary science. Howells' early romanticism (based on living) which produced "the first and last historical romance I ever wrote,"[79] soon gave way before the vitality of a realism which asserted that "fidelity to experi-

---

[73] Howells, *A Modern Instance,* p. 472.
[74] Howells, *A Traveler from Altruria,* p. 296.
[75] Howells, *A Woman's Reason,* p. 466.
[76] Howells, *Heroines of Fiction,* I, 40.
[77] Howells, *The World of Chance,* p. 374.
[78] Howells, *The Son of Royal Langbrith,* p. 282.
[79] Howells, *My Literary Passions* and *Criticism and Fiction,* (Library Edition), p. 24.

ence and probability of motive are essential conditions of a great imaginative literature."[80] It is true that science was not alone responsible for this repudiation of romanticism and enthusiastic allegiance to realism; much of Howells' enthusiasm was generated by his reading of the English and Russian realists. Although his "literary liberation began with almost the earliest word from"[81] Heine, he found most that was both admirable and instructive in the works of Jane Austen, George Eliot, Tolstoy, Turgeniev and Thomas Hardy. In addition, Lowell, T. W. Higginson and other members of the *Atlantic Monthly* group encouraged Howells toward realism. His Middle-Western background and early journalistic experiences must also be recognized as important influences on his theories of realism and objective literary criticism. A further influence of major importance was his concept of American democracy, based not on illusion but the quest of truth, which was also the god of science; "democracy in literature," he writes, "wishes to know and to tell the truth, confident that consolation and delight are there . . ."[82] He insists that "the arts must become democratic, and then we shall have the expression of America in art."[83] "Truth . . . is the highest beauty," but truth includes Fiske's evolutionary view that "morality penetrates all things" and that "the beast-man will be . . . subdued."

In expounding his idea of literary realism for the working novelist, Howells also drew upon science for confirmation and illustration. He asserts that scientific discussion was primarily responsible for overcoming Victorian reticence,[84] and that the test of fiction should be "is it true—true to the motives, the impulses, the principles that shape the life of actual men and women?"[85] In returning to the "world of actualities," the novelist must obey "the principle which has vitalized the later realists" and "leave a faithful study of life, in cause and effect, to enforce its own lesson," without too much moralizing or subjective evaluation.[86] The true realist, Howells declares, must portray all experience; "he cannot look upon human life and declare this thing or that thing unworthy of notice, any more than the scientist can declare a fact of the material world beneath the dignity of his inquiry."[87] And the realist, like the scientist, must recognize that

[80] *Ibid.*, p. 200.
[81] *Ibid.*, p. 128.
[82] *Ibid.*, p. 282.
[83] *Ibid.*, p. 258.
[84] Howells, *Heroines of Fiction*, I, 40.
[85] Editor's Study," *Harper's*, LXXIV, 826, (April, 1887).
[86] Howells, *Heroines of Fiction*, I, 117.
[87] Howells, *My Literary Passions* and *Criticism and Fiction*, p. 201.

this desired truth is non-qualitative, for (as Valdes says) "he turns the objective of a powerful equatorial towards the heavenly spaces where gravitates the infinitude of the stars, just as he applies the microscope to the infinitude of the smallest insects; for their laws are identical." "In nature there is neither great nor small; all is equal." Howells quotes with approval Valdes' statement that "all is equally grand, all is equally just, all is equally beautiful, because all is equally divine."[88] Thus, the realist recognizes the value of the habitual, the normal, and the commonplace. To strive artistically for the Platonic "ideal" would be analogous to offering the scientist a "cardboard grasshopper" when a "real grasshopper"[89] is available.

In this context of a realism based on unqualified observation in a "world of actualities," it is important to notice what is an apparent limitation on the scientific basis of Howells' literary realism. Having equated the methods of the scientist and the novelist in the accomplishment of their ends, he implies in discussing Zola that a limitation of the scientific method exists for the novelist:

> "As to his methods, they by no means reflected his intentions. He fancied himself working like a scientist who has collected a vast number of specimens, and is deducing principles from them. But the fact is, he was always working like an artist . . . . . piecing it [experience] out by his own invention . . . . . He supposed that he was recording and classifying, but he was creating and vivifying."[90]

Thus, Howells feels, whatever similarity exists in their methods of observation, the scientist concludes by deducing and classifying and the novelist by imagining and creating. Howells subsequently declares however, that even this limitation on the novelist's use of scientific method is unnecessary; he questions "whether the imaginative author were not rather to blame for not having gone far enough in the right scientific fashion than for having taken that course at all."[91] He remarks that science has "as it were, caught the bread out of fiction's mouth and usurped the highest functions of imagination . . . . . science no longer waited for the apple to fall before inferring a law of gravitation, but went about with a stick knocking fruit off every bough in the hope that something suggestive would come of it."[92]

---

[88] *Ibid.*, p. 223; quoted by Howells from Armando Palacio Valdés.
[89] *Ibid.*, p. 198; see also "Editor's Study," *Harper's*, LXXVI, 155 (December, 1887).
[90] "Emile Zola," *North American Review*, CLXXV, 594 (1902).
[91] Howells, *Imaginary Interviews*, p. 212.
[92] *Ibid.*

Howells feels that perhaps "the mistake of fiction, when it refused longer to be called an art and wished to be known as a science, was in taking up the obsolescent scientific methods, and in accumulating facts, or human documents, and deducing a case from them, instead of boldly supposing a case, as the new science did, and looking about for occurrences to verify it."[93] The function of imagination, Howells feels, is thus as justifiable scientifically for the novelist as for the scientist, and the limitation of the scientific method for the novelist implied in his discussion of Zola is consequently eliminated in his later thought.

Consistent with his belief in objective observation of the actual phenomena of experience and in the function of scientific imagination, Howells demands a logical approach to fictional characterization. "Let fiction cease to lie about life," he writes, "let it portray men and women as they are, actuated by the motives and the passions in the measure we all know."[94] The characters of a novel must "have . . . . . a genuine function, and . . . . . contribute to the evolution of the plot by fulfilling their function."[95] In accordance with his belief in the evolutionary principle, Howells feels that fictional characterization must be true to its conditions of heredity and environment. Much as he admires George Eliot, he thinks that she fails "to account largely enough for motive from social environment."[96] "Differentiation by environment," Howells asserts, "is one of the subtle triumphs of the author's art,"[97] especially in dealing with women who were not, he thinks, adequately presented until biology and psychology were part of the novelist's equipment. He praises J. W. DeForest, whose Nellie Armitage "is a great little creature, quite true to herself and her circumstances."[98] Henry James' Daisy Miller "is destined by innate and acquired indiscipline to do the things she does."[99] Bathsheba Everdene as "a Hardy heroine, had a degree of control over her destiny which might almost be called free-will; at least she was not so much the prey of determination as most of the others . . . . . she is, upon the whole, the least wrought upon by her environment."[100] Howells observes that "in fact most of the women of Mr. Hardy could urge that they *had* to do the things they did, even when they wished to do them."[101] Realistic

---

[93] *Ibid.*, p. 213.
[94] Howells, *My Literary Passions* and *Criticism and Fiction*, p. 244.
[95] Howells, *Heroines of Fiction*, I, 114.
[96] Howells, *My Literary Passions* and *Criticism and Fiction*, p. 138–39.
[97] Howells, *Heroines of Fiction*, I, 75.
[98] *Ibid.*, II, 154.
[99] *Ibid.*, II, p. 171.
[100] *Ibid.*, II, p. 178.
[101] *Ibid.*, II, p. 177–8.

characterization, Howells feels, must take into account the scientific concern with hereditary and environmental determinism.

The style of Howells' novels suggests, in at least one respect, the influence of scientific methodology. In keeping with his belief that the realistic[102] novelist must portray actual phenomena, Howells seldom intrudes on the factual development of his story. He projects several characters with definite backgrounds in particular conditions and, in calm and rational language, describes, rather than directs, the resultant action. His style is thus generally less an example of decorative art than it is a vehicle of creative reportage.

Although Howells rejected, with a few exceptions, the unexpected and fortuitous type of plot development frequently relied on by many novelists, his familiarity with the principles of evolutionary science led him to question whether the world was not one of chance and moral relativism. In a world of natural selection and hereditary and environmental determinism, moral judgments are inconclusive, and it is this which explains in large measure Howells' tendency to withhold moral judgment in his novels. He seldom blames or praises; in general, he places his characters in definite conditions and lets them interact.

IV

Howells' principles of literary criticism[103] were influenced by science as considerably as were his theories of literary realism. Indeed, the intimate connection between literary theory and literary criticism rendered science an interrelated influence; acting upon one, it reacted proportionately upon the other. Rejecting intuitional or personalized[104] criticism, he insists upon a criticism based largely upon scientific methodology. Literature is like a plant that cannot be otherwise than it is, and rather than evaluating, the critic is to proceed as a botanist examining new plants and is "to place a book in such a light that the reader shall know its class, its function, its character."[105] The true critic will be a "gentle, dispassionate, scientific student of current literature" who will "classify and analyze the fruits of the human mind very much as the naturalist classifies the objects of his study."[106] Judicial criticism must "altogether reconceive its office"

---

[102] See G. W. Allen and H. H. Clark, *Literary Criticism from Pope to Croce* (New York, 1941), pp. 562ff.

[103] The best discussions are in D. G. Cooke, *Howells,* 1922, Oscar Firkins, *Howells,* 1924, and Rudolf and Clara Kirk's Introduction to *Howells* in the "American Writers Series" with an annotated bibliography by George Arms.

[104] See Firkins on this matter, p. 264ff.

[105] Howells, *My Literary Passions* and *Criticism and Fiction,* p. 209.

[106] *Ibid.,* p. 208.

and "reduce this to the business of observing, recording, and comparing; to analyzing the material before it, and then synthesizing its impressions."[107] "There is a measure of the same absurdity," Howells reasons, in the critic's "trampling on a poem, a novel, or an essay that does not please him as in the botanist's grinding a plant underfoot because he does not find it pretty . . . . it is his business to identify the species and then explain how and where the specimen is imperfect and irregular."[108]

More influential than scientific methodology on Howells' theories of literary criticism was evolutionary science, particularly as it was interpreted for him by a select group of literary historians like J. A. Symonds, T. S. Perry, and H. M. Posnett, as well as by minor critics like H. H. Boyesen, and possibly, George Pellew. Under the guidance of these men, Howells came to view literature as determined by the social and historical environment in which it was produced, and, desirably, as reflecting that environment in a realistic and truthful manner. Although he never moved to a monistic philosophy, Howells contends that literature obeyed the same law as all other human activity—the law of evolution. In the opening pages of *Criticism and Fiction,* he considers the question of "a final criterion for the appreciation of art" and finds a conclusion of J. A. Symonds in *The Renaissance in Italy* "applicable to literature as to the other arts":

> "Our hope with regard to unity of taste in the future then is, that all sentimental or academic seekings after the ideal having been abandoned, momentary theories founded upon the idiosyncratic or temporary partialities exploded, and nothing accepted but what is solid and positive, the scientific spirit shall make men progressively more and more conscious of these *bleibende Verhältnisse,* more and more capable of living in the whole. . . . The perception of the enlightened man will then be the task of a healthy person who has made himself acquainted with the laws of evolution in art and in society."[109]

In this context, criticism which cried for a national literature wasted its fallacious breath; writers could only create "what the nation likes, involuntarily following the law of environment."[110] Howells expresses this idea of literary determinism again in analyzing the differences between English and American fiction; by tracing these differences to their sources, he writes, "some-

---

107 *Ibid.,* p. 216.
108 *Ibid.,* p. 208.
109 "Editor's Study," *Harper's,* LXXV, 964–65 (Nov. 1887), and LXXVI, 153; also *My Literary Passions* . . ., pp. 193–94.
110 "Editor's Study," *Harper's,* LXXXIII, 964 (Nov. 1891).

thing will have been done toward explaining American novelists to themselves, and reconciling them to their performances as the necessary outcome of their conditions."[111] Also, discussing Hawthorne, to whom (with James) Howells traced the modern realists' concern with psychology, he states:

> "Men may invent anything but themselves, and it was not because Hawthorne made himself psychological, but because he was so, that in the American environment he bent his vision inward. His theory was that our life was too level and too open and too sunnily prosperous for his art, but it was an instinct far subtler than this belief that he obeyed in seeking the subliminal drama. Hawthorne was romantic, but our realists who have followed him have been of the same instinct, and have dealt mainly with the subliminal drama, too."[112]

Another evolutionary principle which influenced Howells' ideas of literary criticism was that of atavism—the reversion to a former type, or quality. "Personality resides rather in the motives than in the actions of men," but "there is another law," he writes, "Rather of the author's nature than his art, to which his allegiance is involuntary and insensible, and this is the law of recurrence in the type he treats."[113] Thus, George Eliot's Romola "is spiritually a reversion to Dinah Morris . . . . . as Tessa, her husband's ignorant little paramour, is a reversion to Hetty Sorel."[114]

Howells' contemplation of a world scientist, regarded as deterministic and relativistic, and the consequent tendency to withhold moral judgment in his novels, which has been previously considered in connection with his literary realism, is reflected as well in his ideas of literary criticism. His attitude towards moral judgment in a deterministic world is clearly expressed in his discussion of *Vanity Fair*. Describing Becky Sharp, Howells writes of Thackeray:

> "He is boisterously sarcastic at her expense, as if she were responsible for the defects of her nature and must be punished for her sins as well as by them. His morality regarding her is the old conventional morality which we are now a little ashamed of, but in his time and place he could scarcely have any other; after all, he was a simple soul and strictly of his epoch. A later and subtler time must do finer justice to a woman born and reared in dependence and re-

---

[111] Howells, *Heroines of Fiction,* II, 260.
[112] *Ibid.,* II, p. 261–62.
[113] *Ibid.,* II, p. 62.
[114] *Ibid.,* II, p. 63.

> pression. . . . . It is difficult to know what may be the lesson of a character so evilly conditioned that its evil was inevitable, but possibly it may be to move the spectator less to 'justice' than to mercy."[115]

Although Howells as a liberal disliked notions of "The Brahmin Caste" with which Dr. O. W. Holmes was associated, it seems probable that, as his neighbor, Howells must have been stimulated by this Dean of the Harvard Medical School who in his "medicated fiction" such as *Elsie Venner* (1861) and in scientific essays such as "Mechanism and Morals" and "Crime and Automatism" had developed advanced ideas about determinism and heredity and the view that if wrong-doers have little free-will they are not responsible and therefore deserve pity and scientific treatment rather than punishment. But Howells' noncommital essay on Holmes in *Literary Friends* provides no conclusive proof of any direct influence by Holmes. In his discussion of Scott's Effie and Jeanie Deans, Howells again condemns the application of an absolute standard of morality to a world in which character is relative to heredity and environment. He states:

> "We judge one another so inadequately and unfairly in the actual world . . . . . the light nature will be condemned for the deeds done in it as if they were done in a serious nature, and a serious nature will be honored for truth to itself as if it had overcome in this the weakness of a light nature. Especially among all peoples of Anglo-Saxon birth and breeding will the same inflexible measure of morality be applied, and the characterization of one who has done nobly will be thought greater than that of one who has not done nobly."[116]

Howells' faith in democracy influenced his ideas of literary criticism as it did his theories of literary realism. In a statement which reflects not only his democratic sentiments but also the influence of Darwin's evolutionary principles, Howells vigorously rejects personalized, qualitative criticism:

> "Literature is the whole world; it is the expression of the gross, the fatuous, and the foolish, and it is the pleasure of the gross, the fatuous, and the foolish, as well as the expression and the pleasure of the wise, the fine, the elect. Let the multitude have their truck, their rubbish, their rot; it may not be the truck, the rubbish, the rot that it would be to us, or may slowly and by natural selection become to certain of

---

[115] *Ibid.*, I, 194–95.
[116] *Ibid.*, I, p. 104.

them. But let there be no artificial selection, no survival of the fittest by main force—the force of the spectator, who thinks he knows better than the creator of the ugly and the beautiful, the fair and the foul, the evil and the good."[117]

Howells' widening familiarity with the principles of evolutionary science directed his admiration for many contemporary critics. Most important was his long friendship with Thomas Sargent Perry, much interested in the relation of science and realism, whom he credits with teaching him "the new and true way of looking at literature."[118] When Howells edited the *North American Review* for one issue (October, 1872), an article by Perry on "American Novels" appeared, presumably accepted by Howells, and Perry contributed heavily to the *Atlantic Monthly* during Howells' editorship.[119] The two friends co-edited the *Library of Universal Adventure by Sea and Land* (1888); as late as July, 1912, they collaborated on "Recent Russian Fiction," which appeared in the *North American Review*. Also, Howells reviewed Perry's *Evolution of the Snob* and praises it for the "wide knowledge and the scientific methods that distinguish his work in criticism from the *ad captandum* expression of likes and dislikes."[120] He commends Perry's essay, "The Progress of Literature," for its "vast scope and effective grasp" and characterizes it as regarding literature "as the reflection, sometimes conscious and sometimes unconscious, of several periods and peoples among whom it rose."[121] In 1886, Howells, who had opened in earnest the battle for realism, wrote Perry, "but isn't it strange that in all this vast land there should not be one intelligent voice besides yours on the right side?"[122]

When Howells, in 1886, reviewed the work of Hutcheson Macaulay Posnett, who based his literary history almost entirely on evolution, he strongly approved of the method but thought his friend Perry had already well illustrated it. "We cannot see," he writes, "that his [Posnett's] method is different or that his application of scientific theories to literature is different."[123] "Many flourishing critics," comments Howells, "will have to go out of business altogether if the scientific method comes in."

---

[117] Howells, *Daughter of the Storage,* (New York, 1915), p. 223.

[118] *Life in Letters of William Dean Howells* (edited by Mildred Howells; New York, 1928. 2 vols.), I, 379. See Virginia Harlowe's *Thomas Sargent Perry* (Durham, N. C., 1950) for Perry's interest in science and his relation to Howells.

[119] See *The Atlantic Index (1857–1888),* (Boston, 1889), pp. 165–170.

[120] "Editor's Study," *Harper's,* LXXIV, 160 (December, 1886).

[121] *Ibid.,* 161. See also Howells' very favorable review of Perry's *History of Greek Literature,* in *Harper's,* LXXXII, 802–04 (April, 1891).

[122] *Life in Letters,* I, 378. See the index to Vol. II for letters to Perry.

[123] "Editor's Study," *Harper's,* LXXIII, 318 (July, 1886); see also LXXX, 322 (December, 1889).

"Critics will have to know something of the *laws* of [the] mind, and of its generic history" and "the example lately set" by Posnett is "calculated to make many complacent authorities' heads ache and hearts fail them."[124]

Howells' recognition of the central influence of evolution is certainly evident in his praise of Perry and Posnett, who based their work on analogies between literature and biology and who held, Howells states, "that literature is from life, and that it is under the law as every part of life is."[125] This approval of Symonds, Perry and Posnett contrasts sharply with his earlier (1872) "friendly distrust"[126] of H. Taine's "distorted philosophy"[127] and of the "sparkling errors" of a "too inflexible and exclusive application of his theory." This is a bit misleading, however, for Howells in his *later* critical views did come close to Taine's theory of literature as determined by time, place, and race; and Taine in 1888 recognized Howells as a kindred spirit and was instrumental in getting *The Rise of Silas Lapham* translated and published in France.[128]

Howells' admiration for writers influenced by evolutionary thought strengthened a steady interest in "my friend Boyesen,"[129] his frequent house-guest, whose poem, "Evolution," appeared in the *Atlantic Monthly* in May, 1878. Boyesen's pioneer writings, especially his critical essays, explicitly invoked evolution as the main agent in ousting Romanticism and in inspiring realism. Fitly enough, Howells' judges Boyesen's development in fiction by the latter's own evolutionary principles, remarking that it has been "so strictly obedient to the laws of his origin and environment."[130] Allied to his respect for Boyesen was his interest in Björnsterne Björnson, whom Boyesen praises as being, "in the front rank of scientific radicalism."[131] Less well remembered than Boyesen, George Pellew also receives Howells' approval as "the most complete democrat, esthetically and mentally, that I ever knew," who "took one of the first steps in the direction of the new criticism—the criticism which studies, which classifies and registers."[132] Pellew, who had won the Bow-

---

124 *Ibid.*, LXXIII, 317–18.
125 *Ibid.*, 318.
126 *Atlantic Monthly*, XXVII, 396 (March, 1871).
127 *Ibid.*, XXX, 240 (August, 1872).
128 *Ibid.*, XXIX, 241 (February, 1872); and *Life in Letters*, I, 411–12.
129 *Life in Letters*, I, 172; see also 414 and 423–24.
130 "Editor's Study," *Harper's*, LXXIX, 477 (August, 1889).
131 See *Life in Letters*, I, 289–90 and Howells' review of Björnson's early work in the *Atlantic Monthly*, XXV, 504–12 (April, 1871). For Boyesen's remark on Björnson, see his "Scandinavian Literature," *The Chautauquan*, VIII, 283 (February, 1888).
132 Howells' "George Pellew," *Cosmopolitan*, XIII, 527 (September, 1892). See also Howells' favorable review of Pellew's *Life of John Jay* in *Harper's*, LXXXI, 642–43 (October, 1890).

doin prize at Harvard for his essay on Jane Austen and who defended Howells' realistic literary criticism,[133] was a friend of T. S. Perry and also of John Fiske, to whom he dedicated his manuscript work on metaphysics containing a chapter on literature which pleased Howells.[134] After Pellew's early death, the "Introduction" to a volume of his poems was written by Howells.

Like Pellew, Henry Mills Alden, who was editor of *Harper's Monthly* from 1869 to 1919, became closely associated with Howells after the latter had formulated his final principles. Alden, however, with whom Howells edited a series of Harper's Novelettes, quite possibly confirmed some of his beliefs. Certainly, Alden's policy of favoring the reticence necessary in a "family magazine" reinforced the reservations of Howells' realism. Alden also contends explicitly that "science in its quest of reality has registered the general progress toward emancipation from unreal fancies" and that "the abstract ideal to which we fly, escaping reality, ceases to have those virtues which we hoped to find in its tenuous atmosphere, and which, after all, are sensibly apparent to us only as we dwell in the real."[135] Yet, most relevant to the present discussion, Alden applied the concept of evolution to his literary theory; he accepted gradual, material progress but cited creative evolution as the source of genius in art and literature; he writes that progress "afforded permissive conditions for new species in the creative evolution of life and literature."[136] Howells, it will be remembered, remained closely associated with *Harper's* from 1886 to 1892 and from 1900 to his death in 1920.

Finally, it should be carefully noted that Howells takes his opening quotations (which serve as a sort of "text" for his sermon) in *Criticism and Fiction* from the British J. A. Symonds, many of whose ideas in his essay "On the Application of Evolutionary Principles to Art and Literature" (1890) Howells paraphrases. Symonds states his thesis as follows: "A type of art, once started, must, according to my view, fulfill itself, and bring to light the structure which its germ contained potentially. As this structure is progressively evolved, it becomes impossible to return to the past. . . . . To create a new type, while the old one is existent, baffles human ingenuity, because the type is an expression of the people's mind, and has its roots deep down in the stuff of national character. . . . . After meridian accomplishment,

---

[133] See *Life in Letters,* I, 412–14, 388.

[134] See *The Letters of John Fiske* edited by Ethel F. Fisk (New York, 1940), p. 532; also, Howells, "Pellew," *Cosmopolitan,* XIII, 529–30.

[135] See Alden's chapter, "What is Reality," pp. 43–53 of *Magazine Writing and the New Literature* (New York, 1908).

[136] Alden, *Magazine Writing and the New Literature,* pp. 163–64.

a progressive deterioration of the type becomes inevitable and cannot be arrested."

In his own specific literary criticisms, Howells favorably reviewed the work of Garland, Norris, Crane, and other novelists who showed the influence of contemporary scientific developments. He commends Frank Norris's *Octopus:*

> "The play of an imagination fed by a rich consciousness of the mystical relations of nature and human nature, the body and the soul of earthly life, steeps the whole theme in an odor of common growth. . . . ."[137]

The friendship of Howells and Garland, the admitted devotee of Taine and Spencer, is well known, and Howells wrote favorably on Garland's literary work.[138] Howells also championed the frank naturalism of Stephen Crane and, despite the lack of "smiling aspects," remained convinced that *Maggie* was a worthwhile novel.[139] Crane had explicitly written that he strove to teach that Maggie's becoming a prostitute was determined by her environment and therefore that she deserved pity. Discussing Zola's *La Terre,* Howells warns that it "is certainly not a book for young people" or for anyone "who finds himself the worse for witnessing in literature the naked realities of lust and crime"; however, he continues, "this said, it is but fair to add that it legitimately addresses itself to scientific curiosity and humane interest."[140]

Howells' literary criticism in practice exhibits an interesting dualism which contrasts with his expressed theories of criticism. On occasion, however, he does combine evolutionary science and literary criticism with impressive results; concerning the theater, he writes:

> "The fact is, the two kinds do not mingle well, but for a while yet we must have the romantic and the realistic mixed in the theatre. That is quite inevitable; and it is strictly in accordance with the law of evolution. The stage, in working free of romanticism, must carry some rags and tags of it forward in the true way; that has been the case always in the rise from a lower to a higher form; the man on a trapeze recalls the ancestral monkey who swung by his tail from the forest tree; and the realist cannot all at once forget the romanticist."[141]

---

[137] "Frank Norris," *North American Review,* CLXXV, 775 (Dec., 1902).
[138] See Howells' preface to Garland's *Main-Travelled Roads* (Chicago, 1893) and "Mr. Garland's Books," *North American Review,* CXCI, 523–28 (Oct., 1912).
[139] See Herbert Edward's "Howells and the Controversy over Realism in American Fiction," *American Literature,* III, 247 (1931), for proof that Howells continued to defend Crane's *Maggie.*
[140] "Editor's Study," *Harper's,* LXXVI, 642 (April, 1888).
[141] "Editor's Study," *Harper's,* LXXXIII, 478 (Sept., 1891).

Thackeray's Ethel Newcome, Howells asserts, "does not finally change her mind so much as have it changed for her by events and circumstances; and in this she, even more than Laura Bell, is like girls in life, and justifies herself as a work of the author's highest art."[142] He writes that "a truer art than Dickens's, or Dickens's time (these things are apparently chronical, rather than personal, in great measure) would have recognized a higher duty than the reader's comfort in the situation."[143] Despite his occasional application of this "new and true way of looking at literature," however, the bulk of Howells' later critical writing is personalized and qualitative appraisal, notably in *Literary Friends and Acquaintances*. But his *theory* of criticism was in a large measure evolutionary.

Howells was himself dissatisfied with his critical efforts; "in all this reviewing," he writes, "he had not once satisfied himself with his work. Never once had he written a criticism which seemed to him adequate, or more than an approximation to justice."[144] He felt himself bound in a convention of criticism whose nature "assumes to be and to do more than it can. Its convention is that it is an examination of a book and a report upon its qualities. But it is not such a report."[145] In place, then, of "the conventional verdicts and sentences of the courts of criticism," Howells would substitute "something stated and organized in the way of intelligent talk about books."[146] This non-qualitative scientific method of discussion rather than personal value-judgment would be consistent with his expressed principles of literary criticism but would include as well a large measure of the sympathetic recognition of an author's efforts which Howells was unable to avoid. "The sympathetic critics," he writes, are "the only real critics,"[147] and a reader's recognition of the author's meanings is "always more precious than the reports of the conventional critics." Since an author writes "for his readers and not for his critics, for pleasure and not for judgment," why should there not be "a critical journal embodying in a species of fragrant bouquet the flowers of thought and emotion springing up in the brains and bosoms of readers responsive to the influence of a new book?"[148] This, then, is the "something stated and organized in the way of intelligent talk" with which Howells would replace the conventional criticism of judgment and per-

---

142 Howells, *Heroines of Fiction*, I, 214.
143 *Ibid.*, p.147.
144 Howells, *Imaginary Interviews*, p. 303.
145 *Ibid.*, p. 302.
146 *Ibid.*, p. 303.
147 *Ibid.*, p. 223.
148 *Ibid.*, p. 304.

sonalized evaluation. By thus combining the scientific method advocated in his principles of literary criticism with the sympathetic appreciation revealed in the bulk of his critical writings, Howells would reconcile the evident dualism in his profession and practice. Although in his critical work he could never wholly escape a sympathetic recognition of an author's personal quality, Howells' own preference for realism and his theories of literary criticism and its intellectual bases for the interpretation of literary history were rooted in and nurtured by the developments of contemporary science.

V

Since Howells insisted upon the intimate relationship between literature and life, it is not surprising that many of the forces which influenced his literary ideas also conditioned his attitude towards political and social problems. Although his increasing concern with the problems of social evil and his search for their solution paralleled and in large measure was directed by his widening familiarity with the trends of contemporary science, the important influence of other forces must also be recognized. Howells' father had read "the writings of Emanuel Swedenborg, and had embraced the doctrine of that philosopher with a content that . . . . . lasted him all the days of his many years."[149] This atmosphere in his early years and home life was an influence which permeated Howells' thought and actions throughout the course of his life. It was an important element in his later insistence on the collective rather than the individual reform; he writes that Swedenborg maintained that "the regeneration which is to take place will be a social, not a personal effect; not so far as a man obeys God, but as far as he loves his fellow, is he saved."[150] Swedenborg had been in part a scientist and his insistence on the doctrine of the correspondence of the laws of physics and ethics is paralleled by Howells' insistence that the evolution of bodily structure will lead to the evolution (and improvement) of morals and ethical ideals.

Closely related to Howells' Swedenborgian emphasis on collective action to control the operation in society of the law of natural selection was his unending stress on the necessity of a Christian brotherhood. Recently returned from his consulship, he declared that Christianity is "the life of our political system."[151] The equalitarian brotherhood, which Howells believes

---

[149] Howells, *My Literary Passions* and *Criticism and Fiction,* p. 5.

[150] See Howells' review of Henry James Sr.'s, *The Secrets of Swedenborg,* in the *Atlantic Monthly,* XXIV, 762–63 (December, 1869).

[151] *The Atlantic Monthly,* XVIII, 253 (August, 1866).

essential to the survival of that democracy, is based largely on "a conception of fraternity such as Christ meant."[152] His great interest in Tolstoi also did much to reinforce Howells' Christian view of mankind's interdependence.

Howells was also influenced in his conception of a collectivism based on Christian brotherhood and social complicity by the Haymarket Riot of 1886. The repercussions of this unfortunate affair aroused Howells' social conscience to vigorous action, and, with *Annie Kilburn* in 1888, his major economic novels began to appear. In the preceding year, he had become interested in the speeches and writings of Laurence Gronlund and in the Socialist Labor Party.[153] (Gronlund drew on the Evolutionists considerably.) The importance of this influence on Howells' social attitudes is evident in the fact that he was a contributor in 1906 to the campaign fund of the Socialist Party to [whom] which he sent "a warm letter of encouragement."[154]

Having duly recognized the importance of these factors, one can affirm without danger of distorted emphasis that contemporary science was an influence of major proportions on Howells' attitude towards social evil and its remedy. Although inclined to regard himself as "the unscientific reader," Howells had "a fondness for books of popular science, perhaps because they too are part of the human story," and he especially liked books on medicine[155] and, after his friendship with John Fiske began in 1867, he became increasingly interested in the contemporary trends of evolutionary science. In this context, the development of Howells' concern with social problems was itself evolutionary, from a generally casual regard of social evil and the opinion that its solution lay within the existing social structure, his concern with the problems of society expanded and led him not only to criticize the existing social framework based on laissez-faire and ruthless competition, but to evolve the idea of a Utopian society to replace it.

In picturing this Utopian state, which he significantly names "the Evolution,"[156] Howells emphasizes the fact that each stage in its development is evolved from a previous and a lower one. The final stage in the development of his ideal state of Altruria is evolved from "the discipline of competitive conditions."[157] A similar evolutionary concept governs his attitude towards the

---

152 "Who Are Our Brethren," Century, XXIX, 932 (1895).

153 George Arms, "The Literary Background of Howells Social Criticism," *American Literature*, XIV, 261 (November, 1942).

154 Hillquit, Morris, *Loose Leaves from a Busy Life*, (1934), pp. 115–16.

155 Howells, *My Literary Passions* and *Criticism and Fiction*, p. 174.

156 Howells, *The Traveler from Altruria*, p. 266.

157 *Ibid.*, p. 291.

past and the concept of progress. Howells sees the past in a dual light; he admits the charm of some ancient institutions and usages which have lived on into a new and different world, yet he never allows this charm to blind him to the hideous conditions of a bloody and pitiless past. "It's because we have so many new and square things," he writes, "that we like the old, crooked ones."[158] Quebec "had the charm of those ancient streets, dear to Old-World travel, in which the past and the present, decay and repair, peace and war, have made friends in an effect that not only wins the eye, but, however illogically, touches the heart."[159] When he visited Pompeii, however, it led him "back into the dead past—the past which, with all its sensuous beauty and grace, and all its intellectual power, I am not sorry to have dead, and, for the most part, buried."[160] He loves Florence, "not because of that past which, however heroic and aspiring, was so wrong-headed and bloody and pitiless, but because of the present, safe, free, kindly, full of possibilities of prosperity and fraternity."[161] He does not regret that "we can never return to the past on the old terms,"[162] yet he recognizes that "the past is part of us; it can't be ignored any more than it can be destroyed."[163] It is necessary rather to recognize the past and to grow out of it than to attempt to ignore it or to destroy it. Howells remarks on "the slow progress from epoch to epoch,"[164] and feels that "we have only to evolve a little further."[165] He laments that Tolstoi "gropes for a hopeless reversion to innocence through individual renunciation of society instead of pressing forward to social redemption; . . .[166] the freed soul and the freed mind of man are working together for the elevation of the race through conscience illumined by science."[167] To carry out his idea of a Christian brotherhood, Howells advocates a socialism defined as the "gradual extension of the popular ownership to the things they [the people] believe naturally common to all."[168] "If some such conception of society could possess the entire State," he writes, "a higher type of civilization would undoubtedly eventuate."[169] From the mistakes of the past, through the efforts of the present,

---

[158] Howells, *A Chance Acquaintance,* (Boston, 1873), p. 187.
[159] *Ibid.,* p. 161.
[160] Howells, *Italian Journeys,* (Boston, 1867, 1890), p. 90.
[161] Howells, *Tuscan Cities,* (Boston, 1886), p. 122.
[162] Howells, *Literature and Life,* p. 302.
[163] Howells, *The Ragged Lady,* (New York, 1899), p. 356.
[164] *The Atlantic Monthly,* XXIV, p. 640 (November, 1869).
[165] Howells, *Literature and Life,* p. 246.
[166] "Lyof N. Tolstoy," *The North American Review,* CLXXXVIII, p. 857 (December, 1908).
[167] "Editor's Study," *Harper's Magazine,* LXXV, 964 (November, 1887).
[168] Howells, "Life and Letters," *Harper's Weekly,* XXXIX, p. 820, (August 31, 1895).
[169] Howells, *New Leaf Mills,* (New York, 1913, 1913), p. 154.

to realization in the future is the evolutionary development of Howells' Utopia. The past is a link and progress a transition in this evolutionary development; "there is an evolution in the moral, as well as the material world," his Reverend Mr. Peck says, "and good unfolds in greater good."[170]

The development of Howells' concern with social problems and their solution paralleled and, in large measure, was influenced by the development of his familiarity with evolutionary science. During the years immediately following his return to America in 1865, Howells' criticism of social conditions was confined within a general belief that the existing structure of society was fundamentally a good one. After a visit to New York in 1866, he attacks the New York street-car system, lack of sanitation, and lack of adequate housing and health facilities and concludes that "if we are better provided with ways and means for material comfort, have we gained also in self-reliant and industrious and simple habits?"[171] Howells feels at this time that a certain standard of civic responsibility is necessary, but that self-reliance and industrious and simple habits of the individual are more important in the solution of social problems. Discussing in 1869 Horace Greeley's autobiography, detailing his rise from "poverty and obscurity to distinction," Howells terms it the "perpetual romance" which "delights and touches all, for in this nation it is in some degree the story of every man's life or the vision of his desires."[172] In 1874, he not only glorifies free enterprise but ardently supports laissez-faire government; "the state which persistently meddles with the religious, domestic, and commercial affairs of its people," he writes, "dooms itself to extinction."[173]

During Howells' editorship of *The Atlantic* (1871–1881) he solicited and published a multitude of articles (averaging about two in each issue) dealing with social improvement and with the causes of depression. It is note-worthy, however, that none of these articles is by a spokesman of socialism, and the most radical of the articles merely advocates cooperatives. Howells expressed most admiration for Jonathon B. Harrison's articles, eight of which appeared in *The Atlantic* between October 1878 and 1879 and were collected in 1880 in a book entitled *Certain Dangerous Tendencies in American Life*. In Howells' review of the book, he agrees with Harrison that the "relief which may

170 Howells, *Annie Kilburn* (New York, 1889), p. 239–40.
171 "Minor Topics," *Nation*, II, 133 (February 1, 1866).
172 *The Atlantic Monthly*, XXIII, 260 (February, 1869).
173 Howells, "Mr. Parkman's Histories," *The Atlantic Monthly*, XXXIV, 603 (November, 1874).

come from better times is temporary and delusive," but he objects to the charge that Harrison's point of view is pessimistic:

> ". . . . . certainly nothing could be more inexact, unless pessimism consists in the recognition of needlessly deplorable conditions, and the expression of a belief that the sufferers have the cure in their own hands. If it is pessimism to show the rich what excellent types of character exist among working-men and their wives, and to teach the poor how a capitalist may necessarily be their friend, by all means let us have nothing but pessimism hereafter."[174]

Howells reflects his belief at this time that social improvement and progress result from self-reform and toleration between classes within the existing social and economic structure; he sums up Harrison's prescription for progress as the condition of all classes living "a simpler and honester life, resulting from the diffusion of real intelligence concerning its problems, from habits of frugality in spending and closeness in thinking, from home-training in unselfishness and benevolence, from a better understanding between the different stations and conditions of society."[175]

During the period of his association with *The Atlantic Monthly* (1866–1881) Howells was essentially a poet, a minor playwright, a writer of travel sketches, and the author of five novels such as *Their Wedding Journey* and *A Foregone Conclusion* in which he developed his descriptive abilities, plotting techniques, and characterization. By 1885, as his familiarity with the contemporary developments of evolutionary science widened, his novels had become studies of the interaction of character and environment. The evolutionary principle of hereditary and environmental determinism led him to believe in 1895 that "we are always mistaking our conditions for our natures, and saying that human nature is greedy and mean and false and cruel, when only its conditions are so."[176] Howells' Altrurian traveler observes that American competitive economic conditions " 'establish insuperable inequalities among you, and . . . . . forbid the hope of brotherhood which your polity proclaims.' "[177] In *The Quality of Mercy,* Howells describes the effect on Maxwell, the journalist, of his early environment:

---

174 Howells, "A New Observer," *The Atlantic Monthly,* XLV, 849 (June, 1880). (See L. J. Budd's excellent "Howells, the *Atlantic Monthly,* and Republicanism," *American Literature,* XXIV, 139–156, May, 1952.)

175 *Ibid.* See also his praise of Harrison in *Life in Letters,* II, 34.

176 "Equality as the Basis of Good Society," *Century,* m.s. XXIX, 67 (November, 1895).

177 Howells, *A Traveler from Altruria,* p. 98. See also *ibid.,* p. 56–57, 61–62, and "Letters of an Altrurian Traveler," *Cosmopolitan,* XVI, p. 268 (January, 1894).

> ". . . . . as for his hardness, that probably comes from his having had to make such a hard fight for what he wants to be in life. That hardens people and brutalizes them. . . . . If we had a true civilization a man wouldn't have to fight for the chance to do the thing he is fittest for, that is, to be himself."[178]

Criminals, too, he feels, are produced by evil environments; visiting a criminal court, he remarks that "these bad boys and girls came up and had their thrashing or their rap over the knuckles, and were practically bidden by the conditions of our civilization to go and sin some more."[179] "Almost any honest expression," he writes, "concerning the monotonous endeavor and failure of society to repress the monotonous evolution of the criminal in conditions that render his evolution inevitable, must seem pessimistic."[180] To expect people to rise above the conditions that produce them, he feels, would be as futile as to expect them "to overcome the attraction of gravitation."[181] Furthermore, Howells feels that just as long as evil circumstances are permitted to exist and warp human nature, moral condemnation is meaningless, for, "if a man is in conditions which hinder him from doing what he will, he can no more have honor than he can have shame."[182]

Howells' familiarity with the evolutionary principle of natural selection and its corollary principle of the survival of the fittest in a struggle for existence led him to believe that their parallels in the conditions of free enterprise and laissez-faire government, which he had formerly advocated, were responsible for most of the problems of social evil. He faces the realization with sturdy honesty; "it is not ill," he writes, "but it is very well to be confronted with the ugly realities, the surviving savageries, that the smug hypocrisy of civilization denies; for till we recognize them we shall not abate them, or even try to do so."[183] Free enterprise is delusive, he feels in 1894; "we had hugged so long the delusion of each man for himself, that we had suffered all reality to be taken from us."[184] In a competitive society, he states, a man "cannot be nobly unselfish without being a fool."[185] The struggle for existence in a competitive society is "pushing and pulling, climb-

---

178 Howells, *The Quality of Mercy,* p. 334.
179 Howells, *Impressions and Experiences,* p. 91.
180 *Ibid.,* p. 92–93.
181 "The Nature of Liberty," *Forum,* XX, 407 (December, 1895).
182 *Ibid.*
183 Howells, *Heroines of Fiction,* II, 92.
184 Howells, *The Traveler from Altruria,* p. 267.
185 Howells, *Through the Eye of the Needle,* (New York, 1907), p. 4. See also *Traveler from Altruria,* p. 201–2, *The Quality of Mercy,* p. 368, *Impressions and Experiences,* p. 234–35.

ing and crawling, thrusting aside and trampling underfoot, lying, cheating, stealing . . . . . covered with blood and dirt and sin and shame . . . . . to a palace of our own or the poor-house, which is about the only possession we can claim in common with our brothermen";[186] we should be, feels Howells, "heartily ashamed of our competitive conditions."[187] The economy of free enterprise which he had formerly glorified has become for him in 1900 "an ill-contrived economy, where it is vainly imagined that the material struggle forms a high incentive and inspiration."[188]

The material development of America following the Civil War must have been a consistent source of proof to Howells that natural selection and survival of the fittest lead to corruption and wide-spread misery and that conditions ought to be controlled for the higher good of society as a whole. The Haymarket Riot "indefinitely widened" his horizons and prompted him to "reading and thinking about questions that carry me beyond myself and my miserable literary idolatries of the past."[189] He became increasingly concerned with the problem of *counteracting* the operation in society of the evolutionary principles of natural selection and survival of the fittest; even literature, he felt, must be pressed into the service of evolving (through propaganda) other conditions than those which turn human nature into brute nature. "What literature was to do," he writes, "was to join political economy in making men so equal in fortune that there could be no deformity, no vulgarity in them which sprang from the pressure of need or the struggle of hiding or escaping its effects."[190] As a "soft" evolutionist, he looks forward to the time "when the beast-man will be so far subdued and tamed in us that the memory of him in literature shall be left to perish."[191] He praises Björnson, whose "political radicalism (after light idylls) has assumed the social and economic phase, apparently inevitable in the evolution of those who sympathize with the people."[192] With *Annie Kilburn* in 1888, Howells' own novels assumed a "social and economic phase" and developed his belief that the reform of social evil lies not in the self-reform of the individual within accepted social classes, but rather in the outer reform of the conditions which produce the evil.

---

186 Howells, *A Hazard of New Fortunes*, p. 507.
187 "Editor's Study," *Harper's Monthly*, LXXVII, 154 (June, 1888).
188 Howells, *Literary Friends and Acquaintances*, p. 287.
189 *Life in Letters*, I, 407–408.
190 Howells, *Seen and Unseen at Stratford on Avon*, p. 74.
191 Howells, *My Literary Passions* and *Criticism and Fiction*, p. 43.
192 "Editor's Study," *Harper's Monthly*, LXXVIII, 491 (February, 1889).

It has been previously observed that Howells' familiarity with the evolutionary principle of natural selection led him to view the world as one of chance and moral relativism. He could not, however, as a Swedenborgian and a Christian socialist, wholly accept the idea of a world so disorganized. With P. B. S. Ray in *The World of Chance,* Howells finally decides:

> ". . . . . somehow we felt, we knew, that justice ruled the world. Nothing, then, that seemed chance was really chance. It was the operation of a law so large that we caught a glimpse of its vast orbit once or twice in a lifetime. It was Providence."[193]

Earlier Basil March concludes that life is "law, though it seems chance."[194] The Altrurian traveler reports that his commonwealth has "eliminated chance."[195] Although natural selection leads to moral relativism and a fortuitous world, there is a higher law, Howells feels, to which man can make social forces conform. "If the human intelligence could be put in possession of the human body," he writes, "we should have altruism at once."[196] Through the operation of intelligence, human nature can control and change the conditions which produce the brute nature in man; moral law will reassert itself when natural selection is controlled by social cooperation. It is significant that Howells paid repeated homage to the co-discoverer of Darwinism, A. R. Wallace, because he became an ardent apostle of socialism and cooperation.

By 1894 Howells had come to believe that the competitive conditions which are the result of the operation in society of the evolutionary principles of natural selection and survival of the fittest must be changed if the social evils which they produce are to be remedied. He is convinced that "the economic solution of the 'riddle of the painful earth' is to be by emulation, not by competition."[197] Howells does not believe that "there is freedom where the caprice of one citizen can interfere with the comfort or pleasure of the rest."[198] Since character is conditioned by heredity and environment, he feels, human selection must evolve other conditions for the determination of character than those of "each successive personality crushing out and oversloughing some other, without that regard for proportion and propriety

---

193 Howells, *The World of Chance,* p. 375.
194 Howells, *A Hazard of New Fortunes,* p. 507.
195 Howells, *A Traveler from Altruria.*
196 Howells, *The World of Chance,* p. 99.
197 "Howells' Unpublished Prefaces," Arms, George, (ed.) *The New England Quarterly,* XVII, 589–90 (December, 1944).
198 Howells, *Impressions and Experiences,* p. 281.

which only the sense of a superior collective right can inspire."[199] The weak, threatened by natural selection, must be protected by human selection; "it is a law which must be divine," he writes, "though we find it embodied in human justice nowhere out of fiction, that the weak and slight nature has a paramount right to our sympathy when it suffers."[200] The conditions of a competitive economy which create an artificial class structure must be changed if the effects of natural selection in society are to be circumvented; between the rich and the poor, he argues, there can be "no common ground . . . . . even in the work of reform" despite "all stooping from above or straining from below."[201] To those who would maintain the idea that rich and poor, strong and weak, and the competition between them are fundamental factors of human nature, Howells replies in 1907:

> "the capitalistic world believes human nature cannot be changed, though cannibalism and slavery and polygamy have all been extirpated in the so-called Christian countries, and these things were once human nature, which is always changing, while brute nature remains the same."[202]

To those others who agree that the problems of social evil are the results of natural selection operating in society but who pessimistically argue that the hope of changing these conditions is idle and Utopian, Howells answers that "every fruitful and hopeful scheme of modern civilization is based upon what were once Utopian dreams."[203]

It must be emphasized that Howells wished to change the conditions of competitive society rather by evolutionary than by revolutionary means. He does not advocate the destruction of civilization and the return to a primitivistic state of nature based on the concept of natural goodness; Howells felt that only civilization and a democratically organized government could control the brute nature in man. When man "sacrifices himself to the community," he writes, he then "ceases to be wholly savage."[204] Only the inherited wisdom of society, Howells believed, could preserve man from wasting himself in an animal-like struggle for existence. He advocates a change in the competitive conditions of society by the evolutionary growth of a Christian socialism within the structure of civilization rather than by its revolutionary destruction. Howells felt that man is not inher-

---

199 Howells, *Roman Holidays,* (New York, 1908), p. 120.
200 Howells, *Heroines of Fiction,* II, 55.
201 Howells, "American Civic Life," *Literature,* III, 475 (November 19, 1898).
202 Howells, *Through the Eye of the Needle,* p. 219.
203 Howells, "Diversions of the Higher Journalist," *Harper's Weekly,* XLVII, 1220 (July 25, 1903).
204 "Who Are Our Brethern?" *Century,* m.s. XXIX, 932 (1895).

ently and ineradicably evil in mind or character; he is only the sum of his experience:

> "Experience, the whole of what we have known up to a certain time, not the process of logic, is what prepares us for the reception or rejection of this postulate or that . . . . ."[205]

Therefore, he writes, "to have human brotherhood . . . . . you must change human conditions," or the social contexture which contains and constitutes experience, "and this is quite feasible."[206]

Howells believed that such a change is necessary because evil involves the innocent in its consequences. It is not enough merely to punish evil; it must be eliminated by changing the environment which produces it, because, "there's really no measuring the sinuous reach of a disaster . . . . . it strikes from a coil then seems to involve everything."[207] "You can't strike at it," Howells writes of evil, "without wounding the best and gentlest."[208] Atherton, in *A Modern Instance,* states:

> " 'We're all bound together. No one sins or suffers to himself in a civilized state—or religious state; it's the same thing. Every link in the chain feels the effect of violence, more or less intimately. We rise or fall together in a Christian Society.' "[209]

Evil, therefore, must be eliminated, not punished, and Howells looks forward to the time when "that military ideal of duty which is so much nobler than the civil ideal of self-interest . . . . . will yet become the civil ideal, when the peoples shall have learned to live for the common good, and are united for the operation of industries as they are now for the hostilities."[210]

To achieve this goal by changing the competitive conditions of society, Howells would evolve a social brotherhood and an economic collectivism to complete the promise of political democracy. He asks his readers "to consider whether a public management of public affairs is not as well in economics as in politics,"[211] and, although the "world . . . . . is not yet so sternly collectivistic as I could wish,"[212] he hopes that there is "a growing

---

205 "Editor's Study," *Harper's,* LXXX, 806 (April, 1890).

206 "Equality as the Basis of a Good Society," *Century,* XXIX, 67 (Nov., 1895).

207 Howells, *The Quality of Mercy,* p. 88.

208 Howells, *The Son of Royal Langbrith,* p. 112.

209 Howells, *A Modern Instance,* p. 474. This doctrine of social "complicity" was first consciously elaborated in *The Minister's Charge* (Boston, 1887); see pp. 29, 240. It also underlies the basic judgments of *The Quality of Mercy.*

210 Howells, *Literature and Life,* p. 151.

211 Howells, "Letters of an Altrurian Traveler," *Cosmopolitan,* XVI, 261 (January, 1894).

212 Howells, *Roman Holidays,* p. 287.

sense in Americans that what is common is the personal charge of every one in the community."[213] Howells considers himself "a collectivist, with a firm belief in the government ownership of railroads."[214] Thus the problems of industrialism as well as the implications of evolution helped inspire his revolt from the competitive struggle for existence. He feels that only public control of housing is adequate protection against the self-interest of landlords:

> "Upon the present terms of leaving the poor to be housed by private landlords, whose interest it is to get the greatest return of money for the money invested, the very poorest must always be housed as they are now. Nothing but public control in some form or other can secure them a shelter fit for human beings."[215]

The concept of social brotherhood with which Howells would augment his economic collectivism and political democracy has been previously described. He advocates a social structure based on the equalitarian principles of Christ, "whose doctrine we seek to make our life as He made it His."[216] "In his responsibility for his weaker brethren," writes Howells, "he was Godlike, for God was but the impersonation of loving responsibility, of infinite and never-ceasing care for us all."[217]

Howells' religious views also reflect the influence of his familiarity with the developments of contemporary science. Reared in the home atmosphere of his father's Swedenborgianism, he also "read somewhat of the theology of the Swedenborgian faith I was brought up in."[218] It was perhaps from this background that he acquired the tendency towards super-rationalism and mysticism which never completely left him throughout his life. In his youth Howells was grateful for a touch of the sort of wisdom which we are losing sight of in these hard days of science and fact, and he reviewed Farrer's *Life of Christ* sympathetically and regarded *Jesus and His Biographers* as epoch-making.[219] He continued to retain "fond dreams of a future life . . . . . despite the hard skeptic air of our science-smitten age."[220] Although his faith in the existence of a human soul and his hope of immortality was never wholly destroyed, his expanding familiarity with the principles of evolutionary science did cause

---

213 Howells, *Impressions and Experiences*, p. 224.
214 Howells, *Roman Holidays*, p. 273.
215 Howells, *Impressions and Experiences*, p. 149.
216 Howells, *A Traveler from Altruria*, pp. 299–300.
217 Howells, *The Minister's Charge*, p. 459.
218 Howells, *My Literary Passions* and *Criticism and Fiction*, p. 174.
219 Howells, *Atlantic Monthly*, XXXIV, 492 (October, 1874).
220 *Atlantic Monthly*, XXXV, 105 (Jan., 1875); XXXIV, 492 (October, 1874).

him to turn temporarily to agnosticism and an emphasis on the methods of science rather than on super-rationalism. Looking back in 1918 over his life, he states that "the [scientific] methods of the inquiry . . . . . turned us from believers to agnostics when Evolution cut the ground of our faith from under us."[221] "I got caught," Howells writes in 1915, "in the wave of agnosticism in the survival-of-the-fittest times, and found I couldn't put up a prayer in the old gospel terms. So I left off."[222]

He never wholly lost, however, his basic faith in the existence of a human soul and its immortality; after his temporary agnosticism, he turned to the hope that science and its methods would find a rational substantiation for his belief. Miss Hannah Belcher states:

> "For a while in the years near the turn of the century he almost persuaded himself that he had the final solution in the scientists' exploration of the supernatural. Then he saw limits and returned to intuitive faith."[223]

In this return to intuitive faith, Howells never reconciled his belief in scientific methodology with its inability to determine truth in psychical and spiritual realms. "His loss of confidence," Miss Belcher feels, "made it impossible for him to share consistently the happy calm of Fiske."[224] Howells was able, however, to derive "immense consolation" from "a paper by a man of that science which deals with life on strictly physical lines . . . . . because it reaffirmed that the soul has not only its old excuse for being in the unthinkability of an automatic universe and the necessity of an intentional first cause, but with Evolution, in the regard of some scientists, tottering on its throne, and Natural Selection entering the twilight into which the older pagan deities have vanished, is newly warranted in claiming existence as that indestructible life-property or organizing power which characterizes kind through kind from everlasting to everlasting."[225]

In 1902, Howells used the outcome of the Boer War to reinforce his religious optimism; "once more," he writes, "we have reason to doubt if God is altogether on the side of the strongest battalions."[226] He continues:

---

221 "Editor's Easy Chair," *Harper's Monthly,* CXXXV, 884, (November, 1917). Cf. *ibid.,* CXXXVI, 603 (March, 1918).

222 "Editor's Easy Chair," *Harper's Monthly,* CXXX, 309 (January, 1915).

223 Belcher, Hannah, "Howells' Opinion on the Religious Conflicts of his Age as Exhibited in Magazine Articles," *American Literature,* XV, 262–78 (Nov., 1943).

224 *Ibid.*

225 Howells, *Imaginary Interviews,* pp. 314–15.

226 "A Suggestion from the Boer War," *Harper's Weekly,* Part I, XLVI, p. 747 (June 14, 1902).

"It would be interesting to trace the rise of that atheistic superstition back to the science which recently felt itself authorized to affirm, when it was never authorized to do more than inquire. The brutalization of the civilized world, within the last three or four decades, undoubtedly began with the misinterpretation of evolution, when the strongest read itself into the doctrine of the survival of the fittest. This gross delusion took practical form in the armament of nations [cf. Admiral Mahan's work] and each vied with the other in maintaining hundreds of thousands of soldiers, and in floating the mightiest navies .....

"Those who wish the world well, in fact, have the consolation ..... of reasonably concluding that God is not yet sleeping, or gone on a journey, but is looking after human affairs in the way we used to believe before the survival of the fittest seemed to displace His ancient Providence."[227]

Much evidence has been presented to show the influence of science on Howells' literary and social thought. But it must also be recognized that Howells did not completely and systematically adopt a scientific approach to life. In his intellectual maturity, he still felt that many of the sciences might be "useless information because they so rapidly denied and superseded themselves," and that "till science has ceased to change her mind," men "need not hastily surrender any long cherished beliefs at the behest of science."[228]

Throughout his life, Howells retained a basic religious core which was never wholly relinquished or eradicated. In his period of social and political rationalism, he never lost a working dualism of mind and soul which refused to surrender the hope of immortality, "those fond hopes of eternal life which most of us cherish."[229] He lauds his friend, John Fiske, for buttressing this hope of immortality with Evolution, and continues:

" 'Till some other scientist, or philosopher of science, came to prove the contrary, that hope could not be taken from men, and as yet that hope remains to us. Indeed the general trend of science, in recognizing the unity of the universe, is to the support and lasting establishment of that hope."[230]

---

[227] *Ibid.*

[228] "Editor's Easy Chair," *Harper's*, CIX, 481 (August, 1904); "Editor's Study," *Harper's*, LXXVIII, 158 (December, 1888); *Ibid.*, LXXXI, 967 (November, 1890).

[229] *Atlantic Monthly*, XXXII, 105 (July, 1873). See Hannah G. Belcher, "Howells' Opinions on the Religious Conflicts of His Age as Exhibited in Magazine Articles," *American Literature*, XV, 262–78 (November, 1943), for a summary of Howells' changing attitude toward religion. Mr. and Mrs. Rudolf Kirk have uncovered an unpublished letter written when Howells was eighty years of age to Mrs. John Piatt; he speaks of the dreams of his dead wife and declares that "after long unbelief I am getting back some hope again."

[230] "Editor's Easy Chair," *Harper's*, CVIII, 642 (March, 1904).

"But we should still hold with the Soul a little,"[231] he remarks, and confesses that "where I cannot believe, there I often trust; and as all faith is mystical, I would have the bereaved trust their mystical experiences."[232] But even this trend in Howells' later thought is not completely out of accord with the trend of scientific thinkers of the age, for Howells had in 1891 praised the pragmatic William James as "one of the few scientific men who do not seem to snub one's poor humble hopes of a hereafter,"[233] and James' *Varieties of Religious Experience* (1902), while treating religion from the scientific and psychological point of view, argued that even mysticism may for certain individuals have value "from the biological point of view" and that the significance of religious states of mind "must be tested not by their origin but by the value of their fruits." And of course Fiske had reconciled his faith in science and theistic immortality.

In conclusion, the evidence presented should make it clear that, while Howells never became a complete rationalist or materialist, science did in one way or another help to inspire much of his thought. In literary theory and practice, as well as in criticism, his passion for truth, for freedom of discussion, and for a realism based not on the exceptional or the erratic but on the law of averages owed much to science. For example, he argues that before the rise of the evolutionary age "a tendency towards a more scrupulous tone seems to have been the effect of the general revival of religion at the close of the last century, which persisted down to that time in our own century when the rise of scientific agnosticism [cf. Robert Ingersoll] loosed the bonds of expression. Now again of late years men and women in the best company talk together of things which would not have been discussed during the second and third quarters of the century."[234] Howells' later recognition of scientific theories of the determinism of heredity and environment reinforced his native Christian charity of heart and led him to advocate sympathetic and appreciative literary criticism (as opposed to the harshly judicial) and to advocate a more understanding and constructive attitude toward wrong-doers regarded as not entirely responsible. He urged changing the bad social and environmental conditions which he thought encouraged wrong-doing. Science helped Howells maintain a logical frame of reference for his analysis of social evils and strengthened his tendency to search for the

[231] *Ibid.,* CXXVIII, 151 (December, 1913).

[232] *In After Days* (a collection of essays by many authors; New York, 1910), p. 5. Howells' essay is entitled "A Counsel of Consolation."

[233] *Life in Letters of W. D. Howells,* I, 14.

[234] Howells, *Heroines of Fiction,* I, 40.

cure of the ills of society in cooperative social action and a mild collectivism inspired in part by evolutionary ideas of interdependence and the "complicity" of all mankind. He realized that science and technology were creating a new and complicated industrial environment and that a fruitfully human adaptation to this new environment could be achieved only by modifying our traditional laissez-faire habit of free competition in the direction of governmental regulation for the good of all. While some conservative thinkers such as W. G. Sumner[235] insisted that the evolutionary struggle for existence sanctioned ruthless competition, Howells concluded after 1890 that evolution had merely proved how ruthless and rapacious completely unrestrained men can be if merely left to follow what even the scientific Huxley attacked as a natural "gladitorial" theory of ethics. To that extent he reacted *against* science, or rather wished to be realistic in recognizing that competitive men need ethical and governmental control. It should be clear that he has little in common, in his socialism, with Marxian ideas of harsh materialism and class-hatred; his socialism owed much of its positive ideal of brotherhood and sympathy to the broad tradition of Christian charity and his middle-western nurture in Swedenborgian and Quaker ideas of fellowship and social solidarity. His *Traveler from Altruria,* embodying his later Christian socialism, attacks the complacent view that the class "divisions among us are rather a process of natural selection" as, for example, in his story about meritorious teachers who are supposed to rely supinely on "the process of natural selection to determine whether they shall finally be teachers or waiters."[236] And finally along with Howells' faith in Christian brotherhood, science—especially as interpreted by his friends Fiske and William James—provided a reassuring foundation, beyond despair and individualistic retreat, on which to build hopes of a growing mastery of a distinctively social and humane life on earth and some degree of hope in a non-materialistic destiny. While many of Howells' contemporaries such as Mark Twain and Henry James eventually approached defeatism, Howells appears to have been a pathfinder and in his serene constructiveness he appears to have been distinctive in having been in pioneer accord with the way the United States actually has in the twentieth century managed, gradually and without internal violence, to supplement

---

[235] Although Richard Hofstadter's *Social Darwinism in American Thought* (Philadelphia, 1944) does not deal at length with Howells since novelists are excluded, the book is relevant for purposes of orientation brilliantly handled.

[236] *Traveler from Altruria,* (New York, 1894), pp. 12–13.

competition with cooperation and some degree of governmental regulation for the good of all. His views of science are not entirely consistent, as we have seen, but one can hardly account for his development as a novelist, critic, and social commentator if one ignores the role of science in his thought. And of course his reactions to science take on much greater significance when one remembers his vast articulateness (in forty novels, twenty-three plays, eleven travel books, eight volumes of literary criticism, and nearly seventeen hundred book reviews in which he served as the arbiter of American taste) and the fact that more than any other writer of his time he is generally regarded as our *representative* spokesman.[237]

---

[237] In the Introduction to Howells' *Rise of Silas Lapham* (1951) I have treated the representative quality of this book, partly, in relation to ideas associated with evolution.

PROCEEDINGS OF THE ACADEMY

1951

The 81st Annual Meeting of the Academy was held April 13 and 14, 1951 at Milwaukee–Downer College with headquarters at Pillsbury Hall in Sabin Hall. Approximately 120 members and guests were registered. The following program was presented.

ACADEMY SECTION

April 13, 1951

The meeting was called to order by President William C. McKern followed by an address of welcome by Dr. Lucia R. Briggs, President of the Milwaukee–Downer College. Papers were presented as follows: Howard K. Suzuki, Marquette University, *Geographic variations in the wood frog (Rana sylvatica) in North America;* Albert Fuller, Milwaukee Public Museum, *Natural areas in Wisconsin;* Raymond H. Reis and Frank DiPierro, Marquette University, *Spontaneous change of form of the green hydra, Chlorohydra viridissima;* Floyd E. Morbeck and John W. Saunders, Jr., Marquette University, *The amino acid, tyrosine, as chromogen in the synthesis of melanin pigments in the skin of the fowl;* Dorothy R. Jutton and Helen T. Parsons, University of Wisconsin, *Vitamin B_{12} activity in feces of normal human subjects;* Mary E. Pankou (introduced by James C. Perry), Marquette University, *The study of the possible recovery of the testis and related organs of the golden hamster from damage produced by estrogen;* Irene M. Serafin (introduced by James C. Perry), Marquette University, *Observations on the possible recovery of the testis and related endocrine glands of the vasectomized male golden hamster following prolonged estrinization;* John P. O'Brien and Maureen J. Tobin, Marquette University, *Some factors influencing tissue responses to X-radiation;* Quentin LaHam and John P. O'Brien, Marquette University, *Radiosensitivity of larval urodele tissues in relation to metabolic rate obtaining at the time of exposure;* James E. Hackett (introduced by E. F. Bean), University of Wisconsin, *The birth and development of ground-water hydrology—a historical summary;* Hugo W. Rohde, Oconomowoc, *A history of Milwaukee breweries;* H. A. Schuette, University of Wisconsin, *Butler's "The Feminine Monarchie";* Robert H. Irrmann, Beloit College, *Work-diaries of Ohio farm hands, 1844–1845;* Berenice Cooper, Wisconsin State College, Superior, *The Abbé Prévost and the modern reader;* Donald B. King, Beloit College, *The appeal to religion in Greek rhetoric.*

ACADEMY SECTION

April 14, 1951

Katherine G. Nelson, Milwaukee–Downer College, *One hundred years of earth science at Milwaukee–Downer College;* Cyril C. O'Brien, Marquette University, *Recent trends in educational psychology with some implications for teacher training;* Nick J. Topitzes, Marquette University, *A program for the selection of trainees in physical medicine in Wisconsin;* Pauline Tepe and Raymond H. Reis, Marquette University, *A comparative study of the renal vascular patterns and their relation to the vena cava posterior* *and the dorsal aorta;* Clifford J. Dennis, University of Wisconsin, *The Membracidae of Wisconsin;* John P. Eastwood, University of Wisconsin, *The biology and taxonomy of Wisconsin blowflies.*

JUNIOR ACADEMY SECTION

April 14, 1951

Audrey Hardiman, Aquinas Science Club, Aquinas High School, La Crosse and John Bloxdorf, Seminar Club, Mary D. Bradford High School, Kenosha, Co-presidents of the Wisconsin Junior Academy of Science, presiding. Thomas Koerber, Science & Camera Club, Messmer High School, Milwaukee, *Experiments in entomology and hibernation of small animals;* Larry Horwitz, Waukesha High School, Waukesha, *The electromagnetic balance;* Marjorie Call, Nature Club, Appleton Senior High School, Appleton, *Analyses of milk;* Lee T. Rozelle, Central High School Science Club, La Crosse, *Eggs-ray;* Patrick McKeough, Science Club, Wausau Senior High School, *Electrochemistry;* Ted Olson, Chemistry Club, Lincoln High School, Wisconsin Rapids, *Induced radioactivity;* Audrey Hardiman, Aquinas Science Club, Aquinas High School, La Crosse, *The effect of two hormones from the adrenal gland on rats;* Willard Bruss, Biology Club, Washington High School, New London, *Care of hamsters;* Don Schlafke, Nature Club, Appleton Senior High School, Appleton, *Experiments with Drosophila;* Alice Engelhard, Aquinas Science Club, Aquinas High School, La Crosse, *The familiar ferment-yeast;* Edward Oakes, Chemistry Club, Lincoln High School, Wisconsin Rapids, *Chromatography;* Myron A. Schroeder, Science & Camera Club, Messmer High School, Milwaukee, *Extraction of caffeine.*

ANNUAL ACADEMY LECTURE

The annual Academy dinner was held on April 13, 1951 at Kimberly Union. President William C. McKern of the Milwaukee Public Museum gave the presidential address on *Prehistoric Pioneers in Wisconsin.*

ACADEMY BUSINESS MEETING

The annual business meeting was held in Sabin Hall with President W. C. McKern presiding.

The following members were elected to Life Membership for long and meritorious service to the Academy: W. H. Barber, Ripon College; B. O. Dodge, New York City; Michael F. Guyer, University of Wisconsin; and Warren J. Mead, Belmont, Massachusetts.

A resolution was adopted by the unanimous vote of the Academy as follows:

WHEREAS: The Wisconsin Academy of Sciences, Arts and Letters has suffered a great loss in the deaths of five outstanding members during the year 1950–51, and

WHEREAS: the Academy wishes to recognize its indebtedness for their inspiring interest and leadership,

Be It Resolved: that the Wisconsin Academy of Sciences, Arts and Letters herewith express its lasting appreciation for the long, intelligent and faithful service given throughout their membership by Professor Emeritus Edward E. Bennett, President Emeritus Edward A. Birge, Professor Emeritus Philo M. Buck, Jr., Dean Emeritus Frederick E. Turneaure and its long-time and devoted Secretary Professor Banner Bill Morgan, and, further,

Be It Resolved: that a copy of this Resolution be inscribed in the official minutes of the organization.

H. A. SCHUETTE
CARL WELTY

A committee on nominations composed of O. L. Kowalke, E. S. McDonough, L. E. Noland, Chmn., R. K. Richardson, and H. A. Schuette presented the following slate of officers which were unanimously elected for the next Academy year:

President: E. L. Bolender, Wisconsin State College, Superior
Vice-President in Science: Alfred M. Fuller, Milwaukee Public Museum
Vice-President in Arts: Roger C. Kirchhoff, State Architect
Vice-President in Letters: Lester W. J. Seifert, University of Wisconsin
Secretary-Treasurer: Robert J. Dicke, University of Wisconsin
Librarian: H. O. Teisberg, University of Wisconsin
Publications Committee: Robert Irrmann, Beloit College

WISCONSIN ACADEMY OF SCIENCES, ARTS AND LETTERS ENDOWMENTS AND ASSETS

April 1, 1951

1.	U. S. Treasury Coupon Bond 1692B	$1,000	
2.	U. S. Treasury Coupon Bond 12894D	500	
3.	U. S. Savings Bond Registered Series G–M1696059G	1,000	
4.	U. S. Savings Bond Registered Series G–C1563347G	100	
5.	U. S. Savings Bond Registered Series G–C1563348G	100	
6.	U. S. Savings Bond Series F–D494206F	500	
7.	U. S. Savings Bond Series F–M989457F	1,000	
8.	U. S. Savings Bond Series G–C3389339G	100	
9.	U. S. Savings Bond Series G–C3457898G	100	
10.	U. S. Savings Bond Series G–C3512841G	100	
11.	U. S. Savings Bond Series G–C3560656G	100	
12.	U. S. Savings Bond Series G–C3564110G	100	
13.	U. S. Savings Bond Series G–C4154481G	100	
14.	U. S. Savings Bond Series G–C5044011G	100	
15.	U. S. Savings Bond Series G–C5044012G	100	
16.	U. S. Savings Bond Series G–C5074307G	100	
17.	U. S. Savings Bond Series G–C5074308G	100	
18.	U. S. Savings Bond Series G–C5463975G	100	
	Total Amount of Endowment		$5,300
19.	U. S. Savings Bond Series G–C2386504G	$ 100	
20.	U. S. Savings Bond Series G–C2386505G	100	
21.	U. S. Savings Bond Series G–C2386506G	100	
22.	U. S. Savings Bond Series G–C2386507G	100	
	Current Assets Invested in U. S. Bonds		400
23.	Savings Account No. 3262 (4/1/51)		270.11
24.	Savings Account No. 498 (Vol. 39 sales)		51.00
	Grand Total		$6,021.11

AARON J. IHDE
Secretary-Treasurer

The contents of the safe deposit box and the savings account were found in order as reported above for the date April 1, 1951.

AUDITING COMMITTEE
E. F. BEAN
HAROLD R. WOLFE

WISCONSIN ACADEMY OF SCIENCES, ARTS AND LETTERS TREASURER'S REPORT

April 1, 1951

RECEIPTS

Carried forward in Treasury March 31, 1950	$1,144.64	
Dues received from April 1, 1950 to March 31, 1951	849.00	
Sale of reprints of Volume 40, Part 1	337.00	
Sale of publications	167.65	
Interest on endowment and other investments	112.04	
Grant-in-aid for research from A.A.A.S.	108.00	
Receipts from Junior Academy	54.46	
Express collected	3.04	
Donation (A. L. Schlaeger)	2.00	
State of Wisconsin (for publication of *Transactions*)	2,681.38	
Total Receipts		$5,459.21

DISBURSEMENTS

Junior Academy expenses		$ 69.69	
A.A.A.S. grant-in-aid to C. C. O'Brien		108.00	
Cost of reprints from Volume 40, Part 1		337.00	
Transfer to savings account No. 3262		65.79	
Transfer to savings account No. 498 (Vol. 39 income)		6.00	
Operating expenses			
Envelopes, labels, etc.		49.75	
Annual meeting expenses		148.96	
Postage and incidentals		89.66	
Safety deposit box rental		4.80	
Secretarial allowance—B. B. Morgan		200.00	
Secretarial allowance—A. J. Ihde		100.00	
Publication expenses			
Printing and binding, 1,500 copies Vol. 40, Part 1	$2,348.50		
Engravings for Vol. 40, Part 1	150.36		
Engravings for Vol. 40, Part 2	182.52		
		2,681.38	
Total Disbursements			$3,861.03
Balance, April 1, 1951			1,598.18

AARON J. IHDE
Secretary-Treasurer

The Auditing Committee has examined the accounts of the Treasurer and has found them in order.

AUDITING COMMITTEE
E. F. BEAN
HAROLD R. WOLFE

PROCEEDINGS OF THE ACADEMY

1952

The 82nd Annual Meeting of the Academy was held April 25 and 26, 1952 at Ripon College with headquarters at Ingram Hall. Registration was 121 members and guests representing 15 Wisconsin communities. The following program was presented.

ACADEMY SECTION

April 25, 1952

The meeting was called to order by President E. L. Bolender followed by an address of welcome by Dr. Clark G. Kuebler, President of Ripon College. Papers were presented as follows: Ernest F. Bean, Wisconsin Geological and Natural History Survey, *Oil exploration in Wisconsin;* Merritt Y. Hughes, University of Wisconsin, *Edmund Spenser, 1552–1952;* Robert J. McGray and E. S. McDonough, Marquette University, *Investigations into the fungistatic activity of an alcohol-soluble extractive of Catalpa heartwood;* Berenice Cooper, Wisconsin State College, Superior, *The Abbé Prévost and the Jesuits;* F. R. Whitesell, University of Wisconsin, *Corista, or the fireproof bird;* Emil P. Kruschke, Milwaukee Public Museum, *Report on Wisconsin Crataegus—collecting and preparing of complete herbarium specimens;* Raymond F. Shumard, University of Wisconsin, *Some effects of mineral supplement on sheep infected with stomach worms;* Charles L. Fluke, University of Wisconsin, *The Syrphidae of the Great Lakes Region;* J. A. Belli, J. P. O'Brien and J. W. Saunders, Jr., Marquette University, *Exposure to X-radiation of localized areas of mammalian skin conditioned to different levels of metabolic activity;* Walter Gojmerac and J. P. O'Brien, Marquette University, *Preliminary observations on the influence of temperature on the response of Anuran larvae to X-radiation.*

ACADEMY SECTION

April 26, 1952

Raymond H. Reis and Frank DiPierro, Marquette University, *Spontaneous change of form of the green hydra, Chlorohydra viridissima, under controlled conditions of temperature, light and pH;* R. S. Pierce, University of Wisconsin, *Determination of electrometric properties of ground water by a field method;* Juanita S. Sorenson (introduced by C. L. Fluke), University of Wisconsin, *The Stratiomyidae of Wisconsin;* John J. Enck, University of Wisconsin, *Memory and Desire: Tennessee Williams' plays;* Lester W. J. Seifert, University of Wisconsin, *The R-sounds of the Koelsch dialect spoken in Dane County, Wisconsin;* Alvin Whitley, University of Wisconsin, (read by John J. Enck), *Arthur Miller: an attempt at modern tragedy;* C. B. Davey, University of Wisconsin, *Decomposition of hard maple sawdust by treatment of anhydrous ammonia and inoculation with Coprinus ephemerus.* Read by title: George H. Conant, Ripon, *The evolution of Triarch products;* K. L. Hatch, Madison, *Ancient Babylon, meeting place of science and history.*

Junior Academy Section

April 26, 1952

Alice Engelhard, Aquinas Science Club, La Crosse, and Don Schlafke, Appleton High School Nature Club, Co-presidents of the Wisconsin Junior Academy of Science, presiding. Ted Olson, Chemistry Club, Lincoln High School, Wisconsin Rapids, *A working model of a cyclotron;* Dick Schulze, Nature Club, Appleton High School, *Television interference from amateur radio stations;* Don Schlafke, Nature Club, Appleton High School, *Electrets;* Philip Yunker, Science Club, Aquinas High School, La Crosse, *The use of instruments in procuring and graphing weather data;* John Chapel, Seminar Club, Mary D. Bradford High School, Kenosha, *Meteorology;* Jerome I. Hanley, Science Club, Marquette University High School, Milwaukee, *Study of the magnetic properties of certain non-ferrous alloys;* Ted Guzie, Science Club, Marquette University High School, Milwaukee, *Problems of the one shot color camera;* Arthur Cook, Science Club, Aquinas High School, La Crosse, *Chromotography;* Marlene Olson, Chemistry Club, Wausau Senior High School, *Cosmetics and chemistry;* Marjorie Call, Nature Club, Appleton High School, *Hom-eze cheese making;* Mark Weigel, Science and Camera Club, Columbus High School, Marshfield, *Colchicine;* Audrey Hardiman, Science Club, Aquinas High School, La Crosse, *Experiments on rats with closely related steroids.*

Annual Academy Lecture

The annual Academy dinner was held on April 25, 1952 at the Frank J. Harwood Student Building on the Ripon College campus. President E. L. Bolender of Wisconsin State College, Superior, gave the presidential address on *Some Problems of Science Teaching and Science Education in This Modern Age.*

Academy Business Meeting

The annual business meeting was held in Ingram Hall with President E. L. Bolender presiding.

Resolutions presented were adopted by the unanimous vote of the Academy as follows:

WHEREAS: The Wisconsin Academy of Sciences, Arts and Letters has lost in death four of its distinguished members during the year 1951–52, and

WHEREAS: the Academy wishes to recognize its indebtedness for their inspiration, devotion and leadership

Be It Resolved: that the Wisconsin Academy of Sciences, Arts and Letters herewith expresses its lasting appreciation given throughout the years by Professor William H. Kiekhofer, Doctor Regina S. Riker, Professor Walter Rogers, Reverend Claude P. Zens and, further,

Be It Resolved: that a copy of this Resolution be inscribed in the official minutes of the organization, and

Be It Resolved Further: that the Academy express its appreciation to the trustees of Ripon College, its President, Dr. Clarke Kuebler, and his faculty for their hospitality, interest, and cooperation in making its annual meeting of 1952 a success.

C. A. HERRICK
RUTH WALKER
April 25, 1952

A committee on nominations composed of G. H. Conant, B. Cooper, A. Hornigold, O. L. Kowalke, Chmn., and A. L. Throne presented the following slate of officers which were unanimously elected for the Academy year 1952–53:

President: Katherine G. Nelson, Milwaukee–Downer College
Vice-President in Science: W. H. Barber, Ripon College
Vice-President in Arts: Ella M. Martin, Wisconsin State College, Platteville
Vice-President in Letters: Berenice Cooper, Wisconsin State College, Superior
Secretary-Treasurer: Robert J. Dicke, University of Wisconsin
Librarian: H. O. Teisberg, University of Wisconsin
Publications Committee: A. W. Schorger, University of Wisconsin

The following amendment was made to Section 1 of the Academy By-Laws reading as follows: "The annual dues shall be three dollars for each active member, to be charged to his account on the first day of January of each year. *Membership shall be available to a husband or wife of active members for an annual dues of one dollar, providing that only one copy of the Transactions shall be received by the family group.*"

WISCONSIN ACADEMY OF SCIENCES, ARTS AND LETTERS
ENDOWMENTS AND ASSETS

April 1, 1952

1. U. S. Treasury Coupon Bond 1692B	$1,000	
2. U. S. Treasury Coupon Bond 12894D	500	
3. U. S. Savings Bond Registered Series G–M1696059G	1,000	
4. U. S. Savings Bond Registered Series G–C1563347G	100	
5. U. S. Savings Bond Registered Series G–C1563348G	100	
6. U. S. Savings Bond Series F–D494206F	500	
7. U. S. Savings Bond Series F–M989457F	1,000	
8. U. S. Savings Bond Series G–C3389339G	100	
9. U. S. Savings Bond Series G–C3457898G	100	
10. U. S. Savings Bond Series G–C3512841G	100	
11. U. S. Savings Bond Series G–C3560656G	100	
12. U. S. Savings Bond Series G–C3564110G	100	
13. U. S. Savings Bond Series G–C4154481G	100	
14. U. S. Savings Bond Series G–C5044011G	100	
15. U. S. Savings Bond Series G–C5044012G	100	
16. U. S. Savings Bond Series G–C5074307G	100	
17. U. S. Savings Bond Series G–C5074308G	100	
18. U. S. Savings Bond Series G–C5463975G	100	
Total Amount of Endowment		$5,300
19. U. S. Savings Bond Series G–C2386504G	$ 100	
20. U. S. Savings Bond Series G–C2386505G	100	
21. U. S. Savings Bond Series G–C2386506G	100	
22. U. S. Savings Bond Series G–C2386507G	100	
Current Assets Invested in U. S. Bonds		400
23. Savings Account No. 3262 (4/1/52)		361.54
Grand Total		$6,061.54

ROBERT J. DICKE
Secretary-Treasurer

The contents of the safe deposit box and the savings account were found in order as reported above for the date April 1, 1952.

AUDITING COMMITTEE
L. E. NOLAND
H. A. SCHUETTE

WISCONSIN ACADEMY OF SCIENCES, ARTS AND LETTERS TREASURER'S REPORT

April 1, 1952

RECEIPTS

Carried forward in Treasury March 31, 1951	$1,598.18	
Dues received from April 1, 1951 to March 31, 1952	987.00	
Sale of reprints of Volume 40, Pt. 2	337.50	
Sale of Academy publications	315.10	
Interest on endowment and other investments	91.43	
Grant-in-aid for research from A.A.A.S.	94.00	
Receipts from Junior Academy	44.25	
State of Wisconsin (for publication of Transactions)	2,318.62	
Donations:		
Anonymous to Junior Academy prizes	25.00	
F. Zirrer to publication of Transactions	5.00	
Sale of Volume 39 retained in Savings Account No. 498	51.00	
Total Receipts		$5,867.08

DISBURSEMENTS

Cost of reprints of Volume 40, Pts. 2	$ 362.00	
A.A.A.S. Grant-in-aid to L. W. Seifert	94.00	
Transfer to Savings Account 3262	91.43	
Operating expenses:		
Envelopes, stationery, etc.	55.15	
Annual meeting, programs, etc.	101.18	
Postage and incidentals	55.63	
Safety deposit box	4.80	
Junior Academy expenses	99.93	
Secretarial allowance to Robert J. Dicke	300.00	
Publication expenses:		
Printing and binding, 1,500 copies Vol. 40, Pt. 2	2,514.25	
Engraving costs	13.65	
Milwaukee Public Museum (closing out Savings Account No. 498 for sale of Volume 39)	51.00	
Total Disbursements		$3,743.02
Balance on hand April 1, 1952		2,124.06
		$5,867.08

ROBERT J. DICKE
Secretary-Treasurer

The Auditing Committee has examined the accounts of the Treasurer and has found them in order.

AUDITING COMMITTEE
L. E. NOLAND
H. A. SCHUETTE