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# TRANSACTIONS

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TRANSACTIONS  
OF THE  
WISCONSIN ACADEMY  
OF SCIENCES, ARTS  
AND LETTERS

Volume 71, Part 2, 1983

Co-editors

PHILIP WHITFORD  
KATHRYN WHITFORD

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# LORINE NIEDECKER: A LIFE BY WATER

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The Wisconsin poet Lorine Niedecker (1903-1970) is easily overlooked, and usually has been overlooked. The short entry in *Contemporary Authors*, the only standard reference work in the library in which I could find her listed, seems, as I expected, quite unremarkable, especially in the sections for "Education" and "Career": "Beloit College, student for 2½ years" and "formerly employed in a library and hospital and at Radio Station WHA, Madison."<sup>1</sup> According to hometown sources in Fort Atkinson, Wis.,<sup>2</sup> Niedecker's mother became deaf and a virtual invalid during Lorine's stay at Beloit, and so the daughter, an only child, felt needed at home and thus left college. She was called "assistant librarian" for a few years during the late 1920's at the Dwight Foster Public Library in Fort Atkinson. Some sort of script writing job for WHA radio in Madison evidently lasted just a brief time during the early 1940's. During the period 1944-50 she worked in Fort Atkinson as a stenographer and proof reader at Hoard's where the well-known journal *Hoard's Dairyman* is published & printed. Her working life outside the home, as we now say, ended with a stint at the Fort Atkinson Memorial Hospital from 1957 to 1962, the year of her marriage (which was actually her second marriage) to Al Millen, a housepainter from Milwaukee. Her job description at the hospital was "dietary position, cleaning."

Her style of life would not have attracted much attention, except perhaps—if anyone had cared to notice—by virtue of its extreme

simplicity. The meager living conditions that were hers during most of her life are referred to quite often in the poetry. But when I looked around in the two-room cabin that she lived in alone during many years before her 1962 marriage, I was still impressed by how gaunt and cramped it seemed. The privy and hand pump close by the cabin were still there, too. I especially noticed them because the arrival of indoor plumbing is specifically mentioned in a couple of poems, including the following:

Now in one year  
a book published  
and plumbing—  
took a lifetime  
to weep  
a deep  
trickle

(Incidentally, that book of poems, which arrived along with the plumbing, was most likely a collection dated 1961.)

This typically short, terse poem reveals several qualities that are typical of Niedecker and that will be important for this essay. First, note how the poet's life and art are described in water imagery. Also, there are rather typical attitudes expressed of humility, and some humorous self-deprecation, combined with strict honesty, in regard to her hard life and work—with the result of reinforcing the emotional impact of that honesty. Alliteratively juxtaposed to plumbing, her poetic output, so modest in quantity, is a mere "trickle." But there is indeed real depth to it, and the price paid for it was high—a whole "lifetime" and with considerable weeping involved.

In regard to material comfort, her childhood, too, evidently fit into this pattern.

This essay is based upon a presentation to the Conference on Wisconsin Writers, held at Lawrence University, Appleton, Wisconsin, September 12, 1980.

According to some of Niedecker's own words, in *Paeon to Place*:

Seven years the one  
dress  
for town once a week  
One for home  
faded blue-striped  
as she piped  
her cry

In adulthood her attitude towards the material was quite firm and expressed again in water imagery:

O my floating life  
Do not save love  
for things  
Throw things  
to the flood  
ruined  
by the flood

Nor did this woman attract any attention by "getting around" much. She spent the great majority of her days in a few different dwellings on Blackhawk Island, which is actually a small spur of land jutting out toward Lake Koshkonong between marshland on one side and the Rock River on the other (close to where the Rock empties into the lake). The previously mentioned cabin is thirty or so yards from the river shore. Maybe a quarter mile down the single black-top road heading toward the tip of the Island is her parents' former home, where Niedecker was born and spent much of her time as a child (with some stints at relatives' homes in town which were closer to school) and, just across the road and right on the river bank, a rambling frame building which was a kind of combination tavern and bait shop operated originally by her maternal grandfather and then by her father, who was also a commercial fisherman. Finally, back on Niedecker's own cabin lot is the more comfortable ranch-style house, right on the river bank again and thus with a nice view of the Rock and Lake Koshkonong beyond, where she lived with her husband after her 1962 marriage. So she was always somewhat

removed, even in a geographical sense, from the community of Fort Atkinson a couple of miles away.

Only rarely during her life did she venture out of her native Fort Atkinson region. The chief exceptions, it seems, were those years in Beloit and Madison and then, after her marriage in 1962, some winters spent in Milwaukee. But in "Fort," today a town of about 9,000, very few people could claim to know her well. Most never heard of her. To put it mildly, Lorine Niedecker did not cut a large figure in the world.

As already mentioned, her poetry is small in volume. The "Writings" section of *Contemporary Authors* lists six different book titles, which actually turn out to be five successive new editions of the slowly growing body of poems, plus one posthumous collection called *Blue Chicory*—all from a few small presses.<sup>3</sup> In all, her poetry fills about 200 pages. The first two books, both quite small (and, almost needless to say, almost entirely overlooked by the literary world) were published in 1946 and 1961, when the poet was, respectively, 43 and 58 years old. The next three books, larger collections of her work, were published during the last three years of her life, 1968-1970. The posthumous collection came out in 1976. As I have noted, few people in her home town knew her at all; fewer still knew of her poetry. But her poetic reputation, though not large, was international, and her acquaintance among poets, very select. Louis Zukofsky she called her mentor over the years, dating back to 1931. She also had some correspondence with William Carlos Williams, Basil Bunting, Jonathan Williams, and especially Cid Corman, her literary executor, a few of whom sought her out for a rare personal visit in Wisconsin. The striking thing is that, although to a very large degree isolated from and neglected by the literary world, she so devotedly kept at her task of writing poems that in form and style were among the more progressive—perhaps even the *avant garde*—of their day. Most

significant of all, much of her poetry is simply excellent.

The title given to the most nearly complete collection of Niedecker's poems is *My Life By Water: Collected Poems 1936-68*. The title *My Life By Water* has a perfectly obvious, literal meaning that I have already discussed: Niedecker spent almost her whole life on Blackhawk Island. (For that matter, even those few periods away from her native place were also spent by water: a few miles downstream on the Rock River in Beloit, in the so-called City of the Four Lakes, Madison, and in the Lake Michigan port of Milwaukee. As Niedecker wrote in a letter to a friend, "I love . . . all water.")<sup>4</sup> But it is in perfect keeping with her style of writing that upon closer inspection, other and deeper meanings can be added to the obvious meaning of the terribly simple words of that title. Because as with Lorine Niedecker, the plain-looking and plain-living person, so her poetry, to repeat, is and has been easily overlooked; but careful study and attentiveness can reveal its true and estimable worth. So in this essay I want to explicate that title and explore its implications.

Clearly suggested by living by water is the importance of nature in Niedecker's poetry, which indeed is full of natural sights and sounds, plants and animals (especially birds), of lake and river, marsh and shore. Delving a little deeper, one notices how often and how easily—almost, it seems, automatically—the poet speaks of herself in the poems in natural and particularly in water imagery. And further exploration of that title, *My Life By Water*, will reveal, or will suggest at least, certain circumstances that exerted great influence upon this poet and certain important choices she made during her life. These circumstances and choices are reflected in key themes in the poetry, and they also bear directly upon the question of why and how this poet, with so little encouragement, and at very significant personal sacrifice, kept at her work. To clarify, I am not claiming that all the meanings that I



Fig. 1. Lorine Niedecker beside Rock River near her home. Photo taken by Gail H. Roub of Fort Atkinson in summer of 1967.

discern in the title *My Life By Water* are intended by the poet. But concentrating on that title and its implications will help us understand the poems and will also help us appreciate the high price paid for this particular life of poetry as well as the rare and precious benefits gained from it.

To preview this discussion with a bit of very colloquial figurative language, Niedecker was not "high and dry" during much of her life. Rather, the one practical everyday concern that seems most often mentioned in her poems and also in letters to her friends is the recurrent spring flooding on the Island. According to one concise autobiographical image,

My life is hung up  
on the flood  
a wave-blurred  
portrait

Again, flooding was important enough to warrant quite a few lines in *Paean to Place*,

the rather long poem which Niedecker referred to as her autobiography. (The *he* and *she* in these lines refer to her father and mother.)

River rising—flood  
 Now melt and leave home  
     Return—broom wet  
     naturally wet

Under  
 soak-heavy rug  
 water bugs hatched—  
     no snake in the house  
     Where were they?—  
 she

who knew how to clean up  
 after floods  
     he who bailed boats, houses  
     Water endows us  
 with buckled floors

Repeated flooding was hard on buildings and people on Blackhawk Island. This unreliability of nature, this business of not being able to take your next step on “buckled floors” for granted, was just one way in which Niedecker’s life was separated from the ordinary, and one form of loss that, I submit, she in her circumstances chose to incur, more or less willingly, but with self-awareness and sometimes doubt and sometimes with a real sense of loss. Why did she make this choice? Because of a deep, strong attachment to that place, is the beginning of the answer—and because of other values also implied in living by water. That is what I want to explore.

In part, then, this paper will be an exercise in how biographical knowledge can enrich our understanding of the poetry. But I do agree, incidentally, with the standard New Critical viewpoint that literary works must stand alone with regard to their *basic* meaning and worth. The excellence of Niedecker’s poems is our primary reason for being interested in her life in the first place. For these reasons, I’ll take a detailed look at some of the poems as I go along.

Niedecker valued her deep roots in her native place and also took an interest in the history of that region, an interest expounded in several early poems. The waterways of Wisconsin were of course very important to the Indians and traders and early settlers, and probably no historical figure is more closely associated with the Rock River than the famous Sauk chief Black Hawk. One of the last great Indian uprisings in the old Northwest Territory is known now as the Black Hawk War of 1832. The cause of the uprising was, predictably, property or territory, as set forth in Niedecker’s poem on the subject.

Black Hawk held: In reason  
 land cannot be sold,  
 only things to be carried away,  
 and I am old.

Young Lincoln’s general moved,  
 pawpaw in bloom,  
 and to this day, Black Hawk,  
 reason has small room.

It is typical of a Niedecker poem to demand a lot of the reader. In this case some knowledge of this chapter in regional history is required.<sup>5</sup>

In 1804 a Fox chief and an earlier Sauk chief had ceded their lands east of the Mississippi, in what is now Illinois and Wisconsin, to the United States. Black Hawk, then a rising war chief, always claimed that this treaty had been made with no tribal authority and that the two chiefs were in fact induced to sign it while drunk. In 1816 Black Hawk himself actually signed a document confirming the treaty of 1804, but afterward he claimed he was ignorant of the terms of the agreement. The Black Hawk of Niedecker’s poem explains his philosophy of property in the first three lines; perhaps it could be called a philosophy of stewardship of the earth, as maintained by a minority of Christians in European and American history. In another Niedecker poem called

“Pioneers,” a somewhat similar claim is made upon some other Indians’ behalf:

Winnebagoes knew nothing  
of government purchase of their land,  
agency men got chiefs drunk  
then let them stand.

Historians tell us that it was after many years of brooding over the loss of Sauk and Fox lands east of the Mississippi that Black Hawk in 1831 and again in 1832 led a band of warriors and their families back across the river in a determined but ultimately futile attempt to regain their ancestral lands. His increasingly pathetic struggle to rally support from other Indians and to keep evading the white men’s armies took him as far east as “the widening of the Rock River known as Lake Koshkonong.”<sup>6</sup> His band paused there but still escaped, for a while longer, the pursuing U.S. Army regulars led by General Henry Atkinson. Hence the name “Black-hawk Island.” (This historical event is now annually commemorated in the town of Fort Atkinson with a Fort Festival and Black Hawk Pageant.)

In the first line of the poem, “Black Hawk held”—with its strong, delayed stress on the third word, further emphasized through alliteration—means, primarily, that Black Hawk reasoned or argued in this manner on the question of land ownership, but with a suggestion, too, of “held” in the sense of “took a stand” and refused to be pushed around any longer. Thus, it is not surprising that this particular word is not found in Niedecker’s source for the rest of these first three lines, namely, Black Hawk’s autobiography, which he dictated a few years after his capture. The key passage follows:

My reason teaches me that *land cannot be sold*. The Great Spirit gave it to his children to live upon, and cultivate, as far as is necessary for their subsistence; and so long as they occupy and cultivate it, they have the right to the soil—but if they voluntarily leave it then any other people have a right to settle upon it.

Nothing can be sold, but such things as can be carried away.<sup>7</sup>

The characteristic simplicity of Niedecker’s diction does not lead us to suspect that her lines are a kind of borrowing. Of course the extreme conciseness and paring things down to their minimum essentials are also typically Niedecker. Next, Black Hawk himself does not make mention of his age at this point in his story, and we should look closely at that extremely, deceptively simple line, “and I am old.” So what? one may ask. First of all, perhaps the beliefs and arguments of an older person, and an experienced and wise leader, should be given special attention, should indeed be listened to and heeded—or such is the practice, anyway, among many so-called primitive societies. Similarly, Black Hawk might also be asking straightforwardly for a bit of sympathy, since, in the opinion of some again, the elderly deserve it. Also, I think that Black Hawk means that he has grown too old and weary to keep on fleeing the white men and their army and too old to endure further deracination, and thus he intends to “hold,” to take his stand, here and now.

Finally, there is a meaning to his words not intended by Black Hawk, most likely: he is part of and, as it turns out, one of the very last truly notable representatives in this territory of an old and dying way of life, a civilization that is steadily and irretrievably being pushed out by a new one.<sup>8</sup> Thus, the youth of Lincoln and the identity of Lincoln himself as a famous representative—and, note, a sympathetic figure—of the new civilization are important in the next line, in addition to the historic fact that young Abe was among the volunteer Illinois militiamen who joined with the U.S. Army regulars to pursue Black Hawk and crush the rebellion during the spring and summer of 1832. Furthermore, the springtime of the year is associated with the advance of white civilization, again in contrast to the age of Black Hawk.



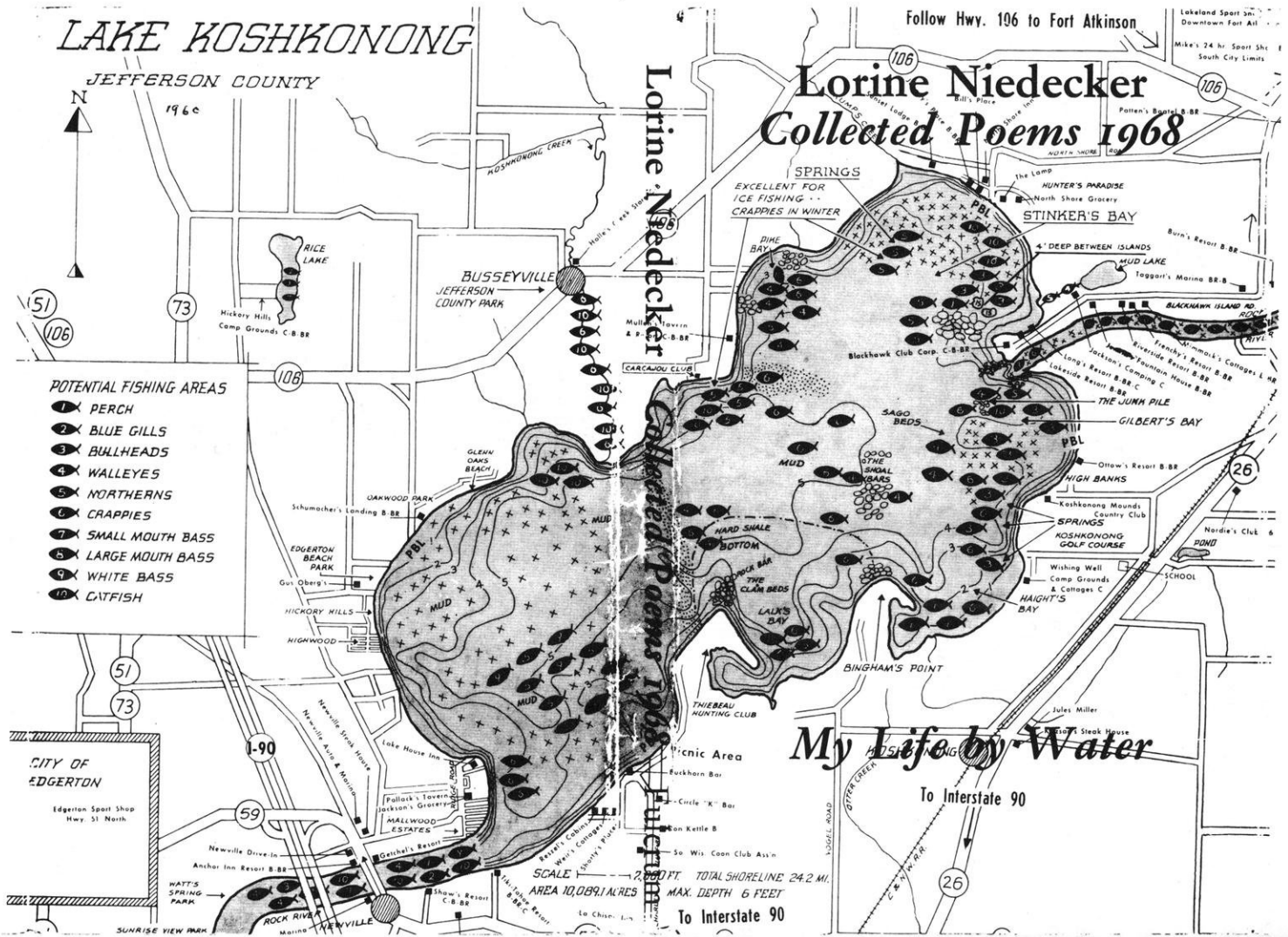


Fig. 2. Dust jacket of *My Life by Water* showing fishermen's map of Lake Koshkonong. From original loaned by Gail H. Roub.

But the way springtime is identified in the poem, in the line "pawpaw in bloom," relates to the question of title to the land. Here is one example, the tree called pawpaw, among many that could be cited, of American Indian names for plants and animals being adopted by the newcomers, the white men. Whose land, indeed, is this? Well, never mind the reasonable answer, because "to this day . . . reason has"—as Black Hawk in 1832 had—"small room."

It's not hard to understand that a person who composed lines such as these would not leave, easily or for very long, her native place. Niedecker was also concerned with maintaining the roots of her family in their life by water. Her father's occupation—or that particular occupation, among the several that he followed, which the daughter preferred to recall and which gets mentioned in one context or another many times in the poetry—was that of commercial fisherman—"he seined for carp to be sold." Notable, too, is the dust jacket of *My Life By Water* which shows a fisherman's map of Lake Koshkonong (Fig. 2), a map, one former neighbor of Niedecker told me, that used to be posted on the wall of her father's tavern on Blackhawk Island. Just listen to the opening lines of "Paeon to Place":

Fish  
 fowl  
 flood  
 Water lily mud  
 My life  
 in the leaves and on water  
 My mother and I  
 born  
 in swale and swamp and sworn  
 to water

Her attachment to river and lake, marsh and shore, and the plants and animals there is hard to overestimate and simply permeates the poetry. The two closest friends of the late poet that I had a chance to talk to in Fort Atkinson could be categorized as one person interested in art and poetry and another with

whom Lorine took long walks on the Island in order to watch the birds. As with her parents, so the daughter, too—albeit in a different way—took much of her living from the water.

But what about Niedecker's life on land, which we've already previewed as to some degree out of the ordinary? What about, first of all, her place not in the natural but the local human community? A couple of her best poems directly address this subject. Here is my favorite:

The clothesline post is set  
 yet no totem-carvings distinguish the  
 Niedecker tribe  
 from the rest; every seventh day they wash:  
 worship sun; fear rain, their neighbors eyes;  
 raise their hands from ground to sky,  
 and hang or fall by the whiteness of their all.

As with many of the nature poems, the poet finds her material in the middle of her humble surroundings and its most ordinary details, and then, as distanced observer and critic (in addition to, it's made clear, a participant), works an artistic transformation upon it. In this poem the poet's identity and roots in the local community are acknowledged—the "post is set" and the Niedeckers are definitely there as one among the other tribes—and then a bit of weekly routine is solemnly mythologized, and simultaneously of course the whole business is rather gently, playfully undercut.

In place of real tribal identity there is conformity. There is, from the highly original perspective of this poetic observer, the appearance of watery ritual and elemental sacrament in the behavior and particularly the physical movements of the villagers. And note how the terse parallel phrases and their abrupt rhythm very effectively suggest this: "worship sun; fear rain." But these are not totem poles, and in reality there is only human interaction, of the most petty and trivial kind. In a very characteristic play upon words, a little pivotal pun, the literal hanging *up* of the laundry becomes, when

juxtaposed to “fall,” the figurative maintaining of face among the neighbors, being able to hold up one’s head, thereby very quickly alluding to “ring around the collar” and all such TV commercial idiocy aimed at the contemporary housewife. The ironic undercutting is also conveyed in the same verb “hang” when it is applied to the victorious launderers—or, more likely, laundresses—almost as if to say, “Give them enough clothesline and white laundry and they will successfully hang themselves.” This compactness is indeed typical of Niedecker at her best. Note, too, how the phrase “their all” at the very end playfully alludes, I think, to the white underwear included among all the other laundry and thus, again, to the villagers’ inane washday rivalry and fear of “exposure.” Lorine Niedecker was *in* this same community, as we know, almost all her life, but she was definitely not entirely *of* it.

In another poem jobs and the workaday world form the context for exploring the poet’s place in the community, and again her distance from it. Though containing an element of admiration, the portrait of the community has grown more harsh, just as the poet’s detachment from it now seems greater. Incidentally, the poem clearly alludes to Niedecker’s job at Hoard’s during 1944-50, which is in accord with the reference to “the bomb” in the first line.

In the great snowfall before the bomb  
colored yule tree lights  
windows, the only glow for contemplation  
along this road

I worked the print shop  
right down among em  
the folk from whom all poetry flows  
and dreadfully much else.

I was Blondie  
I carried my bundles of hog feeder price lists  
down by Larry the Lug,  
I’d never get anywhere  
because I’d never had suction,  
pull, you know, favor, drag,  
well-oiled protection.

I heard their rehashed radio barbs—  
more barbarous among hirelings  
as higher-ups grow more corrupt.  
But what vitality! The women hold jobs—  
clean house, cook, raise children, bowl  
and go to church.

What would they say if they knew  
I sit for two months on six lines  
of poetry?

The “folk” of the community, as they’re called, are associated with the mundane and gauche commercialism and, in turn, with the militarism of their society, which are in such contrast to the meaning of Christmas, the holiday which these people publicly try to celebrate.

The first stanza merely alludes, it seems, to the glare or “glow” of an atomic bomb explosion because the reality of it is too awful to *contemplate*. At least there is a gesture toward peace in the observance of Christmas. Christianity—specifically the old hymn called the Doxology—is also alluded to in the second stanza: blessings, in the form of poetry, flow from the folk—“and dreadfully much else.” Note how the rhythm and stress and colloquial diction capture so simply, but so precisely, both the speech of the folk and the poet’s feelings in regard to working “right down among em.”

The rhythm and diction of the third section get rougher to convey the poet’s feeling of being defiled, it almost seems, as well as embittered by contact with that society, although some of the bitterness seems to reflect back upon the poet herself. Then, in contrast to the ordinary women’s vitality, she sits “for two months on six lines/of poetry.” So the poet does acknowledge how much of ordinary life she is missing out on for the sake of these lines of poetry, and she doesn’t seem altogether confident or pleased about her choice. And the poet knows—or definitely thinks she knows—the unfavorable kind of thing “they” would say if “they” knew, and so, it’s quite clear, she ends the poem more

resolute in her distance and even isolation from her community.

In a third poem dealing with the poet's relationship to her community, some of the earlier humor returns, for a while, but the judgement of that community and its way of life remains harsh.

I rose from marsh mud,  
algae, equisetum, willows,  
sweet green, noisy  
birds and frogs

to see her wed in the rich  
rich silence of the church,  
the little white slave-girl  
in her diamond fronds.

In aisle and arch  
the satin secret collects  
United for life to serve  
silver. Possessed.

The poet starts out on a mock self-deprecating note, picturing herself almost as some kind of muddy monster rising from the deep. But the poem soon turns, in effect, into a defense of her life by water, by attacking the life of the town at one of its key points, the honorable institution of marriage. The poet is in touch, literally, with some of the most basic elements of her natural surroundings, such as the simple plants, algae and equisetum, whereas the young bride is surrounded with richness, with diamonds and satin. Vitality in the form of water, earth, greenness and noise is located this time in the poet's realm, contrasting to the silence and whiteness around the bride. Note how the simple alliterative patterns—the *d* and thick *ch* sounds of the second stanza, the *t* and hissing *s* sounds of the third stanza—reinforce a sinister and stealthy atmosphere surrounding the wedding. The suggestion of white slavery with reference to the bride actually seems, to me, more harsh and unobvious than is characteristic of Niedecker. And the "satin secret" is the unpleasant truth about marriage commonly known (especially by the women, perhaps) but not confessed. That is, the innocent bride is not

forewarned. She will *serve from* silver, maybe. But more important, she will be a lifelong *servant to* silver, she will be dominated by domestic routine and social convention and be possessed by her possessions—with maybe even a hint of madness in the forecast for her future. "Possessed."

This poem and its discussion of marriage brings us again to the subject of Niedecker's personal life—which turns out to be quite a sensitive area indeed. First let us go back to Niedecker's parents and the model of domestic life that they provided. It's her parents' lives in the out-of-doors, you'll recall, that Niedecker liked to remember and celebrate in the poems. Their life indoors was simply not very happy, not at least during those many years when the mother was an invalid, a pitiable figure, deaf and finally blind. Several poems express the sometimes nagging burden felt by the only child in caring for her mother. A couple of poems allude to the drunkenness and philandering that are known to be part of her father's reaction to the situation. In an early poem the mother, speaking of course through the poet, gives a kind of mournful summation of her own version of a life by water, and an important final line helps to define the daughter's status in this family.

Well, spring overflows the land,  
floods floor, pump, wash machine  
of the woman moored to this low shore by deafness.

Good-bye to lilacs by the door  
and all I planted for the eye.  
If I could hear—too much talk in the world,  
too much wind washing, washing  
good black dirt away.

Her hair is high.  
Big blind ears.

I've wasted my whole life in water.  
My man's got nothing but leaky boats.  
My daughter, writer, sits and floats.

Note that terse but unmistakable note of scorn and accusation in the last line: in the mother's opinion, the daughter doesn't really *do* much, she is not involved enough,

her calm is interpreted as cool, distant detachment. But more than this is conveyed in the brief watery metaphor for the poet's way of life—"floats." In reality, the quiet floating is a kind of victory of survival for the daughter and in sharp contrast to the mother, who is "moored to this low shore by deafness." The mother was both right and wrong about her daughter: in order to write so powerfully and yet so subtly about this relationship, she had to feel, intensely, along with the mother, as well as distance herself, deliberately, to compose delicate lines such as these.

And what of Niedecker's own experience with marriage? Her first marriage to Frank Hartwig, described as a "road contractor" in the local weekly, the *Jefferson County Union*, took place in 1928 when Lorine was twenty-five years old.<sup>9</sup> After just four years they agreed to separate. According to the records in the Jefferson County courthouse, Niedecker eventually filed for divorce in 1942. Let us turn at this point to the poem called "Wild Man."

You are the man  
 You are my other country  
 and I find it hard going  
  
 You are the prickly pear  
 You are the sudden violent storm  
 the torrent  
  
 to raise the river  
 to float  
 the wounded doe

The usual kind of subtle artistry seems lacking in this poem. Still, form follows content in a straightforward, unrestrained rush of feeling. To repeat, her life by water—or in the terms of the last section, *in water*—was not always nice. Some people seem to think that Niedecker's late marriage (from 1962 till her death in 1970) to Al Millen was the personal basis for this and a few other grim poems on marriage published posthumously in the volume called *Blue Chicory*. I strongly suspect that a basis might be found as well in the first marriage, not to mention the backdrop of the senior Nie-

deckers' marriage. In any case, following her mother's death in 1951 and her father's death in 1954 came the long period of near isolation in that gaunt, green-painted two-room cabin on Blackhawk Island.

Property, community life, marriage and family—an awful lot of the ordinary sources of satisfaction were, evidently, not very available to her. She did have her poetry.

I wish, now, to look at another deceptively simple poem, which is also the title poem of Niedecker's second collection.

My friend tree  
 I sawed you down  
 but I must attend  
 an older friend  
 the sun

I recall my reaction upon first reading this poem. It seemed a rather clear statement, incidental yet arresting, about the necessity of making choices and of suffering losses. Simple devices of rhyme, diction, and rhythm give that impression some force. But so concisely, in just sixteen words. Typically Niedecker. After studying the other poetry more and especially after learning more about her life, my impression after re-reading the poem much later I would have to describe as shock.

My friend tree  
 I sawed you down  
 but I must attend  
 an older friend  
 the sun

How much indeed did this woman have to give up—or anyway decide that she had to give up—in order to live her life by water and to practice her craft and art, so carefully and so devotedly, over those many decades? But she simply had to get down to the real *essentials* of her life, and note how the image of the sun and its associations with vision and illumination and the source of all vitality can suggest poetry, of course, among many other meanings. Further, when a bit of literary success and a bit of material comfort did come to her, they evidently did not always

seem commensurate with the personal prices that she had paid.

Now in one year  
 a book published  
 and plumbing—  
 took a lifetime  
 to weep  
 a deep  
 trickle

Reflecting upon her life and work, one is drawn powerfully to the conclusion that here was a life of great integrity. The spare and lean, hard yet delicate quality of her style of life that formed a simple, polished case for character of great depth is matched by the identical quality of her polished verses that release profound meaning and impact to the attentive reader.

Almost all commentators on Lorine Niedecker have drawn a comparison with Emily Dickinson. Certainly there are ample grounds for such comparisons, including the shy sensitivity of the women's personalities, their suspicion of, and relative seclusion from, their contemporary societies, some personal and family misfortunes, and, of course, the starting point of such comparisons—their concise, delicate, complex though seemingly simple, and often powerful poetry. In both cases, I think, there is a temptation to create a kind of legend of a victim-heroine poetess driven to—or forced rather reluctantly into—a higher dedication to poetry and personal release through art.<sup>10</sup> I submit, though, that there is a strong likelihood that both of these women deliberately and knowingly chose and accepted their ways of life as the very conditions which made their poetry possible. Look at this excerpt from Niedecker's long poem called "Wintergreen Ridge":

Nobody, nothing  
 ever gave me  
 greater thing  
 than time  
 unless light  
 and silence  
 which if intense  
 makes sound

Here we have a kind of personal commentary, I believe, on the so-called quiet life. It's not that the poet must be satisfied with just the simplest gifts in life—time, light, and silence. Rather, seclusion and quietude and alert attentiveness, raised to a high enough "intensity," become the very conditions for a precious, magical transformation into "sound." And certainly there is an implied identification of this sound with the poet's own voice speaking, her very special poetry. According to the review of her work by the critic Michael Heller, "what Miss Niedecker has achieved, and this is what makes her work distinguished, is not to become the poet-victim of her condition but its agency, singing the song of her world and herself *through* herself."<sup>11</sup>

Surely, then, Lorine Niedecker did finally, confidently, realize the great benefits that she had reaped from her life by water. And surely we are now all her beneficiaries.

#### NOTES

<sup>1</sup> *Contemporary Authors, Permanent Series: A Biobibliographical Guide to Current Authors and Their Works*, Vol. 2 (Detroit: Gale Research Co., 1978), p. 389.

<sup>2</sup> For most of the biographical data in this paragraph I am relying on Jane Knox, "Biographical Notes: Lorine," *Origin*, 4th Series, no. 16 (July, 1981), pp. 3-23. Mrs. Knox is the wife of William D. Knox, President of W. D. Hoard and Sons Co., Niedecker's former employer.

Also in regard to hometown sources of information, this seems a good time to acknowledge my debt to Mr. Gail Roub of Fort Atkinson, former neighbor and close friend of the late poet, who generously gave me a couple days of his time in August 1980—very memorable days for me. Mr. Roub shared with me many recollections of and much information about Niedecker along with some manuscripts, letters and other material of hers, showed me Niedecker's former residences and the environs of Blackhawk Island, and introduced me to Mr. Al Millen, husband of LN, and also some of her former neighbors on the Island.

<sup>3</sup> The following comprise the published collections of Niedecker's poetry:

*New Goose* (Prairie City, Ill.: Decker Press, 1946);  
*My Friend Tree* (Edinburgh, Scotland: Wild Hawthorn Press, 1962);  
*North Central* (London: Fulcrum Press, 1968);

*T & G: The Collected Poems (1936-1968)* (Penland, North Carolina: Jargon Society, 1968);

*My Life By Water: Collected Poems 1936-1968* (London: Fulcrum Press, 1970);

*Blue Chicory* (New Rochelle, N.Y.: Elizabeth Press, 1976).

All quotations from her work in this essay are based on the text of *My Life By Water*, with the exceptions of a poem quoted from *Blue Chicory* and an excerpt quoted from the poem "Pioneers" in *New Goose*.

<sup>4</sup> Quoted in Knox, p. 7.

<sup>5</sup> A good, brief account of the Black Hawk War that I've relied on here is Odie B. Faulk, "Black Hawk," *The McGraw-Hill Encyclopedia of World Biography*, 1973.

<sup>6</sup> Alice E. Smith, *From Exploration to Statehood, The History of Wisconsin*, Vol. 1 (Madison: State Historical Society of Wisconsin, 1973), p. 137.

<sup>7</sup> *Black Hawk: An Autobiography*, Donald Jackson, ed. (Urbana: University of Illinois Press, 1955), p. 114.

<sup>8</sup> It is interesting in this connection to note one authority's estimation of Black Hawk's autobiography as "a unique document, for it narrated from an Indian point of view the tale of frustration, bewilderment, and desperation of a dispossessed people, striving to retain the only way of life they knew against the oncoming rush of a different civilization." Smith, *From Exploration to Statehood*, p. 140.

<sup>9</sup> *Jefferson County Union*, 7 December 1928, p. 11.

<sup>10</sup> For a discussion of this tendency in the criticism and biography of Dickinson, see chapter 1, "Legend and Life," of Paul J. Ferlazzo, *Emily Dickinson* (Boston: Twayne Publishers, 1976).

<sup>11</sup> Michael Heller, "I've Seen It There," *Nation*, April 13, 1970, p. 444. This review is reprinted in *truck*, no. 16 (Summer 1975), edited by David Wilk. This special issue of the little magazine is devoted in its entirety to LN: a selection of her poems and letters; reviews, reminiscences, and appreciations; and thirteen poems dedicated to LN by fellow poets.

## THE VILLAGE REVISITED: THE SPIRIT OF PLAY IN AMERICAN FICTION

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A number of fictional works appearing early in the twentieth century seriously scrutinized life in small-town America. In general, the books were written by natives of these towns who examined the mores and inhabitants of the villages with the double vision of the provincial who has escaped to a more sophisticated urban existence. From Hamlin Garland's *Main-Travelled Roads* to Sinclair Lewis's *Main Street*, these books depicted life in the provinces as barren, ugly and boring, a situation in which the only real future for a sensitive, creative individual lay in escape of some sort. Hence the phrase "revolt from the village," often used to describe these writings, referred to an attitude as well as a physical journey. Usually the portrayal of village life in these books suggested that small American towns were built from a master plan of calculated architectural mediocrity and populated with dour, hardworking inarticulates. The heroes of these works escaped the village principally because it offered no scope for creative interests. Usually the initial discontent began with the hero's awareness that recreation, spontaneity, fun, a spirit of play, were of little importance in small-town America compared with the serious business of making a living.

Many causes exist for the growth of such an attitude, particularly in rural America. The Puritan tradition encouraged hard work while at the same time repressing festivity. Furthermore, the simple necessity for physical labor in expanding the American nation certainly contributed to this attitude. But recognition of the equal necessity of play as a human activity has seldom been absent from any civilization, primitive or sophisticated. Plato in his *Laws* points out the vital

role of play, and philosophers of every ideology have included play as a necessary element of humanity ever since. In an influential modern study of this subject, Johan Huizinga observes, ". . . genuine, pure play is one of the main bases of civilization."<sup>1</sup>

The term one uses—play, leisure or celebration—is not as important as the attitude itself. In *Leisure the Basis of Culture* Joseph Pieper defines this attitude: "Leisure, it must be clearly understood, is a mental and spiritual attitude . . . it is not the inevitable result of spare time, a holiday, a weekend or a vacation."<sup>2</sup> Huizinga further defines the importance of the play element for humans:

As a regularly recurring relaxation, however, it becomes the accompaniment, the complement, in fact an integral part of life in general. It adorns life, amplifies it and is to that extent a necessity both for the individual—as a life function—and for society by reason of the meaning it contains, its significance, its expressive value, its spiritual and social associations, in short, as a culture function. The expression of it satisfies all kinds of communal ideals.<sup>3</sup>

Closely related to an individual's play spirit is the relationship with the community. Every human being has moments of private play when celebrating a personal relationship with the world. Appreciation of nature, physical exercise, musical performance, in fact, most esthetic creations, necessarily comprise individual acts of play. Richard Rupp describes them as moments of "mystery and wonder, a silent celebration of one's own unique identity."<sup>4</sup> But it is in shared leisure that most human bonds are defined, "revealing significant shared social and personal values, uniting separate individuals into a momentary but transcendent iden-



tity.”<sup>5</sup> It is to commemorate the important moments of human existence that most social events have evolved. Such communal celebration “organizes patterns of private and public behavior in conformity to an image of personal and corporate identity.”<sup>6</sup>

The presence of a spirit of play and festivity “links us to a world of memories, gestures, values, and hopes that we share with a much larger community.”<sup>7</sup> The absence of this spirit “as an essential ingredient in human life,” Harvey Cox observes, “severs man’s roots in the past and clips back his reach toward the future. It dulls his psychic and spiritual sensibilities.”<sup>8</sup> Cox could well be describing the Village Virus which afflicted Lewis’s *Main Street* or explaining George Willard’s reasons for leaving Winesburg, Ohio, or Ethan Frome’s unexpressed despair over his bleak future. Significantly, the lack of play and festivity appears as an underlying motif in a number of fictional works which describe the revolt from the village. A comparative study of the significance of play in village life might provide fresh illumination on motives for this revolt and also illustrate differences in scope and stance of the five authors on this theme.

The choices for this study include *Main-Travelled Roads* (1891, revised 1922), by Hamlin Garland; *Ethan Frome* (1911) by Edith Wharton; *My Antonia* (1918) by Willa Cather; *Winesburg, Ohio* (1919) by Sherwood Anderson; and *Main Street* (1920) by Sinclair Lewis. Spanning thirty years and five states, these books provide ample opportunity to examine Richard Rupp’s contention, “Celebration is an ingrained quality in American literature.”<sup>9</sup>

Evidence of the spirit of play or festivity in these books assumes many forms, both public and private. These include meals, weddings, courtship rituals, parties, holiday observations, funerals, games and contests, jokes, initiation rites, clubs, sports, hunting, travel, theater, concerts, lectures, movies, even religious services—whatever activities

pleasurably fill leisure hours. It is important to recognize that play is not always frivolous or superficial. It can be solemn, even profound: for example, George Willard’s moment of illumination, Ethan and Mattie’s single shared dinner, and Jim Burden’s reunion with Antonia. Much of the joy of the moment, in fact, is its release or culmination of earlier strain or insecurity: “To dare, to take risks, to bear uncertainty, to endure tension—these are the essence of the play spirit,” Huizinga notes.<sup>10</sup> As a consequence, however, “The play-mood is one of rapture and enthusiasm, and is sacred or festive in accordance with the occasion. A feeling of exaltation and tension accompanies the action, mirth and relaxation follow.”<sup>11</sup>

Of the eleven stories collected in *Main-Travelled Roads*, seven deal specifically with leisure and play—or their absence. The reader is warned by Garland’s preface, however, that “the main-travelled road of life” is “long and wearyful.”<sup>12</sup> Two stories, “Up the Coulee” and Mrs. Ripley’s Trip,” both from 1891, illustrate Garland’s handling of this theme. In common with other revolt from the village stories, “Up the Coulee” shows a young ex-farmer, Howard, who “had been wonderfully successful” (p. 59) as a New York actor. But he “retained through it all a certain freshness of enjoyment that made him one of the best companions in the profession” (p. 60). His sentimental response as he drives through his former village is “sweet and stirring somehow, though it had little of aesthetic charm at the time” of his youth (p. 58).

Similar ironic juxtaposition is developed through the story as Garland describes the elegantly dressed Howard, “a man associating with poets, artists, sought after by brilliant women” (p. 72). The more he contemplates the grimness of his brother’s farm, “with all its sordidness, dullness, triviality, and its endless drudgeries, the lower his heart sank. All the joy of the homecoming was gone” (p. 61).

At the welcoming party given by neighbors of Grant (the brother), Garland illustrates profusely the role of festivity and play in this country setting. Detailed descriptions of the party's activity and guests reveal the rarity of celebration in this village. Unsure how to act, the people "were all very ill at ease. Most of them were in compromise dress—something between working 'rig' and Sunday dress" (p. 83). Instinctively segregated by sex, the men discussed crops and farms, while the women

forced Howard more and more into talking of life in the city. As he told of the theater and the concerts, a sudden change fell upon them; they grew sober, and he felt deep down in the hearts of these people a melancholy which was expressed only elusively with little tones or sighs. Their gaiety was fitful (p. 85).

A few more examples document the almost atrophied play spirit in these people. Inspired by Howard's description of city revelry, a woman guest proposes dancing: "By an incredible exertion she got a set on the floor, and William got the fiddle in tune. . . . After two or three sets had been danced, the company took seats and could not be stirred again" (p. 87). To Howard's chagrin, the party evokes a bitter confession from his sister-in-law: "I hate farm life. . . . It's nothing but fret, fret and work the whole time, never going any place, never seeing anybody but a lot of neighbors just as big fools as you are. I'm sick of it all" (p. 89). To Howard, the dreary lack of ornament in the house contributes further to this attitude. He was disturbed that there "were no books, no music, and only a few newspapers in sight—a bare, bleak, cold, drab-colored shelter from the rain, not a home" (p. 92). Alongside such vignettes Garland continually contrasts Howard, who appears hedonistic and over-indulgent to the dour villagers.

Both Garland's comments and Howard's reflections restate almost to excess the impossibility of change for this community. In a vain attempt to placate his farmer brother, Howard explains, "Circumstances

made me and crushed you. That's all there is about that. Luck made me and crushed you" (p. 96). The last words are given to Grant, who expresses a resignation about his provincial existence which would probably be shared by his entire community: "'I'm a dead failure. I've come to the conclusion that life's a failure for ninety-nine per cent of us. You can't help me now. It's too late'" (p. 97). Though Garland provides ample description and justification for the lack of festivity in these rural lives, he overstates his case in this story. Occasionally sentimental, sometimes ironic, always profuse, Garland points out repeatedly the contrast between Howard's abundance of play (even making his living at play-acting) and its dearth in the lives of the community he left behind.

The pattern is reversed in "Mrs. Ripley's Trip," with a country woman traveling to an Eastern city for a nostalgic visit. Here Garland portrays a lighter, more credible situation, though a sixty-year old woman who "ain't been away t'stay overnight for thirteen years" (p. 183) has clearly had little leisure in her life. The home, as small and barren as that described in "Up the Coulee," nevertheless resounds with Uncle Ripley's violin and his affectionate though gruff jesting. Further manifestations of a play spirit emerge in Mrs. Ripley's dry humor with a gossiping neighbor and her dramatic revelation of a mitten full of carefully hoarded coins. Furthermore, Mr. Ripley has a "kindly visage. Life had laid hard lines on his brown skin, but it had not entirely soured a naturally kind and simple nature" (p. 188). Thus he can understand that "the old woman needed a play spell. . . . 'I calc'late I c'n get enough out o' them shoats to send her'" (p. 187).

In their mutual surprises the Ripleys acknowledge the importance and rarity of this trip. But it satisfies Mrs. Ripley's need for play: "'I've had my spree, an' now I've got to get back to work. They ain't no rest for such as we are'" (p. 193). Her final analysis of the trip reveals a keen insight into

the nature of the play spirit: "Them folks in the big houses have Thanksgivin' dinners every day uv their lives, and men an' women in splendid clo's to wait on 'em, so't Thanksgivin' don't mean anything to 'em'" (p. 193). As Harvey Cox observes, in a more eloquent restatement of Mrs. Ripley's words, ". . . the reality of festivity depends on an alternation with the everyday schedule of work, convention, and moderation."<sup>13</sup>

The balance of Garland's stories describe further uses and misuses of leisure, on farms and in villages. None of the remaining works repeats the extreme of "Up the Coulee," although "A Day's Pleasure" and "A Branch Road" show young married women almost dead from overwork and no recreation. In both stories Garland illustrates the restorative power of play. Agnes in "A Branch Road" leaves the rigorous farm life to marry her former lover, enticed by his promise to "have a piano and books, and go to the theater and concerts" (p. 50). Less dramatically, Delia Markham spends an afternoon in town, entertained by tea, piano music and refined conversation with a young lawyer's wife, who ". . . through it all . . . conveyed the impression that she, too, was having a good time" (p. 181). Celebration and festivity occur in Garland's stories but more often in the breech than in the observance. It is accurate to conclude that a healthy spirit of play is not a consistent trait in his characters. In some it has never been developed, while in others it is nearly atrophied.

In the case of *Ethan Frome*, Edith Wharton traces a newly developed spirit of play into its eventual distortion and loss. Starkfield, Ethan's New England village, offers little opportunity for recreation except a coasting-ground and infrequent church dances. When Mattie Silver enters Ethan's life, recreation assumes a new importance for Frome as he begins escorting her home "on the rare evenings when some chance of amusement drew her to the village."<sup>14</sup> During these walks with Mattie he learns that

"one other spirit had trembled with the same touch of wonder" (p. 34). Their growing love occurs almost totally during a few buggy rides and the walks, where they discover a mutual love of nature. Ethan ponders the miracle of these new feelings of joy:

The fact that admiration for his learning mingled with Mattie's wonder at what he taught was not the least part of his pleasure. And there were other sensations, less definable but more exquisite, which drew them together with a shock of silent joy: the cold red of sunset behind winter hills, the flight of cloud-flocks over slopes of golden stubble, or the intensely blue shadows of hemlocks on sunlight snow (p. 34).

Other than their shared attitude of joy, Ethan and Mattie have few chances to indulge in a spirit of play until the end. Their brief courtship has only one festive event, the dinner Mattie prepares on Zeena Frome's overnight absence. This shared meal produces in Ethan a "sense of being in another world, where all was warmth and harmony and time could bring no change" (p. 88). Their celebration, more implied in ritualistic gestures than spoken, is marred by the accidental breaking of Zeena's pickle dish. This red dish serves as an ironic reminder of Zeena's own distorted spirit of play. Considering the dish too good to use, she keeps it hidden away until there will be a suitable festive occasion. Such an event, of course, has never occurred in her life.

Zeena's discovery of the broken dish and her determination to send Mattie away intensify Ethan's brief taste of happiness with Mattie: "The inexorable facts closed in on him like prison-warders handcuffing a convict. There was no way out—none. He was a prisoner for life, and now his one ray of light was to be extinguished" (p. 134). The final irony of the book is that Ethan's most intense experience of play leads to his own destruction. Driving Mattie to the station, he laughs and holds her hand, "passing the site of a summer picnic, one of the few that they had taken part in together: a 'church picnic'

which, on a long afternoon of the preceeding summer had filled the retired place with merry making" (p. 153). For both, this last ride is a reminder of their earlier shared pleasures. ". . . That was all; but all their intercourse had been made up of just such inarticulate flashes, when they seemed to come suddenly upon happiness as if they had surprised a butterfly in the winter weeds. . . ." (p. 154).

The sound of passing sleigh bells and the sight of an abandoned sled inspire Ethan's final, but ultimately tragic, act of real play. Flying down the hill with Mattie arouses in him a "strange exaltation of his mood" (p. 163). For the first and last time in Ethan's life he experiences true play as Hugo Rahner defines it:

To play is to yield oneself to a kind of magic, to enact to oneself the absolute other, to preempt the future, to give the life to the inconvenient world of fact. In play earthly realities become, of a sudden, things of the transient moment, presently left behind, then disposed of and buried in the past; the mind is prepared to accept the unimagined and incredible, to enter a world where different laws apply, to be relieved of all the weights that bear it down, to be free, kingly, unfettered and divine.<sup>15</sup>

The intensity of the sled ride "made the other vision more abhorrent, the other life more intolerable to return to" (p. 166). Thus Ethan's decision to use the instrument of happiness as a death weapon is initially shocking but becomes natural and appropriate to his purpose. What the sled ride kills, ironically, is love, happiness and the nascent spirit of splay in Ethan and Mattie. Ethan's attempt to misuse a form of play produces only physical crippling and permanent stifling of the play spirit, rather than the release Ethan sought in their attempted deaths. The end result is a whining, crippled Mattie, an embittered Ethan, and an almost smug Zeena contemplating the results of Ethan's aborted death-wish.

Thus the characters in Wharton's bleak narrative effectively contrast natural and

unnatural attitudes toward play. Starkfield, an aptly named village, offers only slight chances for festivity, whether public or private. Zeena enjoys only housework and her hypochondria, rejecting any social life not directly related to these concerns. Until Ethan meets Mattie, his own life is similarly devoid of pleasure. But Mattie's natural zest for life and her aesthetic interests ("She could trim a hat, make molasses candy, recite 'Curfew shall not ring tonight,' and play 'The Lost Chord' and a pot-pourri from 'Carmen'") (p. 59), meager though they are, inspire Ethan to revive his own lost spirit of play. His attempts, too feeble and too late to have any lasting effect on his life, suggest that a sense of play must grow naturally and continually throughout life. It is as impossible to impose as to stifle, without serious consequences.

Willa Cather's *My Antonia* offers among its many characters several otherwise creative individuals who find difficulty in expressing their spirit of play. In various ways Mr. Shimerda, Jim Burden and Lena Lingard find Black Hawk too confining for their aesthetic fulfillment. Most pathetic is Shimerda, Antonia's father. Antonia attempts to explain her father's discontent and sadness:

My papa sad for the old country. He not look good. He never make music any more. At home he play violin all the time; for weddings and for to dance. Here never. When I beg him for play, he shake his head no. Some days he take his violin out of his box and make with his fingers on the strings, like this, but never he make the music. He don't like this kawntree.<sup>16</sup>

It is not only *this* country but country life itself which is distasteful to Shimerda. A city-bred tailor, he is totally unfit for Nebraska homesteading. White, well-shaped hands and a silk scarf, "carefully crossed and held together by a red coral pin" (p. 27), along with his violin, are poignant reminders of the sophisticated life he left behind in Bohemia. His suicide is no surprise. Over-

whelmed by the reality and grimness of a Nebraska winter, he characteristically plans a ceremonial, almost festive, death. Shaving and dressing carefully, “. . . he was always sort of fixy, and fixy he was to the last” (p. 110).

Lena Lingard, equally fixy and unsuited for homesteading, is driven rather than destroyed by these qualities. The difference lies in Lena's ability to turn her frustrated spirit of play into aesthetic fulfillment and financial security. As a successful dress-maker, first in Lincoln and later in San Francisco, Lena delights in having the money to dress well, attend plays, and provide luxuries for her family. It is tempting to accept Jim Burden's uncritical response to Lena's apparent spirit of play: “Lena had left something warm and friendly in the lamp-light. How I loved to hear her laugh again! It was so soft and unexcited and appreciative—gave a favorable interpretation to everything” (p. 306).

What Jim does not perceive is Lena makes no distinction between her work and her play. She rather calculatedly uses her stylish appearance and attendance at social events to advertise her professional dressmaking skills. Although Jim believes that Lena's passionate interest in good clothes and good times arises from childhood deprivation, he is unaware that her resolution never to marry arises from the same source: “She remembered home as a place where there were always too many children, a cross man, and work piling up around a sick woman” (p. 330). Thus, a strain of hardness and self-interest permeates much of Lena Lingard's approach toward life, revealing an attitude inimical to a true spirit of play and festivity.

For Jim Burden the spirit of play assumes many forms, which are periodically redefined during phases of his maturation. As a boy living in the country, he finds immense joy in the prairie itself. Lyrical passages describe his response to the change of seasons: “There was only—spring itself; the throb of it, the light restlessness, the vital

essence of it everywhere; in the sky, in the swift clouds, in the pale sunshine, and in the warm, high wind—rising suddenly, sinking suddenly, impulsive and playful like a big puppy that pawed you and then lay down to be petted” (p. 137).

During his adolescence in Black Hawk he first is satisfied, then stifled, by the local recreational opportunities. Finally, like George Willard in *Winesburg, Ohio* and Carol Kennicott in *Main Street*, he begins “to prow about, hunting for diversion” (p. 247). These diversions, in a prairie town abundant in social activity, are carefully described by Cather. Maxwell Geismar notes that

in the daily patterns of pioneer activity—the colorful weddings, dances, and costume parties, the all-night gatherings to the tune of a *dragharmonika* or a fiddle, the games, choral societies, and family readings that accompanied the axe, the plow and the Bible,—Miss Cather very early suggested the resources of that frontier life which was to seem so harsh and sterile to a subsequent generation of western rebels and expatriates.<sup>17</sup>

Listing the saloon, drug store, cigar factory and depot as his available distractions, Jim Burden finds these “resources” insufficient for satisfying his newly emerging needs. Seeking a wider source of satisfaction, he leaves Black Hawk for Lincoln. In Black Hawk Jim feels repressed and bored:

This guarded mode of existence was like living under a tyranny. People's speech, their voices, their very glances, became furtive and repressed. Every individual taste, every natural appetite, was bridled by caution. The people asleep in these houses, I thought, tried to live like the mice in their own kitchens; to make no noise, to leave no trace, to slip over the surface of things in the dark. The growing piles of ashes and cinders in the back yards were the only evidence that the wasteful consuming process of life went on at all (p. 250).

Like Lena, Jim thrives at Lincoln. Tennis, reading, and long walks with a Latin teacher

add to the richness of his life: "I shall always look back on that time of mental awakening as one of the happiest in my life. Gaston Cleric introduced me to the world of ideas; when one first enters that world everything else fades for a time, and all that went before is as if it had not been" (pp. 291-2). Jim Burden's scope of play is further widened when James O'Neill's touring *Count of Monte Cristo* "introduced the most brilliant, worldly, the most enchantingly gay scene I had ever looked upon" (p. 309). After this experience Jim presumably continues to explore these same pleasures, first at Harvard and then as a New York attorney. Cather omits description of twenty years of Jim Burden's life, ending the book with a reunion between him and Antonia.

Finally, there is Antonia: in her exuberance, enjoyment, her healthy acceptance of the light and shadow of life, Antonia has perhaps the finest realization of a true spirit of play and festivity of any in this study. Describing the harmonious relationship between Antonia and her employer, Cather writes, "Deep down in each of them was a kind of hearty joviality, a relish of life, not over-delicate, but very invigorating" (p. 205).

Antonia endures a life of almost melodramatic hard work and emotional pain, aging her almost beyond Jim's recognition. Misinterpreting Antonia's physical deterioration as a sign of similar emotional weariness, Jim muses, "If, instead of going to the end of the railroad, old Mr. Shimerda had stayed in New York and picked up a living with his fiddle, how different Antonia's life might have been!" (p. 254). But Jim fails to grasp Antonia's innate satisfaction and delight in her life. Not only has Antonia successfully maintained her healthy acceptance of the fullness of life, but she has reproduced in her dozen children "a veritable explosion of life out of the dark cave into the sunlight" (p. 382). Meeting the exuberant family, Jim is overwhelmed: "It made me dizzy for a moment" (p. 382). Antonia's instinctive

awareness of a play spirit has caused her to marry "a humorous philosopher who had hitched up one shoulder under the burdens of life, and gone on his way having a good time when he could" (p. 402). A wonderful complement to Antonia, Anton Cuzak "seemed to think it a joke that all these children should belong to him" (p. 404).

Jim Burden's eventual recognition of Antonia and Anton Cuzak's capacity for enjoying life occurs in separate observations: "I knew so many women who have kept all the things that she had lost, but whose inner glow has faded. Whatever else was gone, Antonia had not lost the fire of life" (p. 379). Jim's final comment on the Cuzaks aptly illustrates his recognition of the real play spirit engendered and represented by Anton: "There were enough Cuzaks to play with for a long while yet. Even after the boys grew up, there would always be Cuzak himself! I meant to tramp along a few miles of lighted streets with Cuzak" (pp. 417-418). Thus, in Antonia and Anton Cuzak one sees a mature and developed spirit of play which has also been communicated to their children. Even the worldly, sophisticated Jim Burden recognizes that he can benefit from a man like Cuzak who has so fully integrated his spirit of play into his entire life.

The miles of lighted streets which Jim Burden hopes to walk with Anton Cuzak represent a similar enticement for George Willard to leave Winesburg, Ohio, as a youth. With George's escape, however, Sherwood Anderson leaves little opportunity for play and celebration by the town's inarticulate "grotesques," for whom George was often the only social contact. Each of these characters is presented in a social relationship with George Willard in separate short stories. Generally these characters have a distorted or unfulfilled sense of play, finding the community unable or unwilling to meet these needs. Though *Winesburg, Ohio* begins and ends with a note of celebration, Anderson juxtaposes a solitary non-participant in both stories.

The story "Hands" continually contrasts Wing Biddlebaum's solitary life with the conviviality of the berry pickers he hears. Sounds and detailed setting skillfully illustrate Wing's social isolation: "Across a long field that had been seeded for clover but that had produced only a dense crop of yellow mustard weeds, he could see the public highway along which went a wagon filled with berry pickers returning from the fields. The berry pickers, youths and maidens, laughed and shouted boisterously."<sup>18</sup> A man socially isolated from the town for twenty years, Biddlebaum once possessed a rare power "to carry a dream into the young minds" (p. 32) of his students. When one recalls that the Latin *ludus* means both *play* and *school*, Biddlebaum's intensity and joy in teaching can validly be seen as still another manifestation of a spirit of play. To Biddlebaum, teaching was his life, and his students his only pleasure. Such a delicate, pure interest in his students can never be restored after his brutal lynching for a false accusation of homosexuality, but his later attempt to inspire George Willard's ambition indicates that the spirit has not been totally killed.

Another teacher in Winesburg, Kate Swift, has almost too much spirit of play for the town to understand: "She became inspired as she sometimes did in the presence of the children in school. A great eagerness to open the door of life to the boy, who had been her pupil and who she thought might possess a talent for the understanding of life, had possession of her" (p. 164). So intense is her zeal to encourage George's interest in writing and participating fully in life that she soars right over his head. After their conversation, George dimly realizes, "I have missed something. I have missed something Kate Swift was trying to tell me" (p. 166). The incident illustrates the impossibility of giving one's own spirit of play or joy to another, no matter how keenly felt. Eventually George Willard will be ready for such revelations, but Kate Swift's use of him as an outlet for her own suppressed zeal blinds her

to George's incapacity to benefit from her insight.

Alice Hindman in "Adventure" has more self-knowledge than Kate Swift but an equal intensity in her responses to life. Again, however, Anderson pictures a character who attempts desperately and futilely to share this awareness: "Not for years had she felt so full of youth and courage. She wanted to leap and run, to cry out, to find some other lonely human and embrace him" (p. 119). To Alice's credit, although she began "trying to force herself to face bravely the fact that many people must live and die alone, even in Winesburg," (p. 120), she determines to fight her loneliness, participating in Winesburg's available social life.

Other stories explore the participation of the "grotesques" in village play and celebration, usually revealing their failure or ineptness. Joe Welling in "A Man of Ideas" cannot converse normally. Only when he establishes a winning baseball team and courts Sarah King does the town begin to respect him, although his verbosity is still out of control. But the town perceives his play activities as normal or at least as a balance to his conversational eccentricity.

Louise Hardy in "Godliness" also tries too hard and uses the wrong means to break out of her unhappiness:

It seemed to her that between herself and all the other people in the world, a wall had been built up and that she was living just on the edge of some warm inner circle of life that must be quite open and understandable to others. She became obsessed with the thought that it wanted but a courageous act on her part to make all of her association with people something quite different, and that it was possible by such an act to pass into a new life as one opens a door and goes into a room (p. 91).

Unfortunately she chooses studying as her courageous act, never really learning that play would have served better to enhance her social acceptance. Turning to sex as another potential solution, she learns that it is equally ineffective without love. Both acts,

studying and sex, are aspects of a private kind of play, exhilarating when they are performed with a positive attitude and genuine interest, but destructive when performed in Louise's pattern.

Elizabeth Willard also expect marriage to supply "something she sought blindly, passionately, some hidden wonder in life" (p. 224). Anderson pictures a girl full of zest, stage-struck and restless. Finding no real outlet for her energy in Winesburg, she hopes that sexual fulfillment and marriage can replace her unsatisfied spirit of play. In George she relives her hopes and dreams, ecstatic when he announced his decision "to go away and look at people and think" (p. 48). George never shares her delight: "she wanted to cry out with joy, because of the words that had come from the lips of her son, but the expression of joy had become impossible to her" (p. 48).

One of the final scenes shows George wandering alone at the Winesburg County Fair, as "an American town worked terribly at the task of amusing itself" (p. 233). Anderson skillfully parallels George's solitary reflections with the frivolity of the crowd. Unlike that in "Hands," this pairing of isolation and festivity is positive and desired. George's decision to leave Winesburg, shared with Helen White at the now-empty fairgrounds, produces a spontaneous outburst of genuine play. "In some ways chastened and purified by the mood they had been in, they became, not man and woman, not boy and girl, but excited little animals. It was so they went down the hill. In the darkness they played like two splendid young things in a young world" (p. 242). This incident clearly bears out Huizinga's observation, "The play-mood is one of rapture and enthusiasm, and is sacred or festive in accordance with the occasion. A feeling of exaltation and tension accompanies the action, mirth and relaxation follow."<sup>19</sup>

Throughout *Winesburg, Ohio* Anderson illustrates the crippling effects of a stunted spirit of play but offers little remedy. The

grotesques, deficient in a personal sense of play, fail to participate in public play and celebration as well. George Willard, their only social contact, leaves Winesburg. The grotesques remain, inarticulate and alone.

No such loose ends occur in *Main Street*, a highly complex illustration of the American spirit of play, public and private, rural and urban, thwarted and successful. Packing the book with enough detail for a sociology study, Sinclair Lewis examines Carol Kennicott's movement toward a genuine and mature spirit of play. Her inward growth is both caused and illustrated by physical movement from St. Paul to Gopher Prairie to Washington, D.C. and back again to Gopher Prairie. Reared in a family "self-sufficient in their inventive life, with Christmas a rite full of surprises and tenderness, and 'dressing-up parties' spontaneous and joyously absurd," Carol assumes the universality of that particular spirit of play.<sup>20</sup> Her uncritical acceptance of this belief is occasionally threatened in college but "credulous, plastic, young, drinking the air as she longed to drink life," (p. 7) Carol is finally forced to examine her assumptions when she marries Will Kennicott and moves to Gopher Prairie.

The book is structured by Carol's varied attempts to reconcile her concept of the play spirit with Gopher Prairie's theory and practice of play. Though Will has courted her with play and promises of continued opportunity for fun in Gopher Prairie, Carol fails to note his stress on work and progress. As a result, her famous walk through Main Street reveals the overwhelming dominance of work in Gopher Prairie. Only a small movie theater, a few saloons, a tobacco shop, a pool room and several lodges even suggest the possibility of play opportunities. Introducing the first of many parallel scenes, Lewis uses another newly arrived resident, the cleaning woman Bea Sorenson, to reverse the perspective. To Bea, Gopher Prairie fulfills all her emotional and recreational needs: "What did she care if she got



six dollars a week? Or two! It was worthwhile working for nothing, to be allowed to stay here" (p. 43).

Four specific stages emerge in Carol's attempt to realize her spirit of play in Gopher Prairie. Eventually recognizing that the community has a highly structured social life, she struggles to fit. But a welcoming party makes Carol "embarrassed by the heartiness of the cheering group" (p. 31). Her own social offering produces equal discomfort for the guests as she plans a profusion of activity in place of the traditional gossip and stunts. Failure is almost guaranteed by her attitude: "I don't know that I can make them happy, but I'll make them hectic" (p. 76). In describing the nature and significance of play, Huizinga cautions against an attitude such as Carol's: "First and foremost, then, all play is a voluntary activity. Play to order is no longer play: it could at best be but a forcible imitation of it."<sup>21</sup> It takes Vida Sherwin's blunt but accurate observations to begin Carol's reassessment of the meaning of play: "After all, Gopher Prairie standards are as reasonable to Gopher Prairie as Lake Shore Drive standards are to Chicago. And there's more Gopher Prairies than there are Chicagos. Or Londons" (p. 96). Still, Carol suspects that "in their debauches of respectability they had lost the power of play as well as the power of impersonal thought" (p. 77). Vida's balancing perspective gives Carol further insight: "They think you're too frivolous. Life's so serious to them that they can't imagine any kind of laughter except Juanita's snorting" (p. 96).

Temporarily abandoning her attempts to reform Gopher Prairie's established patterns of play, Carol enters her second stage. "She had tripped into the meadow to teach the lambs a pretty educational dance and found the lambs were wolves" (p. 100). Carol then begins the dual process of redefining her own spirit of play and establishing individual but genuine social relationships. Finally she has perceived that she has been "taking her-

self too seriously" (p. 101). In this effort Carol is more successful. Vida Sherwin, Bea Soderstrom, Miles Bjornstam, Erik Valborg, Guy Pollock and several elderly couples give Carol some experiences of real shared pleasure. She also begins to delight in solitary country walks.

Still, she cannot suppress her zeal in bringing more communal play to Gopher Prairie. She organizes skating, swimming, tobogganing, amateur theater parties for the community, which politely samples and then abandons Carol's offerings. In an attempt to define Gopher Prairie's apparent resistance to play, Carol speculates,

It is contentment . . . the contentment of the quiet dead, who are scornful of the living for their restless walking. It is negation canonized as the one positive virtue. It is the prohibition of happiness. It is slavery self-taught and self-defended. It is dullness made God. A savorless people, gulping tasteless food, and sitting afterward, coatless and thoughtless, in rocking chairs prickly with inane decorations, listening to mechanical music, saying mechanical things about the excellence of Ford automobiles, and viewing themselves as the greatest race in the world (pp. 257-8).

Will Kennicott offers an equally blunt assessment of Carol's attempts: "Carrie, you always talk so much about getting all you can out of life, and not letting the years slip by, and here you deliberately go and deprive yourself of a lot of real good home pleasure by not enjoying people unless they wear frock coats and trot out—to a lot of tea parties" (p. 171). Of Kennicott's own spirit of play Lewis writes, "Kennicott had five hobbies: medicine, land-investment, Carol, motoring, and hunting. It is not certain in what order he preferred them" (p. 191). Adding the movies and his card club, Will finds Gopher Prairie more than fills his needs. Carol, however, begins to look beyond the personal and local implications of an attitude toward play: "There are two races of people, only two, and they live side by side. His calls mine 'neurotic;' mine calls

his 'stupid.' We'll never understand each other, never; and it's madness for us to debate" (p. 284).

This stand-off with Will and Gopher Prairie produces Carol's third stage in redefining her concept of play. Because she now feels "alone, in a stale pool" (p. 275), Carol widens her examination, first in a trip to Minneapolis, then in extensive travel in the west, and finally, in a move to Washington, D.C. Despite Will's pledge that "everything'll be different when we come back" (p. 387) and his giving "promise of learning to play" (p. 389), Carol "could discover no more pictures nor interesting food nor gracious voices nor amusing conversations nor questing minds" (p. 401) on her return to Gopher Prairie. Hence she decides that her moving to Washington would give her the necessary perspective to define herself and her relationship to Gopher Prairie: "Do you realize how big a world there is beyond Gopher Prairie where you'd keep me all my life? It may be that some day I'll come back, but not till I can bring something more than I have now" (p. 405).

And the move is salutary. In "a Washington which did not cleave to Main Street" (p. 410) Carol learns and changes. "Her days were swift, and she knew that in her folly of running away she had found the courage to be wise" (p. 409).

What is Carol's newly acquired wisdom? For the first time she recognizes that "the only defense . . . is unembittered laughter" (p. 413). For the first time, too, Carol recognizes that it is she who must change. To Will, visiting Washington to woo her home, she confesses, "'I know it must have been pretty tiresome to have to live with anybody as perfect as I was'" (p. 419). Carol has finally synthesized her outward play activity with a genuine sense of humor and proportion, vital to the play spirit. Until Washington showed Carol how to play naturally and freely, she was just as deficient in a real play spirit as those Gopher Prairie inhabitants whom she once scorned. "I can laugh now

and be serene . . . I think I can,"" (p. 424) a confident, relaxed Carol muses, on her way home. But change is not so easily or quickly accomplished. "She laughed at herself when she saw that she had expected to be at once a heretic and a returned hero; she was very reasonable and merry about it; and it hurt just as much as ever" (p. 429).

Varied though the five books are in defining and illustrating a spirit of play in rural America, several strains reappear. Play or festivity, if it has any meaning, must be totally integrated into a person's and a community's life. Ideally there must be a private commitment as well as a public manifestation of festivity and celebration. Real play will grow out of its environment spontaneously and naturally. It cannot successfully be imposed or forced. At the same time, however, it cannot become obsessive or exaggerated. In both cases it ceases to be play. Further deadening of the play spirit occurs when play becomes rigid and stylized instead of spontaneous.

Does a spirit of play exist in these fictional villages? Certainly. Sometimes natural, more often forced, stifled, or feeble, seldom as spontaneous, free and developed as it should be, this spirit of play, both negatively and positively, is a strong influence on the revolt from the village.

#### NOTES

<sup>1</sup> Johan Huizinga, *Homo Ludens: A Study of the Play Element in Culture* (Boston: Beacon Press, 1955), p. 5.

<sup>2</sup> Josef Pieper, *Leisure the Basis of Culture*, trans. Alexander Dru (New York: Pantheon Books Inc., 1952), pp. 51-2.

<sup>3</sup> Huizinga, p. 9.

<sup>4</sup> Richard H. Rupp, *Celebration in Postwar American Fiction 1945-1967* (Coral Gables: University of Miami Press, 1970), p. 66.

<sup>5</sup> Rupp, p. 159.

<sup>6</sup> Rupp, pp. 27-8.

<sup>7</sup> Harvey Cox, *The Feast of Fools: A Theological Essay on Festivity and Fantasy* (Cambridge: Harvard University Press, 1969), p. 26.

<sup>8</sup> Cox, p. 110.

<sup>9</sup> Rupp, p. 211.

<sup>10</sup> Huizinga, p. 51.

<sup>11</sup> Huizinga, p. 132.

<sup>12</sup> Hamlin Garland, *Main-Travelled Roads* (New York: New American Library Inc., 1962), p. 12. Further references are indicated by page numbers in the text.

<sup>13</sup> Cox, p. 23.

<sup>14</sup> Edith Wharton, *Ethan Frome* (New York: Charles Scribner's Sons, 1911), p. 31. Further references are indicated by page numbers in the text.

<sup>15</sup> Hugh Rahner, *Man at Play* (New York: Herder & Herder, 1967), p. 65.

<sup>16</sup> Willa Cather, *My Antonia* (Boston: Houghton

Mifflin Co., 1918), p. 102. Further references are indicated by page numbers in the text.

<sup>17</sup> Maxwell Geismar, *The Last of the Provincials: The American Novel, 1915-1925* (Boston: Houghton Mifflin Co., 1947), p. 161.

<sup>18</sup> Sherwood Anderson, *Winesburg, Ohio* (New York: The Viking Press, 1958), p. 27. Further references are indicated by page numbers in the text.

<sup>19</sup> Huizinga, p. 132.

<sup>20</sup> Sinclair Lewis, *Main Street* (New York: New American Library, Inc., 1961), p. 12. Further references are indicated by page numbers in the text.

<sup>21</sup> Huizinga, p. 7.

# INCREASE A. LAPHAM'S PIONEER OBSERVATIONS AND MAPS OF LAND FORMS AND NATURAL DISTURBANCES

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Increase Allen Lapham, Wisconsin's first natural historian, lived in Wisconsin from 1836 until his death in 1875 and traveled extensively throughout the state, recording his observations about Indian mounds, vegetation, weather, mineral resources, water and other natural phenomena. He was a prolific writer and, in 1846, published the earliest book on Wisconsin geography, geology, and natural history. Lapham's extensive observations of wind and fire in Wisconsin vegetation provide valuable historical evidence of natural disturbance before European settlement caused large-scale environmental alteration.

Disturbance has long been recognized as an important factor in ecosystem dynamics. Recent studies include Lorimer (1977) on fire and wind in the presettlement forests of northeastern Maine, Zackrisson (1977) on forest fires in the Swedish boreal forest, Brewer and Merritt (1978) on windthrow and tree replacement in a beech-maple woods in Michigan, and Forman and Boerner (1981) on fire in the New Jersey Pine Barrens. Earlier studies include those of succession in canopy gaps created by windthrown trees (Bray 1956), windfalls in northern Wisconsin (Stearns 1949) and effects of hurricanes on northern hardwood forests in the northeastern U.S. (Stephens 1955). Lorimer (1977) in Maine, Canham (1978) in Northern Wisconsin, Dorney (1981) in southeastern Wisconsin and Lindsey (1973) in Indiana all used notes made by early land surveyors to construct vegetation maps showing areas of wind and/or fire damage. White (1979), in a comprehensive review of the subject, concluded that disturbance and cyclic succession are recurrent events affecting vegetation

structure; whereas traditional succession (the sequential replacement of tree species) occurred without disturbance. Ecologists generally agree that disturbance is important in determining species dispersal, community structure, and the rate of community change.

Historical documentation of disturbance has received less attention. White (1979) mentions Raup as an early proponent of the subject with publications dating from 1941. Interest in disturbance in Wisconsin vegetation dates from Norman Fassett, John T. Curtis and their students at UW-Madison from the 1930's to 1950's. While settlers and travelers often noted the effect of fire on Wisconsin vegetation, especially in prairie and savanna (e.g., Beltami 1828, Haight 1907), less attention was given to the effect of wind.

Lapham in an undated note (probably from the 1850's) in his collected work at the Wisconsin State Historical Library, stated:

"The condition of the country now entranced within the limits of Wisconsin, five hundred years ago may have been quite different from the present. It is quite certain that the prairies then covered a much larger portion of the state than at present. The largest trees are probably not more than 500 years old. Large tracts are now covered with forests of young trees, where there are no traces of an antecedent growth. The state is subject to sudden gusts of wind sweeping through the forest, turning up the trees by the roots. The earth turned up with the roots falls upon the decay of the roots forming an elongated mound by the side of the depression at the place where the tree stood. Now as there has been no change of climate, it is clear that this process must have been repeated from time to time and in course of ages the whole

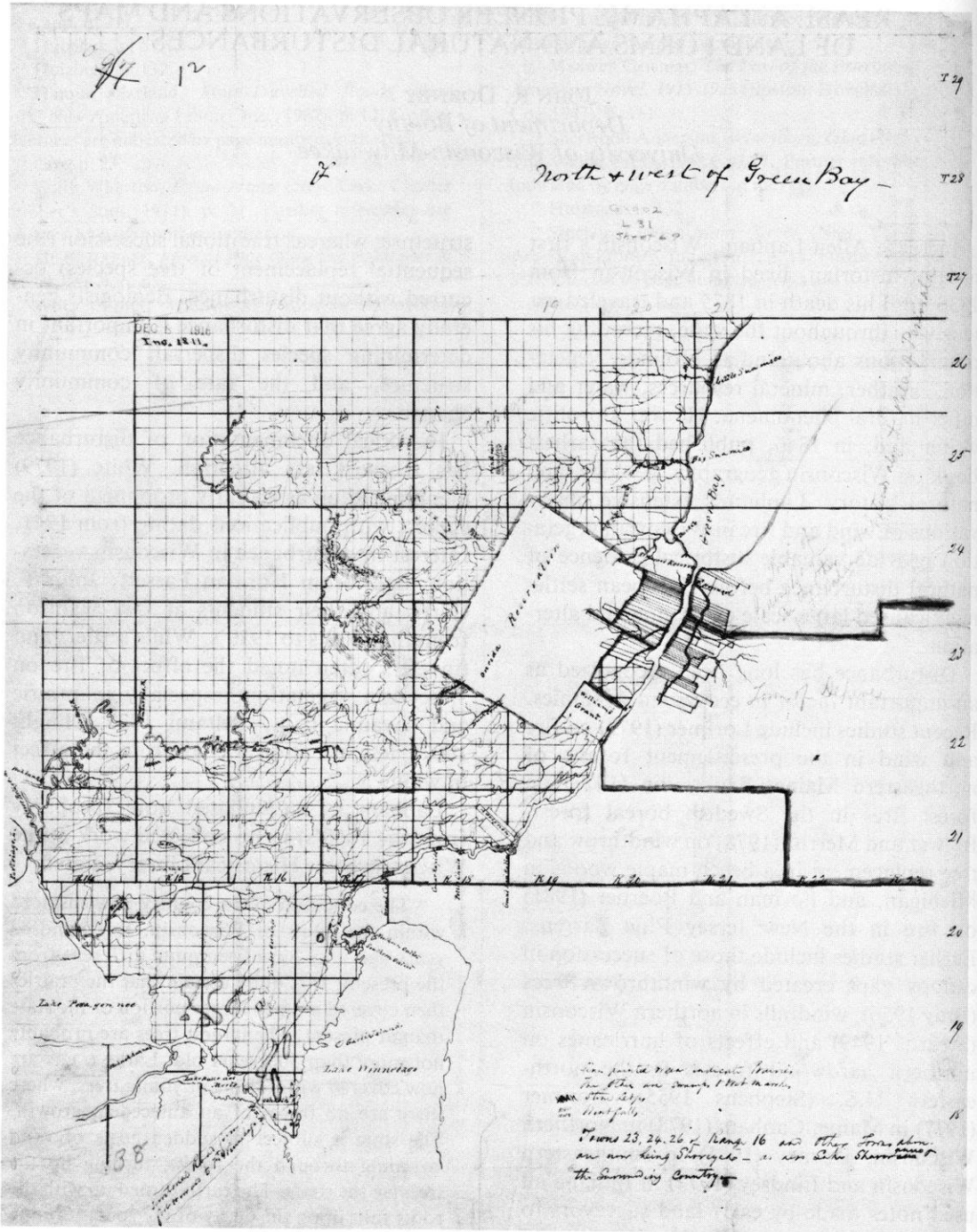


Fig. 1. Area North and West of Green Bay showing windfalls (≡≡≡), rock ledges (\*\*\*\*\*), swamps (○) and prairies (○). State Historical Library-Map Collection Number GX902 L31 Sheet 6P.

surface would be dotted with these small hillocks. The paucity of the 'tree mounds' may be deemed evidence of the recent origin of the forests."

Further, in a letter from Mayville, Wisconsin, dated October 18, 1851, Lapham stated that:

"Every year the high winds prostrate a great number of forest trees, and the earth adhering to the roots form upon their decay a little mound. Now if this process had been continued from a very early period, it is to be presumed that these mounds, made by successive growths of trees, would be very numerous."

In 1855, Lapham published his survey of Indian mounds in "The Antiquities of Wisconsin." After describing the mounds and their location in the state, he discussed the issue of windfalls and restated his earlier views about the presence of tree mounds, fire and the age of southern Wisconsin forests. He said "Whether the greater extent of treeless country in former times was owing to natural or artificial causes, it is now difficult to determine . . . but the country was at least kept free from trees by the agency of man." Lapham referred directly to Indian-caused fires when he stated that the annual fires in oak savanna were "often kindled on purpose by the Indians on their hunting excursions." He also mentioned the ". . . deep shady woods where fires do not so often penetrate . . ." (1846). Lapham described a first-hand experience near Pewaukee in 1850. He was visiting an oak savanna and said "At the time of our visit, a fire was raging through the woods about us, consuming the dry leaves and brush and filling the air with smoke. . . . The peculiar noise made by the fire as it entered the marsh . . . was very great." Lapham's speculation that fire had maintained prairie in southern Wisconsin was corroborated when Curtis (1959), after examining the accumulated evidence, concluded that Indian fires were the

major reason for the persistence of prairie and savanna in Wisconsin.

Lapham also seems to have been the first naturalist to employ the General Land Office (GLO) surveyors' notes for the construction of detailed maps of land forms and vegetation. Such maps were made possible because, in addition to establishing section and township lines, the GLO surveyors were required to note the agricultural value of the land and locations of streams, rivers, prairies, rough land, swamps and windfalls. A portion of one of Lapham's maps based on surveyors' notes was published in his 1855 report but the map is reproduced here in its entirety for the first time (Fig. 1). A century after Lapham had drawn his maps Bourdo (1956) reviewed the use of the GLO notes to prepare vegetation maps and suggested that they be widely used for this purpose.

Lapham's first map (Fig. 1) was a preliminary sketch of the area from the Fox River and Green Bay to the Wolf River and Lake Butte des Morts. It covers about 1000 square miles including portions of the present Brown, Outagamie, Winnebago, Oconto and Shawano counties. The lots along the Fox River were notable. These lots, laid out by the early French settlers in the 1700's lay perpendicular to the river with narrow river frontages. This pattern, largely lost with the imposition of the GLO grid system, is still observable along parts of the Fox River in the City of Green Bay.

Lapham's map presented detail on streams and rivers in the region. Swamps and wet marshes tended to be parallel to rivers or to occur in isolated patches. Lapham also noted stone ledges along the Wolf River and its tributaries. Several sawmills are shown on the Wolf, and Little and Big Suamico Rivers as well as a tannery on the Big Suamico River, but the chief area of settlement on the Wolf was at Oshkosh. The major rapids on the Fox River were noted as was the Oneida Indian Reservation west of Green Bay.

Prairies and an oak opening were mapped near Lake Butte des Morts and Oshkosh. Prairie was unusual this far north in Wisconsin (Finley 1976). On the east side of Green Bay, the surveyors also noted areas of oak savanna that were associated with Potawatomi Indian village sites and were probably maintained by fire.

Of special interest are the eight windfalls shown on the map. They occurred at various places throughout the region but were concentrated mostly west and north of the city

of Green Bay. These windfalls appear to be of two types. Narrow windfalls, such as the one south of the Big Suamico River, were about one-quarter mile wide and several miles long and appear to be tornado tracks similar to those reported by Lindsey (1973) in Indiana. Larger areas tend to be about one mile wide and several miles long like those west of the Oneida Reservation. These may have been caused by downbursts such as those that occurred in northern Wisconsin on July 4, 1977 (Fujita 1977). In northern

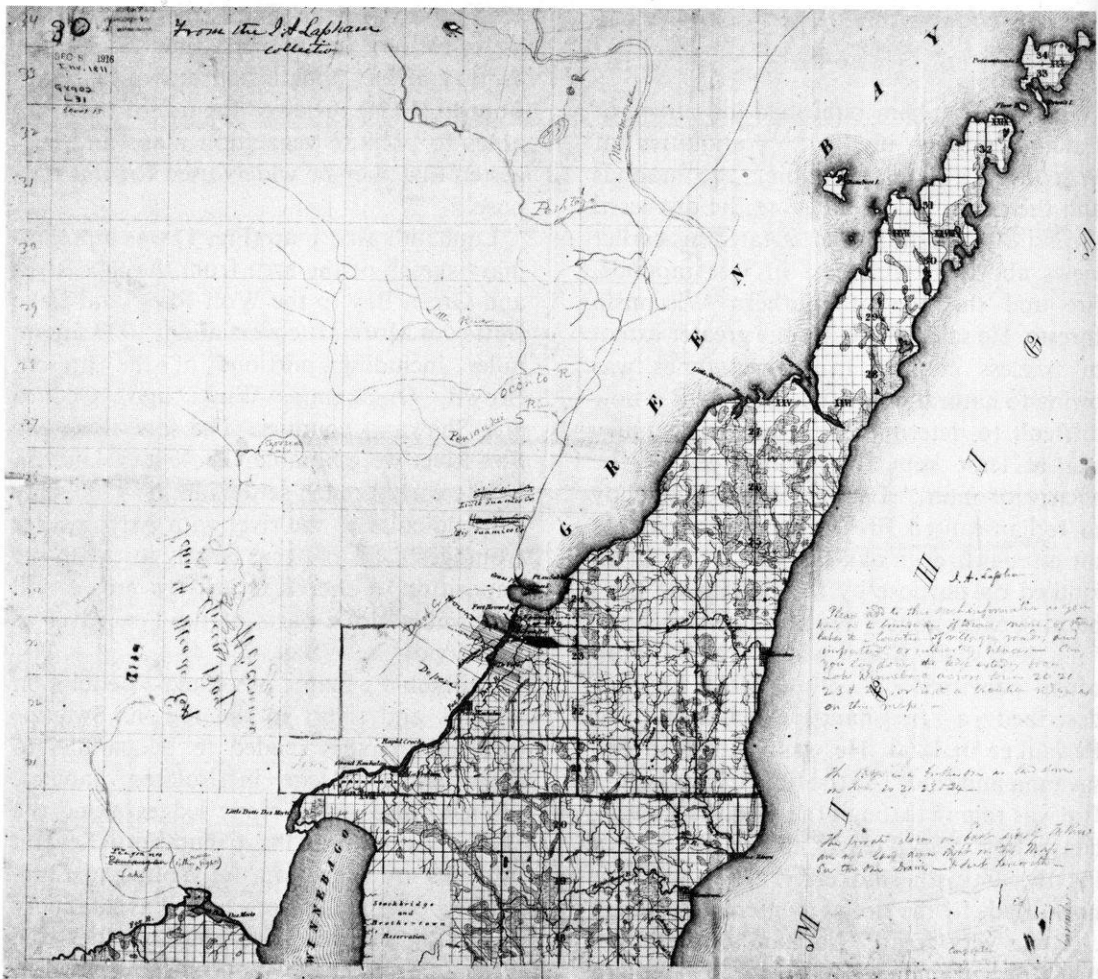




Fig. 2. Door and Kewaunee Counties and parts of Brown, Calumet, Manitowoc, Winnebago, Waushara and Outagamie Counties showing marshes (  ), and stone ledges (  ). State Historical Library-Map Collection Number GX 902 L31 Sheet 15.

Wisconsin, other large windfalls were shown in the GLO notes (Canham 1978). Winds associated with downbursts may flatten trees in large patches.

Lapham also prepared a map of the area east of the Fox River from Lake Winnebago to Door County (Fig. 2). On this map, he showed swamps, rivers, stone ledges and settlements but for some unknown reason, ignored the oak openings and prairies along the east shore of Green Bay (Finley 1976).

Lapham speculated on the age of forests in southern Wisconsin which he estimated to be less than 500 years old and occupying land which previously had been prairie. It is certainly true, as Lapham noted, that windfalls create pit and mound relief. Stone (1975) examined the effect of windfalls on microrelief in forests in New York state. Estimates of the area affected by uprooted trees in his stands varied from 14 to 48% of the land surface. In Pennsylvania, Denny and Goodlett (1965) found that this microrelief was common in old growth forests and concluded that 250 to 300 years of erosion could reduce the height of these mounds to one foot. Stephens (1955) used tip-up mounds in the Harvard Forest to date the windfalls and describe the effect of hurricanes on the vegetation. Such mound and pit microtopography is characteristic of forested landscapes and Lapham was correct in noting that their absence from a forested site suggests recent invasion by trees.

Other evidence also indicated that prairies were more widespread before settlement. Based on pollen stratigraphy, Bryson and Wendland (1967) decided that Wisconsin's climate was drier and cooler around 1200 A.D., which was a period of prairie invasion into central Wisconsin. A gradual change to a wetter climate had occurred by 1850. Also, King (1981) points to pollen evidence from northern Illinois which indicated a trend toward cooler temperatures that began between 900 and 400 years ago. Thus, Lapham's observation that forests in southern Wisconsin were young and occupied sites

which previously had been prairie appears well founded.

Lapham was aware of the impact of natural events on vegetation, particularly wind and fire. In his pioneering observations, he commented mostly on the physical damage caused by wind on trees and soil but apparently did not describe the effect of wind on tree species or plant succession. This is not surprising since plant succession as a process was not well defined in the United States until the work of Cowles and Clements about 50 years later (Oosting 1950). Lapham's observations and records of wind and fire disturbance, and his pioneering use of GLO surveyors' records for mapping original vegetation and early settlement patterns, are important to both historians and ecologists.

#### ACKNOWLEDGMENTS

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# THE GEOMETRIC STYLE IN ART: A BRIEF SURVEY FROM THE PALEOLITHIC TO THE TWENTIETH CENTURY

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The geometric style is perhaps the oldest in history. Beginning in the Upper Paleolithic, the geometric style is still vital in the twentieth century. This brief survey attempts to show how the geometric style may have originated, how it has contributed to the evolution of new art forms, and most important, how it has been an essential instrument in the development of human consciousness.

The geometric style began during the Paleolithic era, about 20,000 years ago. We find it expressed both in mobiliary art (portable art) and in parietal, or cave art. Next to the paintings or engravings of deer, bison, and other animals found in caves or rock shelters from Spain to Southern Russia are painted squares, rectangles, circles, dots, and tectiforms (shapes composed of these geometric elements). Some scholars believe that since these geometric forms are not found in nature they must have a religious meaning. Others feel that these geometric shapes may depict elementary forms of architecture such as the trap, pitfall, or hut. But it is in the mobiliary art that we gain a clearer insight into the meaning and function of the geometric in the Upper Paleolithic era. Some of the carved mobiliary pieces represent animals and fertility goddesses. Others, animal bones and stones, bear incised carvings of plants and animals as well as geometric repeated motifs. Such carved repeated motifs range from simple straight lines to triangles to more complex arrangements of geometric shapes. These incised bones and stones were transported about for long periods of time, as is shown by evidence of wear. The goddesses and incised animals were probably used in fertility cults, and may also have been appreciated as art objects. The same may be said of the small

bones with almost decorative geometric designs. These have been found in large numbers and must have occupied a place of great importance in the Upper Paleolithic, from about 20,000 to 10,000 B.C.

In his book *The Roots of Civilization* (McGraw-Hill, 1972), Alexander Marshack states that mobiliary art with geometric markings may have had an important function in the lives of the Cro-Magnon, the inhabitants of Europe during Upper Paleolithic times. He believes these objects to be notational. They originated, he says, out of a necessity to record time and sequence, so that the Cro-Magnon hunters could survive the Ice Age in Europe. They were not merely curious objects with geometric repeat designs. On the contrary, Marshack's innovative analysis of these mobiliary pieces points toward a lunar notational function. Under a powerful microscope, it can be seen that the carving or incising was done at different intervals using different tools, which means they must have been done over a definite time period for a particular reason, perhaps having to do with gestational or seasonal or migrational patterns. Further, Marshack writes, "In order to record and act upon his lunar observations, he (Cro-Magnon-Ice Age) must have had a spoken language of great range and expressiveness. His notations on stone and bone clearly foreshadow writing. He was becoming a master of art and symbol." Clearly, the geometric may have its origins in basic intellectual development, and in basic perceptual development as well. (Fig. 1)

That geometrical markings on mobiliary art may have been notational, calendrical, and a prelude to writing, removes it from the realm of the merely decorative. And yet, the

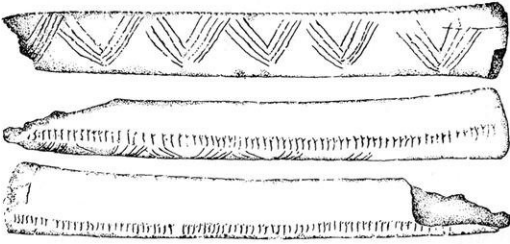


Fig. 1. Three faces of an engraved eagle bone,  $4\frac{1}{2}$ " or 11 cm., from the site of Le Placard. Middle Magdalenian. Adapted from a photo by Alexander Marshack in *The Roots of Civilization*.

geometric as a purely decorative device constitutes an important visual development in the history of art. Mobiliary art with geometric incising or with naturalistic seasonal imagery (animal and plant forms) represents an entirely new schema, or visual concept in art. This schema was presented on the limited surface that the stone or bone provided. For the first time we encounter the portable surface in art. This feature of mobiliary art separated it conceptually from the cave paintings. Cave art was neither centered or framed and certainly not portable, and in many cases, it was almost inaccessible. The schema of the small, portable surface utilizing naturalistic and geometric motifs first developed during the Upper Paleolithic. However, beginning in the European Mesolithic era, the schema finds new surfaces, or a new surface will effect the schema in a new way.

During the Mesolithic (roughly 10,000 to 5,000 B.C.) the ice receded in Europe. Forests

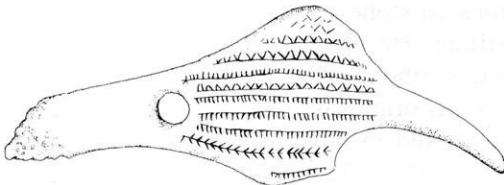


Fig. 2. Ceremonial axe or "antler mattock," engraved in a "geometric pattern," 16" to 20" in length. Adapted from photo by Alexander Marshack in *The Roots of Civilization*.

spread over much of the continent, eliminating the vast grasslands and causing the great herds to disappear. The Cro-Magnon peoples dispersed into small groups of hunters and gatherers. It is perhaps because of this scattering that fewer of their artifacts have been found. Or perhaps, because more time was spent in food acquisition, less time was available for the production of art. Fortunately, however, small, portable, carved artifacts and tools of amber, stone, bone, and antler have been found well preserved in Denmark from the Mesolithic Maglemose Culture. Of great interest is a ceremonial axe made from a reindeer antler which bears organized, variegated rows of repeated geometric shapes incised into the surface of the bone. Alexander Marshack has subjected this ceremonial axe to lunar notational analysis and found the incisions on the axe could be notational for a time span of a year and a half. This could be a seasonal span or perhaps a religious or ceremonial cycle. Whatever its notational function, the geometric schema on the surface has become more organized and sophisti-



Fig. 3. Engraved amber from the Maglemose culture (North Sea Region) with two bands of birds riding on schematized water angles.  $2\frac{3}{4}$ " long. Adapted from an illustration by Alexander Marshack in *The Roots of Civilization*.

cated. The antler axe has a particular, well integrated and pleasing geometric design which has been transferred directly from the Upper Paleolithic. This same design will be transferred again to a new surface in the Neolithic era in Europe. (Figs. 2, 3) Another artifact found in the Maglemose Culture that is evidence of direct transference of decorative schema is an amber piece incised with water angles (triangles) and bands of geometricized waterbirds. This is a seasonal image, according to Marshack. This image would be directly transferred to a new surface, pottery: on a Neolithic pot found in Russian Carelia near Finland, Marshack points out that the same imagery is incised in the surface, an example of the fact that mobiliary art pieces were definitely an early source for the decorative impulse on utilitarian and ceremonial objects. (Figs. 4, 5)

Because of its durability and plentiful supply, pottery or ceramics, the "master fossil," enables prehistorians to follow migrations and discover origins of cultures all over the world. The Neolithic period in Europe (roughly 5,000 to 3,000 B.C.) was the agrarian "settling-down" time, during which pottery became the impermeable and

rodent-proof container for water and grains, and a receptacle for ashes of the dead. Here was a surface that invited a painted or incised decoration. Weaving and basketry shared pottery's practical and artistic functions using geometric motifs to organize and "measure" surface areas into bands and units of rectilinear as well as curvilinear design. It is possible that weaving, with its basic grid form influenced land organization in early agriculture. Land tended to be divided into grids and units of enclosure to accommodate crop and stock-raising. The geometric provides a measuring not only of time, but now in the Neolithic, a measuring of space (land).

During the Neolithic, different styles of the geometric were evolving in different areas of Europe. One style was curvilinear (spirals, whorls, circles); the other was rectilinear and severe (squares, triangles, rectangles). The geometric curvilinear appears ubiquitously, first in southeastern Europe, where it later disappeared only to re-emerge in Crete during the Bronze Age after 2000 B.C. The geometric rectilinear ap-

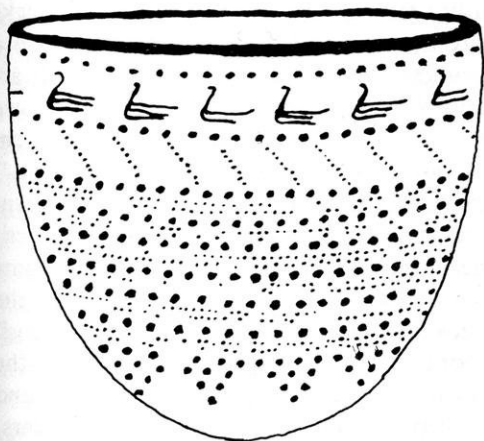


Fig. 4. Comb and pit marked pot with a frieze of swimming water birds from Carelia. (6" high) Adapted from an illustration in *The Stone Age Hunters*, Grahame Clark.



Fig. 5. Pottery from bell beaker culture (6" or 7" high) adapted from a photo in *Prehistoric European Art* by Walter Torbrugge.

parently originated in southwestern Europe and expanded eastward toward Northern Italy, to the Balkans, and eventually into Greece, effecting the art forms of that area, which in turn profoundly influenced all of European art. Even now, folk arts in Europe perpetuate this same rectilinear geometric tradition that originated in Neolithic times. We can see this especially in folk weaving and pottery. Although the two types of geometric traveled in different directions, there was a constant overlapping and alternation of the two forms in pottery decoration as well as in other art forms.

The Neolithic settlements in Thessaly, north of mainland Greece, provide examples of this overlap of the curvilinear and rectilinear. During the 4th millennium B.C. the early Sesklo peoples and the later Dimini painted and incised pottery with both rectilinear and curvilinear decoration. The curvilinear was composed of spirals and whorls. (This form of the curvilinear traveled from the Balkans to Crete via the Dimini culture).

Because the island of Crete and the other Aegean settlements were open to all areas of Europe and the Mediterranean, it becomes important in this survey to focus on these areas, especially Greece. We must trace the influences bearing upon these areas which stimulated the production of pottery, in many ways became the most prominent art form.

During the Bronze Age, which lasted until about the 12th century B.C., the Helladic culture on the Greek mainland developed a so-called Matt-painting technique for ceramic vessels, in which the painted motifs were of a rectilinear geometric nature. This development was the result of an integration of the Balkan and eastern Mediterranean traditions of rectilinear geometric. However, this style was suppressed as the Mycenaean civilization, overcoming the Greek Helladic civilization, asserted itself. The Mycenaeans differed from their conquered subjects in that they had adapted the Cretan style of

naturalistic and curvilinear design. (And in an unsuccessful manner according to some investigators.) The Mycenaean civilization collapsed around the 11th century, as a consequence of internal dissensions within the Mediterranean sea-trading civilizations, combined with invasions from the north by less civilized peoples looking for land and plunder. During this period Central and Northern Europe were asserting themselves with the new weapons, and they were carrying off art and artisans to the north where their skills were most needed. In Mycenaean Greece the time known as the "Dark Ages" began; little is known of the events of this period.

From the "Dark Ages" emerged Geometric Greece, a period which lasted from about 1075 to 700 B.C. A visual and intellectual evolution took place, especially in Athens, during which decoration on pottery or vases paved the way for a new concept in art. Eventually the geometric was to yield some of its dominance of surface area, to make room for a figurative, naturalistic, and narrative presentation of art. The geometric, in effect, became a frame for a naturalistic picture.

In Bernhard Schweitzer's book *Greek Geometric Art* (Phaidon Press, 1969), the author states, "The post-Mycenaean Greeks were the first and only people to develop a Geometric art which spread through all art forms." And, "For the first time artists are seeking the real nature of Geometric form . . . out of the basic elements of geometry." The curvilinear naturalistic Creto-Mycenaean style is gradually replaced by a rectilinear geometric style. Although some scholars disagree, it is thought that the Greek Geometric style of vase and utensil decoration evolved gradually through the stylistic elements of Helladic, Balkan, and post-Mycenaean. Even the Dorian invaders, themselves Greek, settling on the Greek mainland contributed to the re-emergence of the rectilinear.

The rectilinear did not emerge and dom-

inate immediately, however. In Athens, in the 10th century B.C., it was preceded by the Protogeometric vase style. This was a style of concentric circles accurately painted which evolved from the post-Mycenaean curvilinear spiral vase decorations. Located on the belly or shoulder of the vases, depending upon the location of the handles, these concentric circles floating on the vase surface became like icons or mandalas to guide the people of Greece from the poverty of the "Dark Ages" to prosperity. These concentric circles and sometimes half circles were painted on the vase surface with the aid of a compass. The compass and later, the ruler, became the new instruments used to articulate geometric development. The circle, a primary geometric shape like the sun, and completely symmetrical from all directions, was the form that most challenged the Greek vase painters of the Proto-geometric era.

About 900 B.C. a geometric rectilinear decorative style of triangles, chequers, and meanders began to dominate. These elements were organized in rows of separate bands, encircling the vase. During this period in Geometric Greece, the meander became the dominating motif on the vases. From its origin in the Paleolithic onward the meander, a rectilinear geometric design, was symbolic of water, perhaps because of its resemblance to waves, lightening, and rivers. The meander was adapted, or perhaps re-invented and made more complex by the vase painters of Athens. Rectilinear decorations of meanders, triangles, and rectangles, soon covered the vase, like a mesh or mosaic design, becoming one with the vase itself. The shape of the vase was influenced by the design and became more sculptural and architectonic.

During the 8th century B.C. in Athens, the neck and shoulder of the vases were areas of special interest. Here, panels containing geometric elements such as solitary circles, diamonds, and zigzags, were enclosed, or framed, by other geometric elements, often a

small meander band. The panel was thus framed in the area between the handles of the vases, resulting in an almost anthropomorphic effect of back and front. Another development during this time was the Dipylon style funeral amphoras. These vases were sometimes over 5 feet tall. They were set up as memorials on tombs. The panel of special geometric motifs was replaced by a panel framed by geometric designs, leaving the panel itself free for the depiction of a special scene. This was often a funerary scene of mourners. Although the figures of the mourners and dead person were geometrized and although the compositions still resembled the panels of the ornamental compositions of the earlier vases, the funeral scene was a pictorial innovation that opened



Fig. 6. Amphora adapted from Kerameikos Museum, Athens. (1.55 M. high) Photo found in *Greek Geometric Art* by Bernhard Schweitzer.

the way for the narrative, figurative portrayal of the heroes of Greek mythology. The shape and very large size of the funerary vase also contributed to the development of the "picture," presenting the vase painter with a larger, flatter, and framed rectangular surface. This new planar surface brought about new aesthetic considerations for the Athenian artist. (Fig. 6)

From the 6th century B.C. onwards, first in the Black-Figure amphoras, and then in the Red-Figure amphoras, Athenian vase painters depicted the Gods and legendary heroes of Homer and other epic poets. The geometric was reduced to a framing band around the narrative scene, which now dominated the surface of the vase. Because the pictures were placed in areas between the

handles on the front and on the back, the result was that in certain ways the vase became conceptually a two-dimensional object, a portable vehicle for a composed, planar, framed narrative picture. This was an object which every Athenian citizen could possess. The geometric had made space for the picture on the vase surface. Soon the picture would be released to a new non-utilitarian surface emerging as a free picture without a connection to any utensil, vase or building architecture.

Although in Greece the geometric was on the wane in vase painting it continued to function and develop in another realm, architecture. In his book *Greek Geometric Art*, Bernhard Schweitzer writes, "All the sources of Greek temple architecture are to



Fig. 7. Russian Icon, *Our Lady of the Sign*. " × 34-3/4".  
Courtesy of the Elvehjem Museum, Madison, WI.

be found in the Geometric period." This may be true of all architecture to follow.

After the artistic explosion the geometric caused in Greece, from 1075 to 800 B.C., the geometric as a primary visual form receded for many centuries into other forms relating to decoration and ornamentation. European peasant art, for example, stressed geometric motifs of triangles, meanders, and circles. In religious art the geometric retained its primary forms of rectangles, squares and circles in the shapes of the icons, within which saints and deities were portrayed, Europe thus retained the geometric, but in a subtler form. The dormant geometric was to erupt again in Europe, especially in Russia, a "backward" country ripe for both political and artistic revolution.

At the turn of the century in 1900 A.D., Russia was a place of great artistic freedom. The constricting bonds of the French and German schools of art, established in Russia since the 18th century, were being shattered. The patrons of the arts were no longer the nobility, but wealthy industrialists eager to sponsor new and innovative Russian cultural movements in theatre, dance, opera, poetry and the visual arts. This movement looked toward many sources in its attempt to identify the true Russian culture.

In the early 1800's with the help of the wealthy Stroganoff family, Russian scholars had begun to study the history of Russian icon painting. These small medieval paintings with their religious subject matter, having been overpainted for centuries, began to be restored to their original brilliant colors and purity of line. Finally, in 1913, an exhibition of these restored icons in Moscow entitled "Ancient Russian Painting," influenced many of the leading Russian artists of the day, profoundly impressing them by the richness of color and the geometric "flatness" of composition. The image that this portable little painting liberated was to join with certain artistic forces already afoot in Russia in the early 1900's. (Fig. 7)

Another vehicle for artistic liberation in

Russian was the peasant art. Almost intact in some rural areas since the Neolithic, these peasant cultures became the source of a new 'Primitivistic' style of painting in the early years of the 20th century in Russia. With the Russian peasant recognized as the new national hero, the popular arts of weaving, woodcarving, and embroidery became a source of inspiration for this primitivistic movement in Russian culture. Although a great many artists as well as poets and musicians participated, the painters Natalia Goncharova, Vladimir Tatlin, and Kasimir Malevich emerged as the most important innovators during the early 20th century. The folk arts with their schematized and geometricized figures and designs influenced these painters towards flatness, directness and simplicity of composition, opposing the naturalism prevalent in Europe. The icon painting and the folk arts promoted and nurtured this artistic direction, but there were other forces as well which influenced this development. (Fig. 8)

Not only did the artists look to the past for inspiration, but developments in mathematics and science also stimulated the formulation of new artistic concepts and new visual materials. Einstein's "theory of relativity" published in 1905 had a profound effect on concepts of imagery. It denied the existence of "absolute space" and "absolute time." It proposed that measure-



Fig. 8. Russian folk embroidery on end of towel in design known as "Cavaliers and Ladies." Adapted from illustration in Camilla Gray's, *The Russian Experiment in Art*.



ments of space and time were “relative” to some arbitrarily chosen frame of reference. From this moment on, the universe was to be viewed in a different way. Artists such as Kasimir Malevich set about creating an appropriate image to reflect this new concept. Images could no longer exist in 19th century time and space.

The scientific discoveries opened new avenues of thought but also brought about a crisis in religion, not only in Russia but in Europe. Spiritual movements emerged to ease the void and replace the traditional religions. The Theosophical movement was one such movement that inspired many artists toward a non-objective image: God was no longer conceived in Man’s image but as an idea or a transcendental spiritual force. The spiritual movements stimulated the search for a new 20th century image. Male-

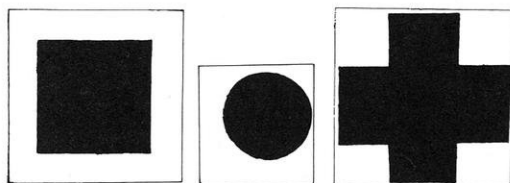


Fig. 9. Primary forms including *The Black Square*. Adapted from illustrations of Malevich’s book, *Suprematism, 34 Drawings*, Unovis Vitebsk, 1920. These were found in *Kasimir Malevitsch* by Antonina Gmurzynska.

vich, like his countryman Kandinsky and the Dutch artist Mondrian, believed that the function of art was to serve as a reflection of cosmic order. Artists turned toward the abstract, toward the non-objective, and with Malevich, toward the geometric.

Lifting the primary geometric shapes of the circle, square, and rectangle directly

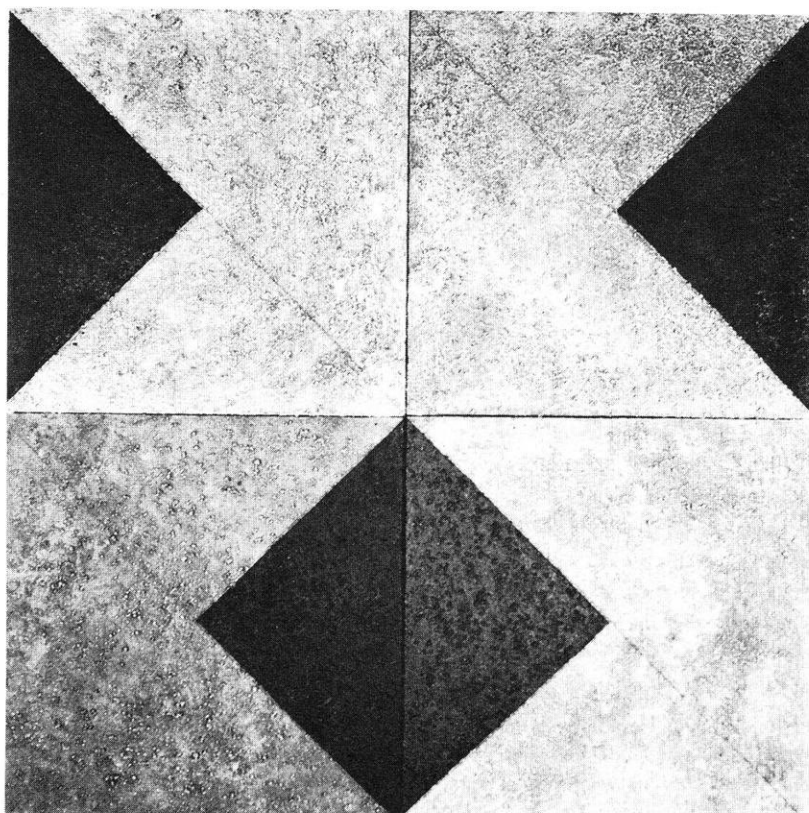


Fig. 10. Painting by Sally Hutchison Ceely (48" x 48") *untitled*. Made of our identical units, which form an image of an enlarged weaving segment.

from the Medieval Russian religious icons, and from peasant decoration, Malevich offered a new modern concept of painting to artists all over the world. The Suprematist Movement had begun. The *Black Square*, one of Malevich's first Suprematist paintings, was hung in a corner of his room, the corner being the place reserved for religious icons. This 1913 painting of a black square on a white ground was what it was. It was not related to, or imitative of nature. Though he received much opposition and criticism for his stance, Malevich revitalized the geometric in art. (Fig. 9)

The Russian poet, Khlebnikov, a close friend of Malevich, sums up the feelings of the time in his essay, "To the Painters of the World." In it he writes about a common language, accessible to all through "mute geometric signs" as the fundamental units of comprehension. Thus, the Russian artists attempted to re-establish the geometric which had begun in the Paleolithic. They attempted to offer concepts which would bring about stability and universality in a time of great upheaval and change.

Malevich in his Suprematist system not only proposed new artistic concepts to the visual artist, he influenced industrial design and architecture as well. His series of three-dimensional idealized architectural drawings done in 1915 were a forecast of what would become the International Style of architecture of the mid-century. As the geometric created the architecture of Greece in 700 B.C., so too the geometric artists of the 20th century paved the way for the modern architecture of today.

The geometric concept of abstraction continues to evolve in contemporary art. The simple primary shapes, alone or combined in repeated forms, provide an untiring and effective imagery. Just as Malevich resurrected the geometric from its subservient decorative function and gave it new life, I hope to find new ways to present the geometric in art. The geometric served admirably during Paleolithic times. It is

waiting to be reclaimed by the artist of today. (Fig. 10)

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# COLOR MIXTURE IN COMPUTER GRAPHICS

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## *Abstract*

Digital control of color television monitors has added precise control of a large subset of human colorspace to the capabilities of computer graphics. This subset is the set of colors spanned by the red, green, and blue electron guns exciting their respective phosphors. A color can be represented as a triple of numbers between zero and one, representing the excitement levels of the respective guns. This capability allows the creation of new and the testing of old mathematical formulae regarding color mixture.

This paper presents the three basic models of color mixture (additive, subtractive, and pigmentary), as well as algorithms for computation of color resulting from mixture of arbitrary amounts of two colors under either of the three methods. Guidelines for extension of the algorithms to deal with simultaneous mixture of more than two colors are provided. Particular emphasis is placed on pigmentary mixture, with a discussion of a new geometric model, in which the hexagon is presented as a shape more consistent for modeling the pigmentary color gamut than the canonical circle.

## INTRODUCTION

The human visual system analyzes color according to the levels of three primary components (red, green, and blue). Color television monitors thus span human colorspace by varying the amounts of red, green, and blue (*rgb*) phosphor excitement. Since computer graphics programs normally interface with these monitors, a color is often defined as an *rgb triple* of numbers representing the excitement levels [17, 20].

Computer graphics have been defined as "the creation and manipulation of pictures with the aid of a computer" [17]. This definition connects the artistic topics of color and color theory to computer science.

This paper is concerned with computer graphics applied to one aspect of color theory, that of color mixture. Three different models of color mixture are commonly discussed: additive, subtractive, and pigmentary.

## ADDITIVE MIXTURE

When colored lights are combined, the color of the resultant light is determined by the rules of *additive mixture*. The color of that light is the sum of the colors of the input lights [7,13,14,15,21].

Since the *rgb* values represent the amount of light to be physically displayed in each of the primaries, the additive system is easily and naturally applied:

If the colors ( $r_1, g_1, b_1$ ) and ( $r_2, g_2, b_2$ ) are mixed in amounts  $m_1, m_2$ , the output color ( $r_3, g_3, b_3$ ) will be equal to their vector addition:

$$\begin{aligned}r_3 &= m_1 * r_1 + m_2 * r_2 \\g_3 &= m_1 * g_1 + m_2 * g_2 \\b_3 &= m_1 * b_1 + m_2 * b_2\end{aligned}$$

If any one of the terms of the output possesses a value greater than one, the output color has luminance greater than can be displayed on the television monitor. In this

case, corrective action must be taken (see Cook [4] for details).

This algorithm is easily extended to an arbitrary number of colors. The output will be equal to the vector addition of all input colors, within the same provision for correction.

#### SUBTRACTIVE MIXTURE

When white light is shone through a series of colored filters, the color of the resultant light is derived according to the laws of *subtractive mixture*. Each filter "subtracts" from the white light the portion of the spectrum which it does not reflect. The final light will consist of only those portions of the spectrum which all the filters reflect [1,5,7,13,15,16]. This process corresponds to mathematical multiplication:

$$\begin{aligned}r_3 &= (r_1^{m_1}) * (r_2^{m_2}) \\g_3 &= (g_1^{m_1}) * (g_2^{m_2}) \\b_3 &= (b_1^{m_1}) * (b_2^{m_2})\end{aligned}$$

This algorithm can be extended to the mixture of an arbitrary number of colored filters by simply extending the number of terms involved in the multiplication. The exponentiation on the components reflects the fact that as the thickness of the filter increases, reflectance decreases proportionally.

#### PIGMENTARY MIXTURE

When pigments or dyes are mixed, the color of the resultant surface is determined by pigmentary mixture. This is the model intuitively used by a computer user. The intuitive mixture of blue with yellow is neither white (additive mixture) nor black (subtractive mixture), but rather green, the pigmentary mixture.

A model of pigmentary mixture is proposed which deals in terms of a color's **hue**, its **saturation**, and its **lightness** (hsl). The hue of a color reflects its basic nature, the saturation its paleness, and lightness the amount of white present in it. Well-defined algorithms

for translation between rgb and hsl exist [12,20].

The hue of a number can be defined according to a variety of differing color wheels [2,6,8,10,14,18,19,21]. For example, the rgb to hsl translations commonly provided [12,20], use a circular color wheel with red, green, and blue primaries. Pigmentary mixture, based on a red, yellow, blue primary system, requires a wheel in which those three colors form primaries (i.e. are equally spaced around the wheel at 120 degree angles) [8,18,21]. Translations between these two wheels can be made by simple mathematical mappings.

Each color can be uniquely mapped to a point in a hexagonal cylinder. As hue is essentially a modular quantity, the hue of a color corresponds to an angle of location. Saturation represents the proportional length of a line drawn at that angle from the center of a hexagon plane. For example, colors with saturations of 0 and 1 would be located at the center and edge, respectively, of the hexagon. The lightness of the color determines its height in the third dimension of the cylinder. The unique point so constructed will be called that color's *color point*.

Varying the hue changes the angle of location of the color point within the hexagon. Varying the saturation changes the distance of the color point from the center. Varying lightness changes the height of the color point in the cylinder.

After two color points have been constructed, one for each color in the mixture, a line can be drawn between them. This line describes all the mixtures of these two colors as their concentrations vary. The color point of the mixture is the point on the line located such that the ratio of the lengths of the two line segments formed is equivalent to the ratio of the amounts of the colors being mixed. For example, if there are equal amounts of color being mixed, the color point of the result will lie at the midpoint of

the line. Once the color point of the mixture has been determined, its *rgb* value can be determined by inverting the operations described above.

Extension to more than two pigments can be accomplished by regarding the location of the mixture as the center of gravity of the color points of the colors being mixed, where each colorant is given a weight corresponding to its proportional presence in the mixture.

The above model contains many of the same rules as those of Sargent [18] and Von Bezold [1], with two major changes: lightness, not value, is used for the third dimension, and the hexagon, not the circle, is used for the planar figure.

A fundamental property of pigment mixtures is that complementary pigments, in equal proportion, mix to grey [3,8,9,15,20]. In the hue, saturation, and value (*hsv*) system used by Sargent [17] and Von Bezold [1], all colors of maximum intensity (value) lie on the same plane. For example, red, blue, green, orange, and white all are of full value. If the complementary colors of red and green or blue and orange are mixed, the color point that lies at the center of the plane is that of white, as it possesses no saturation and equivalent value. Thus, mixture in the *hsv* system fails to account for mixture of complementary pigments.

In the *hsl* system, all colors of equivalent brightness (1) lie on the same plane. Specifically, grey lies in the center of the primary (red, blue, green, orange) plane, rather than white, as grey possesses the same brightness as the primaries. Mixture of complementaries is thus perfectly simulated, grey lying at the center of the primary plane.

#### JUSTIFICATION OF HEXAGONAL GEOMETRY

Some previous studies of color [1,5,6,12,18] have used the circle as the planar geometric figure within which to locate colors. However, the circle is not a suitable figure for pigmentary mixture. The mixture of two

adjacent fully saturated colors should produce a mixture of full saturation. The midpoint of a line drawn between the color points of those colors will be displaced towards the center of the circle. Therefore, the mixture predicted by a circular model will be abnormally desaturated, because the midpoint of a chord of a circle will never lie on the edge of the circle. Thus, abnormal desaturation will occur in *all* but complementary mixtures using a circular model.

That problem can be minimized by using a regular *n*-gon instead of a circle. The midpoint of a line drawn between two points on the edge of an *n*-gon will often lie on the edge as well.

Note that this will also predict abnormal desaturation on occasion, as when the color points lie on the center of adjacent faces. However, it does this far less often than the circular model. The precise mechanism of computing resultant saturation is still under investigation. Curved lines connecting the color points fare no better than straight ones, as they predict abnormally high saturations for near-complementary mixtures. Straight line mixtures are easily computable for arbitrary color points, and were maintained for this reason.

What value should *n* take? *N* must be a multiple of two, so that every color is located symmetrically with respect to its complement. It must be a multiple of three, due to the presence of the three primaries. It should be as small as possible, because as *n* approaches infinity, a regular *n*-gon approaches a circle, a figure whose shortcomings have been discussed. Thus, the geometry of the situation implies that a hexagon will best approximate pigmentary mixture.

This geometric conclusion is supported by the findings of Smith [20] that the *rgb* system lends itself naturally to hexagonal color space, and of Kupperts [14] that the hexagon represents pure color more logically than the circle.

While the model will not predict the precisely correct solution in every case, it is generally believed that no model can [1,5,7,13,19,21]. In nearly every case, however, it provides an excellent approximation.

Specifically, it satisfies each of the three basic principles of pigmentary mixture [3,9,10,16,21]: a color mixed with black will lower its lightness, mixed with white will lower its saturation, and mixed with its complement will produce grey.

#### IMPLEMENTATION

These algorithms have been implemented as part of an interactive color mixing/matching/making database program written in the C programming language. This program is presently running at the University of Wisconsin Image Processing and Graphics Laboratory on a PDP-11/45 computer with an STC-70 graphics terminal.

#### FURTHER RESEARCH

Currently, research is being performed to test the applicability and usability of old (e.g. C.I.E. and Kupperts [14]) and new color solids, and the "integrated mixture" algorithm of Kupperts [14].

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# BENJAMIN FRANKLIN AND THE THREE FACES OF WOMEN

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*English 783: Proseminar  
in Intellectual Backgrounds  
to the American Revolution*

Three categories of woman appear in Benjamin Franklin's works: the "painted Woman," the "good Wife," and the "Woman of Wit." The painted woman corresponds to the feminine *daimon* found in mythology, and to the harlots in the Bible. She emerges in the eighteenth century as a woman of low life, the strumpet, embodying ungoverned sensuality, disease, corruption, and *deceit*, as evidenced by her "mask of paint." The good wife corresponds to the Sarahs, Rebekahs, Rachels, Marthas, and Marys of the Bible; she inherits, up through the nineteenth century, the guardianship of moral and social values. The woman of wit, rarely surfacing in ancient literature—Sappho and Queen Esther are possible candidates—emerges as a kind of welcomed aberration, who, in the eighteenth and succeeding centuries, offers intellectual diversion and a less rigid morality. She is more trustworthy than the painted woman, less reliable than the good wife. This typology of women parallels the feminine images in three distinct stages of Franklin's life: youth, early adulthood, and maturity.

Before the eighteenth century there had been but two categories of woman fixed in the collective consciousness, the painted and the untainted. While hints of a mysterious and more complicated blend of femininity cropped up here and there, as in Leonardo's "Mona Lisa" (intellectualized earthiness bathed in spirituality), theological conditioning largely plowed that image under. Examine St. Paul's instructions to women:

. . . to be discreet, chaste, keepers at home, good, obedient to their husbands, that the word of God be not blasphemed.

(Titus 2:5)

Wives, submit yourselves unto your own husbands, as unto the Lord.

(Ephesians 4:21-24)

. . . that women should adorn themselves in modest apparel, with shamefacedness and sobriety;

. . . Let the woman learn in silence with all subjection.

(Timothy 2:9)<sup>1</sup>

Although those directives may have held some merit, such passivity imposed on women by the patriarchy from St. Paul to the Puritan fathers, denied more or less half of the world's talent. Suppression can be a form of mutilation, producing some kind of un-wholesomeness, e.g., muteness leading to ultimate rage as in the works of Margaret Cavendish, a seventeenth century intellectual who wrote ". . . poetry, plays, orations, biography, autobiography, letters, philosophical works, and scientific treatises," and ". . . struggled to get her works accepted by the universities."<sup>2</sup>

Despite her enraged voice, Margaret Cavendish was a good wife and is largely remembered for the biography she wrote of her husband.

However, not all women felt type-cast. Across the channel, one century later, Mme. de Pompadour exerted tremendous influence at Versailles with diplomacy and dimples for King Louis XV and witty conversation for Montesquieu and for Voltaire, who characterized the Age of Enlightenment as somewhat more schizoid than we like to believe: "We live in curious times," he said, "and amid astonishing contrasts: reason on the one hand, the most absurd fanaticism on the other . . ." <sup>3</sup> If the traditional dualistic view of women was now passing through a prism



(the light of reason) and becoming triadic, those women who dared to surface with wit and intellect were no less subject to ridicule than the women of paint had been. Mary Manley, the first Englishwoman to be called a political journalist, successor to Jonathan Swift as editor of the *Examiner*, was arrested for publishing her satirical work *Secret Memoirs and Manners of Several Persons of Quality of Both Sexes From the New Atlantis, an Island in the Mediterranean*.<sup>4</sup>

The good Wife was still the most revered woman in the Neo-classic mind. Further, she gained more respect as the century progressed, as the pursuit of Virtue became mandated by the great thinkers of the Age. With lyrical flourish Diderot remarked: "*Rendre la vertu aimable, le vice odieux, le ridicule saillant voila le projet de tout honnete homme qui prend la plume, le pinceau, ou le ciseau.*"<sup>5</sup> Lord Shaftesbury, whose writings had created religious doubts in young Franklin's mind and carried him far away from the clutches of Bostonian Calvinism, wrote: "... the knowledge and practice of the social virtues, the familiarity and fervour of the moral graces are essential to the character of a deserving artist and just favorite of the Muses."<sup>6</sup> The genre of *Conduct Literature* was ascending: Novels, diaries, memoirs, poems, plays, autobiographies, and personal letters tended to concentrate on moral issues, restraints and controls. "One recorded one's daily life in order to evaluate one's conduct, and also to find evidence of God's will in the pattern of events."<sup>7</sup>

Right conduct was emphasized in Benjamin Franklin's young life by his father, Josiah: "At his Table he [Josiah] lik'd to have as often as he could, some sensible Friend or Neighbour, to converse with, and always took care to start some ingenious or useful Topic for Discourse, which might tend to improve the Minds of his Children. By this means he turn'd our Attention to what was good, just, and prudent in the Conduct of Life."<sup>8</sup> Though little can be

gleaned from Franklin's writings concerning his mother Abiah, evidence suggests that she fostered Franklin's belief in the power of virtue and the value of leading a discreet life.

Always an independent thinker, Franklin preferred to choose his own religious beliefs. Although he read "Books of polemic Divinity," from his father's library, he later regretted the time spent on them. Works of practical morality such as Plutarch's *Lives*, Defoe's *Essay on Projects* and Mather's *Bonifacius, An Essay upon the Good . . .* gave him such "... a Turn of Thinking that [they] had an Influence on some of the principal future Events" of his life.<sup>9</sup> Of the three, Mather seemed to wield the most influence.

As Franklin began to feel the temptations of sex, he gradually succumbed to the Painted Woman. His only confession of this occurs when he recalls his London sojourn in the *Autobiography*:

... that hard-to-be govern'd Passion of Youth, had hurried me frequently into Intrigues with low Women that fell in my Way, which were attended with some Expence and great Inconvenience, besides a continual Risque to my Health by a Distemper which of all Things I dreaded, tho' by great good Luck I escap'd it.<sup>10</sup>

If Franklin had lived in the early twentieth century would he have been more explicit about his sexual adventures? Would we discover, for instance, that he *really* had had "an intrigue with a girl of bad character" before he left Boston for good? Or that he had been somewhat more involved with the "two women travelling together" on his way to New York, and ultimately London, than his memoirs reveal?

Franklin's neglect of Deborah Read during his eighteen-month stay in London, was the "erratum" he claims to have felt most guilty about; he sent only one letter to her during his stay abroad.<sup>11</sup> The need to correct his errant ways may have been predicated upon his growing understanding of what constituted a good relationship with a

woman and the ultimate costs of being involved with a bad woman. London, for Franklin, was a laboratory for sexual experimentation; during his first English residency, far way from familial restraints and no longer influenced by "Religious restraints," he fell into a certain licentious style of life. Hogarth attempted to show how the very atmosphere of London was conducive to corruption. One cannot easily imagine Franklin, back in Boston, or even Philadelphia, making the kind of seductive proposal he did to "Mrs. T." She was the millener who had previously lived "together some time" with his friend James Ralph. Ralph had gone away to "a small Village in Berkshire" to teach, "recommending Mrs. T." to Franklin's "care";<sup>12</sup>

It was through his exposure in London to all sorts and conditions of women that Franklin began to formulate, at some point between his return voyage to America and his marriage to Miss Read, what I call his "theory of the open countenance" regarding women. The painted woman is a creature of false allurements whose bodily adornment and cosmetic coverings represent a mask. Her superficial beauty may disguise a deeply-flawed nature. When he later composed verses for the Poor Richard Almanacs, he extolled the supremacy of virtue over beauty:

'Tis not the Face with a delightful Air,  
A rosy Cheek and lovely flowing Hair;  
Nor sparkling Eyes to best Advantage set,  
Nor all the Members rang'd in Alphabet,  
Sweet in Proportion as the lovely Dies,  
Which bring th' ethereal Bow before our Eyes,  
That can with Wisdom Approbation find,  
Like pious Morals and an honest Mind;  
By Virtue's living Laws from every Vice  
refin'd.<sup>18</sup>

In 1744 Franklin reprinted Samuel Richardson's *Pamela, or Virtue Rewarded*; it was the first novel published in America. Richardson expressed views similar to Franklin's on what constitutes virtue: "Beauty, without goodness, is but skin-deep

perfection" and "Virtue only is the true Beauty."<sup>14</sup>

Unlike the painted Woman, "the good Wife" possesses an inner beauty that does not fade. The implication in Franklin's concept of male/female relationship is that while men are responsible for the various vices of women, men need the rope of woman's virtue to pull them into shape. Poor Richard Saunders indicates as much:

The plain Truth of the Matter is, I am excessive poor, and my Wife, good Woman, is, I tell her, excessive proud; she cannot bear, she says, to sit spinning in her Shift of Tow, while I do nothing but gaze at the Stars; and has threatened more than once to burn all my Books and Rattling-Traps (as she calls my Instruments) if I do not make some profitable Use of them for the good of my Family. The Printer has offer'd me some considerable share of the Profits, and I have thus begun to comply with my Dame's desire.<sup>15</sup>

The Richard/Bridget Saunders union is a comic parody of the Benjamin/Deborah Franklin marriage. Franklin offers a similar tribute to his wife in the *Autobiography*: ". . . it was lucky for me that I had one [wife] as much dispos'd to Industry and Frugality as my self. She assisted me cheerfully in my Business, folding and stitching Pamphlets, tending Shop, purchasing old Linen Rags for the Papermakers, &c. &c."<sup>16</sup> There are constant warnings, however, in Franklin's writings, against marrying a termagant. Perhaps this was Franklin's subtle way of keeping Deborah "cheerful." Both Lopez and Van Doren, the principal Franklin biographers, allude to Deborah Franklin's quick temper. Nevertheless, she earned the longest poem ever written by Franklin to a woman. It begins this way:

#### Song

Of their Chloes and Phillisses Poets may prate  
I sing my plain Country Joan  
Now twelve Years my Wife, still the Joy of my Life  
Blest Day that I made her my own,  
My dear Friends  
Blest Day that I made her my own.

## 2

Not a Word of her Face, her Shape, or her Eyes,  
 Of Flames or of Darts shall you hear;  
 Tho' I Beauty admire 'tis Virtue I prize,  
 That fades not in seventy Years,  
 My dear Friends<sup>17</sup>

Virtue, it would seem, is not natural but acquired. One needs a boost of some sort, either a strong tie with a virtuous person, or the practice of virtue through systematic moral exercise. Franklin invented a system as simple and as complicated as St. Ignatius Loyola's *Spiritual Exercises* to arrive at "moral Perfection." Understanding that "contrary Habits must be broken and good ones acquired and established, before we can have any Dependence on a steady uniform Rectitude of Conduct,"<sup>18</sup> he drew up a list of Thirteen Names of Virtue: TEMPERANCE, SILENCE, ORDER, RESOLUTION, FRUGALITY, INDUSTRY, SINCERITY, JUSTICE, MODERATION, CLEANLINESS, TRANQUILITY, CHASTITY, HUMILITY.<sup>19</sup>

Each of these virtues was transformed into any number of epigrammatic lines in the *Poor Richard Almanacs*. Through the ingenuity and industry of Benjamin Franklin, the "wisdom" literature of the ancients was transformed into homely practical knowledge for the right conduct of Americans. We should look to the *Almanacs* to determine and understand subconscious attitudes toward women in America: "She that paints her face, thinks of her tail"; "Three things are men most liable to be cheated in, a Horse, a Wig, and a Wife."<sup>20</sup>

Once he had passed the dangerous shoals of youth, a very large dimension of Benjamin Franklin's character was govern'd by sobriety, high moral purpose, self-discipline and self-denial. After conceiving a plan to (a) practice each virtue for one week, (b) record his progress in a booklet, and (c) start over again when the thirteen-week cycle ended, he carried out the regimen diligently for a time.

Franklin's "Project in Virtue" establishes the tone for our introduction to the Woman of Wit and Franklin's mature years. Some observers would have us believe that he was a rake and a bounder who romped up and down the New England coast and the Continent, leaving a trail of bastards in his wake. To suggest such a hedonistic enterprise is absurd. Whether Franklin was guilty of infidelity cannot be verified. What is known is that in his mature years, Franklin was attracted to several women of wit and intelligence, that he formed close relationships with them, epistolary and otherwise, and that his life and theirs were enriched through these associations. One such relationship was established with Catharine Ray Greene.

Before considering the Frankin-Greene liaison, we must understand the pedagogical role Franklin often assumed with women. It probably stemmed from a relationship formed in childhood with his sister Jane, ever his "peculiar favorite." In one of his youthful disputations with his friend John Collins, Franklin argued for the education of women:

He was of Opinion that it was improper; and that they were naturally unequal to it. I took the contrary Side, perhaps a little for Dispute sake.<sup>21</sup>

Despite the motive he claims, Franklin appears elsewhere in his writings to believe that a more enlightened education should be provided for the eighteenth-century woman of intelligence. Silence Dogood relates how her "Master," a "Country Minister," endeavored to raise her consciousness:

... observing that I took a more than ordinary Delight in reading ingenious Books, he gave me the free Use of his Library, which tho' it was small, yet it was well chose, to inform the Understanding rightly, and enable the Mind to frame great and noble Ideas.<sup>22</sup>

Franklin was most likely influenced but not likely convinced by Daniel Defoe's *An Essay on Projects*. Defoe's proposal for "An

Academy for Women" sounds two centuries ahead of the time:

The capacities of women are supposed to be greater and their senses quicker than those of the men; and what they might be capable of being bred to is plain from some instances of female wit, which this age is not without; which upbraids us with injustice, and looks as if we denied women the advantages of education for fear they should vie with the men in their improvements.

To remove this objection, and that women might have at least a needful opportunity of education in all sorts of useful learning, I propose the draught of an Academy for that purpose.<sup>23</sup>

Although no such women's academy was proposed for the meritorious female population of Philadelphia, Franklin in principle, was not against educating women beyond the homely arts. Nevertheless, the woman must never be educated to the point where she would desire to be anyone other than the "good Wife," for hers is the highest achievement of womanhood. In educating his own daughter Sally "[H]e did not intend to open up to her the full Pandora's box of knowledge, but mainly the useful, the functional skills: reading and writing . . . arithmetic and some bookkeeping."<sup>24</sup> He believed a woman should receive enough education to be able to take care of herself in the event of possible widowhood. That goal was far short of what Defoe proposed for the pedagogy of woman, but Franklin was at least more open-minded than Hawthorne, who had little use for an intellectual woman, particularly a literary one.

Franklin conducted a kind of "academy-by-mail" in the numerous letters he wrote to innumerable people to educate them in scientific and political matters. Polly Stevenson, the daughter of Mrs. Margaret Stevenson with whom Franklin boarded in London, was one such fortunate pupil. Their correspondence continues from 1758 to 1786, undergoing many transformations. Polly was one "woman of Wit" to whom he could

write highly technical letters. Theirs was an intelligent epistolary dialogue. James Stifler says of the friendship:

It would have been an exceedingly dull man, which Franklin never was, not to have responded to the keen sparkle of this young woman's letters. All his life Franklin liked good company and clever conversation. He warmed up and uncovered the most delightful aspects of his amazing versatility under just such stimulus. Polly Stevenson gave it to him.<sup>25</sup>

Another such lady of genius in Franklin's life was Georgiana Shipley, the fourth daughter of Bishop Jonathan Shipley of Twyford, the small but famous site where the *Autobiography*, Part I, was written. Franklin met her in 1771 when he first visited Twyford; she was a scant fifteen years old when their correspondence began, but

[i]n the course of time Georgiana wrote and read Latin and Greek as readily as English. She was equally at home in all Continental languages so that her friendship and correspondence was sought after by eminent persons throughout Europe.

Her affections were strong and generous and to no one outside her family was she so devoted as to Dr. Franklin.<sup>26</sup>

But the most unguarded, playful, yet at the same time, highly educative correspondence was the one Franklin shared with Catharine Ray Greene. It carried undertones of

. . . a romance in the Franklinian manner, somewhat risqué, somewhat avuncular, taking a bold step forward and an ironic step backward, implying that he is tempted as a man but respectful as a friend. Of all shades of feeling, this one, the one the French call *amitie amoureuse*—a little beyond the platonic but short of the grand passion—is perhaps the most exquisite.<sup>27</sup>

Catharine met Franklin in Boston about 1754. They corresponded until just short of his death in 1790. Her husband was William Greene, a surveyor and minor statesman, later Governor of Rhode Island (1778-1786).

Better known as "Caty," she was a woman of finely-wrought intelligence and ". . . a keen sense of humor and always had a house full of guests." Mother of six children she ran both house and farm and was "a model eighteenth-century housewife."<sup>28</sup> Although she had no formal education, she was known for her wit. One of the most famous letters of the Greene-Franklin portfolio, sent to Caty on October 16, 1755, embodies Franklin's expectations of an exemplary wife:

Let me give you some fatherly Advice. Kill no more Pigeons than you can eat.—Be a good Girl, and don't forget your Catechise.—Go constantly to Meeting—or Church—till you get a good Husband; then stay at home, & nurse the Children, and live like a Christian.—Spend your spare Hours, in sober Whisk, Prayers, or learning to cypher.—You must practise *Addition* to your Husband's Estate, by Industry & Frugality; *Subtraction* of all unnecessary Expenses; *Multiplication* (I would gladly have taught you that myself, but you thought it was time enough & woud'n't learn) he will soon make you a Mistress of it. As to *Division*, I say with Brother Paul, *Let there be no Division among ye.*<sup>29</sup>

We have, in the end, come full circle—back to Pauline Christianity. Although Franklin, in his youth, was attracted to the "painted Woman," he most likely, in his later years, came to admire most the woman who combined the faces of the "good Wife" and the "Woman of Wit." Most significantly, that composite—Franklin's ideal woman—remains, a paradigm whose wit serves only the causes of virtue.

#### NOTES

<sup>1</sup> *The Holy Bible*, Authorized King James Version (London: Collins' Clear-Type Press, 1943).

<sup>2</sup> Joan Goulianoa, ed. "Margaret Cavendish, Duchess of Newcastle," *by a Woman writt: Literature from Six Centuries By and About Women* (Baltimore: Penguin, 1974), p. 55.

<sup>3</sup> Alfred Cobban, ed. *The Eighteenth Century:*

*Europe in the Age of Enlightenment* (New York: McGraw-Hill, 1969), p. 260.

<sup>4</sup> Goulianoa, "Mary Manley," *by a Woman writt*, p. 103.

<sup>5</sup> Cobban, p. 245. (To show virtue as pleasing, vice as odious, to expose what is ridiculous, that is the aim of every honest man who takes up the pen, the brush or the chisel.)

<sup>6</sup> *Ibid.*

<sup>7</sup> David Levin, "The *Autobiography* of Benjamin Franklin: The Puritan Experimenter in Life and Art," *In Defense of Historical Literature: Essays on American History, Autobiography, Drama, and Fiction* (New York: Hill and Wang, 1967), p. 62.

<sup>8</sup> Benjamin Franklin, *The Autobiography of Benjamin Franklin*, Leonard W. Labaree, et al., eds. (New Haven: Yale Univ. Press, 1964), p. 55. Hereafter cited as *Autobiography*.

<sup>9</sup> *Autobiography*, p. 58.

<sup>10</sup> *Autobiography*, p. 128.

<sup>11</sup> *Ibid.*, 96.

<sup>12</sup> *Ibid.*, 99.

<sup>13</sup> *The Papers of Benjamin Franklin*, Leonard W. Labaree and Whitfield J. Bell, Jr., eds. (New Haven: Yale Univ. Press, 1959- ), II, 10. Hereafter cited as *The Papers*.

<sup>14</sup> Samuel Richardson, *A Collection of the Moral and Instructive Sentiments* (Delmar, N.Y.: Scholars' Facsimiles & Reprints, 1980), p. 7.

<sup>15</sup> *The Papers*, I, 311.

<sup>16</sup> *Autobiography*, 145.

<sup>17</sup> *The Papers*, II, 353-54.

<sup>18</sup> *Autobiography*, p. 148.

<sup>19</sup> *Ibid.*, 149-50.

<sup>20</sup> *The Papers*, II, 142 (from Poor Richard's Almanac, 1736).

<sup>21</sup> *Autobiography*, 60.

<sup>22</sup> Silence Dogood Letter No. 1 (Printed in *The New England Courant*, April 2, 1722), *The Papers*, I, 10.

<sup>23</sup> Daniel Defoe, *The Earlier Life and The Chief Earlier Works of Daniel Defoe*, Henry Morley, ed. (New York: Burt Franklin, 1970), pp. 144-45.

<sup>24</sup> Claude-Anne Lopaz and Eugenia W. Herbert, *The Private Franklin: The Man and His Family* (New York: W. W. Norton, 1975), p. 71.

<sup>25</sup> James Madison Stifler, "My Dear Girl": *The Correspondence of Benjamin Franklin with Polly Stevenson, Georgiana and Catharine Shipley*. (New York: George H. Doran, 1927), p. 38.

<sup>26</sup> *Ibid.*, 231.

<sup>27</sup> Lopes and Herbert, p. 56.

<sup>28</sup> William Greene Roelker, ed. *Benjamin Franklin and Catharine Ray Greene: Their Correspondence 1755-1790*. (Phil.: American Philosophical Society, 1949), pp. 2-3.

<sup>29</sup> *Ibid.*, p. 5.

# POTENTIAL VERSUS ACTUAL DEVELOPMENT OF IRRIGATED AGRICULTURE IN CENTRAL WISCONSIN

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## *Abstract*

Only 5 percent of the ten-county central sands area of Wisconsin having conditions suitable for irrigated agriculture is now actually being used for that purpose. Nearly 3 million acres in the region have an underground water supply great enough to sustain high capacity irrigation wells. Yet only 133,000 acres of cropland are presently being irrigated. A doubling or tripling of the irrigated cropland in the area is possible by 1990. Development of irrigated agriculture has had an impact on the economy and the natural resources of the area. Careful planning and decision-making is needed now so that the irrigation potential of central Wisconsin is realized by anticipation and not by accident.

In the past 20 years, there has been a seven-fold increase in the total amount of cropland being irrigated in Adams, Jackson, Juneau, Marathon, Marquette, Monroe, Portage, Waupaca, Waushara, and Wood Counties (Census of Agriculture, 1978). The reason for this rapid growth is self-evident. Yields on the sandy soils in the area are increased considerably with the addition of an artificial water supply. For example, Russet Burbank potatoes grown without irrigation may yield from 100-200 cwt/acre. Irrigation can increase this yield to 500 cwt/acre. The quality of the product is enhanced as well. For example, the percentage of higher value U.S. No. 1 potatoes is 19% greater on irrigated versus non-irrigated farmland (Vegetable and Fruit: Potential for Production and Processing in Central Wisconsin, 1964).

## *Actual Development Less Than Potential*

Plentiful irrigation water is readily available in the vast aquifer underlying Wisconsin's central sands. As shown on Table 1, nearly three million acres in central Wisconsin have a subsurface water supply suitable for intensive irrigated agriculture. Five hundred gallons per minute is generally con-

sidered to be the minimum amount necessary for wells supplying smaller irrigation systems. One thousand gallons per minute is more desirable for the center-pivot irrigation units, which cover 160 acres in one revolution (Berge, 1964). As shown on Figure 1, there are about 2 million acres in central Wisconsin where wells could be expected to yield from 500-1,000 gallons of water per minute. An additional 1 million acres of the ten-county area could produce 1,000 or more gallons per minute (Lippelt, 1981).

Yet the latest agricultural census figures indicate that only 132,985 acres are being irrigated. This is just 4.6% of the *total land area* where ground water conditions would permit pumpage rates high enough to justify the use of irrigation equipment. Thirty-five percent of the ten-county area is cropland. Only about 7% of the existing *cropland* is being irrigated (Irrigable Lands Inventory Plan of Work, 1980).

Within the region, Portage County leads all others in the number of acres being irrigated (49,494). It is also the county which has realized the greatest amount of development. Nearly fourteen percent of the land area having irrigation potential is now being used for that purpose. Waushara County has

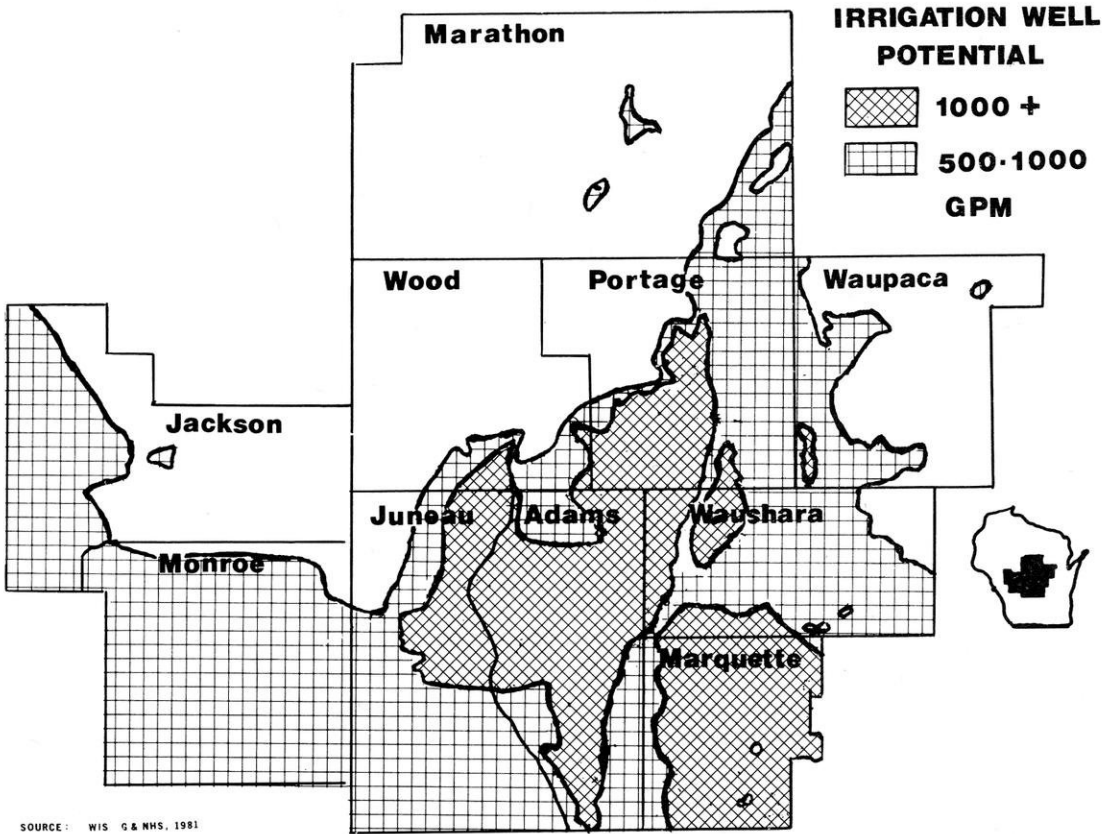


Fig. 1.

10.7% of its irrigation potential developed. None of the other eight counties in the region have realized even a 5% development level. Of these, Jackson and Monroe Counties have had less than 1% of the land area with potential actually developed (Table 1).

*Future Development:  
How Much and Where?*

There is the potential for an even faster rate of growth. A doubling or tripling of the amount of agricultural land being irrigated in central Wisconsin seems probable by the end of the decade. There is somewhat less certainty about where this additional irrigated acreage will be developed. Portage and Waushara Counties will, no doubt, see a continuation of the existing growth pattern.

It is possible that counties such as Adams, Juneau, and Marquette will experience the sharpest absolute as well as percentage increases in irrigated cropland in the next few years. For it is in these three counties that the largest share of underdeveloped 1,000+ gallon per minute well potential exists. It is also that area which has geographic conditions most similar to Portage and Waushara Counties.

Geographic conditions other than ground water supply and well yield potential also help to determine whether or not an area is suitable for irrigation development. Soil properties, length of growing season, depth to ground water, and the steepness of the slope are factors which need to be considered. Rough terrain in Monroe County, for

TABLE 1. Central Wisconsin Agricultural Irrigation: Actual Versus Potential

COUNTY	IRRIGATION FOR AGRICULTURAL USE									
	Water use in millions of gallons per year <sup>1</sup> (1979)		Actual acres under irrigation <sup>2</sup> (1978)		Potential acres under irrigation <sup>3</sup> Maximum yields of wells in gallons per minute			Actual acres as percentage of potential acres Yields > 500 gallons per minute)		
	Amount	Rank	Amount	Rank	A M O U N T			Rank	Percent	Rank
Adams	4,180	3	20,646	3	122,125	297,952	420,007	3	4.9	3
Jackson	19	10	1,570	10	247,521	—	247,521	7	0.6	9
Juneau	731	4	5,388	4	328,619	111,766	440,385	2	1.2	8
Marathon	123	8	3,792	6	77,418	—	77,418	10	4.9	3
Marquette	240	6	3,774	7	33,530	263,195	296,725	6	1.3	7
Monroe	41	9	2,006	9	534,705	—	534,705	1	0.4	10
Portage	10,000	1	49,494	1	209,357	147,749	357,106	5	13.9	1
Waupaca	516	5	4,009	5	113,947	7,224	121,171	8	3.3	6
Waushara	5,340	2	39,143	2	265,104	100,044	365,148	4	10.7	2
Wood	166	7	3,163	8	48,932	20,309	69,241	9	4.6	5
Area Total	21,356		132,985		1,981,258	948,239	2,929,497	—	4.6	—
State Total	30,600		234,557		?	?	?			
Area as % of State	69.8		56.7		?	?	?			

<sup>1</sup> Interim Report Statewide Water Conservation, Part II, Agricultural and Industrial, Wisconsin DNR, December 1981, p. 6.

<sup>2</sup> United States Census of Agriculture, 1978.

<sup>3</sup> Irrigable Lands Inventory—Phase I, Groundwater and Related Information, Wisconsin Geological and Natural History Survey, September, 1981 (aquifer potential maps).

example, limits the development potential. Summer frosts are a threat to crops grown in the lowlands of Wood and Portage Counties. Wetlands occupy large areas of Waushara County. Poorly-drained soils are found in eastern Marquette County. In addition, the existing vegetation (native jack pine or scrub oak) may pose somewhat of a barrier to expanded agricultural land uses (Collins, 1968).

No estimate has been made of the amount of land in the 5,394,560-acre region which has its irrigation potential reduced because of the presence of unsuitable geographic conditions of the kind discussed above. However, estimates are available of the

amount of land in the ten-county area where the existing land use precludes the development of irrigated agriculture. Homes, commercial or industrial enterprises, and public facilities have been built on land which was equally well-suited for agriculture. A network of roads, highways, and railway lines connects the many cities and villages, which further reduces the amount of land on which irrigated agriculture crops might have been produced. According to figures compiled by the Golden Sands RC&D office, these urban or built-up areas occupy 4% (215,782 acres) of the region. The federal government controls the ownership of large tracts of land with agricultural potential (e.g., Fort



McCoy). State parks, waysides, and wildlife areas may, in part, be located on lands of agricultural opportunity. Public lands, considered collectively with the area covered over with streams or lakes, account for 10% (539,456 acres) of the ten counties. Woodlands cover 42% of the landscape (2,265,715 acres). Large, wooded holdings are corporation-owned (paper companies) while smaller parcels are held by individuals or public bodies (school system, county). Agricultural use of the land for pasture and cropland (2,373,606 acres) constitutes 9% and 35% of the area, respectively.

From the foregoing, it can be concluded that aquifer potential is but one of many factors to be weighed when determining the development potential for irrigated agriculture in central Wisconsin. One must subtract from the 3 million acres where ground water conditions are suitable for intensive agriculture the land area where other physical characteristics make it difficult, if not impossible, to develop the potential. Also to be deducted are those areas reserved for other human activity (residences, businesses, industry, recreation, transportation).

### *Economic and Environmental Impacts*

The development of irrigated agriculture has had tremendous impacts on central Wisconsin. These impacts have been both positive and negative in character. On the positive side are the significant economic advances the region has experienced. Money received by producers of potatoes, sweet corn, and snap beans is reinvested through the purchase of local labor and goods. Part of the income farmers earn is passed along to state and federal government in the form of taxes. The increasingly valuable agricultural property is taxed by local government. Income and property taxes benefit all area residents, because they help maintain roads and highways, support schools and universities, and contribute to the nation's defense system.

The following facts brought out during a March, 1982 Conference on Irrigated Agriculture at Stevens Point reflect the importance of such activity to the area economy (Kenyon, 1982):

1. "Barren" land, once valued at a few dollars per acre, is now worth as much as \$2000 per acre.
2. Area farmers annually earn \$25 million from the sale of their products to two Portage County canning and potato processing companies.
3. One Portage County potato products firm has just invested \$30 million in order to double its capacity (annual employee payroll, \$12 million).
4. One Portage County canning plant processes twenty-six semi-trailer truck loads of snap beans per day during the peak production period.
5. More food is produced than can be consumed locally; consequently, one Portage County potato broker shipped out 5500 semi-trailer truck loads last year.

The negative features of irrigated agriculture are largely associated with the natural environment. The rapid growth of this method of farming has had adverse impacts on soil, water, and wildlife resources. These adverse impacts are exemplified by the following facts, also presented at the 3-82 conference.

1. Chemical substances manufactured for farmers to control plant pests or to stimulate crop growth have been carried downward through the soil into drinking water supplies by excessive amounts of rain or irrigation water.
2. The removal of wind breaks or natural vegetation cover on large fields cleared to accommodate self-propelled pivoting irrigation systems has resulted in loss or displacement of soil.

3. University reports have pointed out a loss of habitat for foxes, rabbits, grouse, songbirds, and other wildlife types where marshes have been drained or trees cleared to produce irrigated agricultural products.

In addition, federal government research suggests that the development of lands for irrigation causes seasonal as well as long-term changes in ground water levels (Weeks, 1971).

There are still other impacts of irrigated agriculture which are neither economic nor environmental. For instance, there have been social-political consequences where such agricultural activity has been carried out in close proximity to rural subdivisions. Non-farm residences are not very compatible with intensive agricultural activity of the type associated with irrigation in central Wisconsin. The arguments about which human activity is the "highest or best use" or which activity was "located there first" are inevitable signs of this land use conflict.

#### *Needed: A Regional Development Plan*

Uncontrolled development of irrigated agriculture—just like uncontrolled urban development—is not in the best interests of society. If allowed to grow as projected without limits or bounds, irrigated agriculture could pose a threat to the long-term health and well-being of central Wisconsin residents (Butler, 1978). Short-range economic benefits should not take precedence over longer range environmental costs.

What is needed now are joint discussions between farmers, agri-business interests, and those knowledgeable about natural resource management and protection. Such discussions will help pave the way for the eventual establishment of policies on the growth of irrigated agriculture in central Wisconsin. When policies like these are developed and in place, they will help guide the anticipated growth. Controlled growth will allow farm-

ers and agri-businessmen to make a profit while at the same time reducing the possibility of adverse environmental side effects.

The purpose of such discussions would be 1) to examine the growth projections of irrigated agriculture from now until the year 2000; 2) to examine the complex set of factors which today influence the amount and location of irrigated agriculture in central Wisconsin; and 3) to discuss alternative policies, programs, and practices which government (local, state, federal) might employ to better guide the development of irrigated agriculture in the region over the next two decades.

The ideas distilled from such discussions could then be reviewed and evaluated. Those with the greatest promise of success would then be adopted by decision-makers, policy bodies, and law-makers in the interest of reasonable and rational development of irrigation between now and the year 2000 in the region.

Future growth of irrigation in central Wisconsin is inevitable. But there are two rather different possible scenarios for this growth. On the one hand, growth could occur haphazardly and explosively, to the detriment of both the economy and the environment of the area. On the other hand, the growth may occur in a systematic rational fashion as a result of thoughtful anticipation and the establishment of sound policy designed to accommodate it.

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# GADWALL DUCK INTRODUCTION IN NORTHWESTERN WISCONSIN

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## *Abstract*

Gadwall (*Anas strepera*) ducklings were released into unoccupied habitat in northwestern Wisconsin in 1970 and 1972 in an effort to establish a breeding population. Despite heavy first-year hunting mortality, sufficient survivors returned in subsequent years to establish a modest but successful breeding population. Releasing a large number of ducklings can overcome the initial heavy hunting mortality.

## INTRODUCTION

Releasing gadwalls into unoccupied habitat to establish breeding populations has been successful in several states in North America, including Massachusetts (Borden and Hochbaum 1966), New Jersey and New York (Henny and Holgerson 1974), and Minnesota (Moss 1975). In 1970 and 1972, young gadwall ducks were released in the Crex Meadows Wildlife Area (CMWA) in northwestern Wisconsin through a cooperative project between the U.S. Fish and Wildlife Service (USFWS) and the Wisconsin Department of Natural Resources (WDNR). The objective of stocking gadwalls was to fill an unoccupied niche created by intensive management of the CMWA.

I acknowledge the efforts in this project of J. Bergquist, W. Wheeler, R. Hunt, and P. Kooiker of the WDNR, F. Lee and H. Nelson of the USFWS, and N. Stone.

## STUDY AREA AND METHODS

The 10,820-ha CMWA, located in Burnett County, Wisconsin, is managed primarily for waterfowl, sharp-tailed grouse (*Pedioecetes phasianellus*) and prairie chicken (*Tympanuchus cupido*) by the WDNR. Intensive fire and water management has attempted to restore the prairie wetland complex to conditions similar to those existing at the time of white settlement in the 1850's. Detailed descriptions of the area and its

management are given by Vogl (1964), Bergquist (1973), and Zicus (1974). Gadwalls were released in the 970-ha refuge located in the center of the CMWA. Gadwalls were not known to breed on the CMWA prior to the stocking experiment although there was a vague and doubtful historical breeding reference somewhere "in the extreme northern part of the state" reported by Kumlien and Hollister (1903). Breeding records do exist for southeastern Wisconsin (Jahn and Hunt 1964).

The refuge contains approximately 320 ha of open water; 240 ha are sedge (*Carex* spp.) and cattail (*Typha* spp.) marsh; 110 ha are cultivated (corn, rye, and buckwheat); 280 ha are brush prairie (big bluestem (*Andropogon gerardi*), little bluestem (*A. scoparius*), sweet fern (*Myrica asplenifolia*), hazel (*Corylus* spp.), and oak (*Quercus ellipsoidalis*) brush); and 16 ha are aspen (*Populus* spp.) forest. Soils are organic peats and deep sands of the Meenon-Newson Association overlying Cambrian sandstone. Climate is cool continental and precipitation averages 800 mm annually.

In 1970, gadwall eggs were collected by USFWS personnel on the J. Clark Sayler National Wildlife Refuge in North Dakota and were taken to the Northern Prairie Wildlife Research Center, Jamestown, North Dakota, for hatching. On 10 August 1970, WDNR personnel transported 400 4-week-old gadwalls (200 ♂, 200 ♀) at night by

truck from Jamestown to the CMWA where they were released the following day into an open-topped, 2.4-ha pen. The ducklings were banded with standard USFWS aluminum leg bands and numbered, white plastic nasal saddles (Greenwood 1977) were placed on the females for field identification of individual birds in subsequent years. Mortality in the pen was low—only 4 females died before the birds became capable of flight and left the pen.

On 8 August 1972, 200 additional gadwall ducklings (95 ♂, 105 ♀) were sexed, leg-banded, and transported from Jamestown to the CMWA where they were released during the night in the refuge pen. A raccoon (*Procyon lotor*) killed 6 birds during the second week of confinement.

Waterfowl breeding transects have been conducted on the CMWA since 1957 to develop annual breeding pair and brood indices using criteria developed by Hammond (1969). The road transect covers 10.6 km<sup>2</sup> and is conducted every 7-10 days in May, June, and July. Roads are driven during the early morning and all waterfowl observed with 7×35 binoculars and 25×60 spotting scope are recorded.

#### RESULTS AND DISCUSSION

In 1970, gadwalls left the CMWA by 8 November. There was apparent heavy hunting mortality with a direct recovery rate approaching 25%. Most direct recoveries were in the vicinity of the CMWA with nearly 70% from Wisconsin. Approximately 5% of the ducks checked (95) during the first 2 days of the 1970 hunting season on the CMWA were gadwalls. Prior to 1970, gadwalls averaged 1% of the opening-day duck harvest checked. Indirect recoveries continued through 1972.

Gadwalls were again observed on the CMWA in mid-April of 1971. The 7 May waterfowl survey indicated 7 pairs (3 of the females had nasal saddles) plus an extra drake on the 10.6 km<sup>2</sup> transect. Two nests, both subsequently destroyed by predators,

were found in the release area. No broods were observed. In 1972, the only gadwalls observed were 5 drakes in a flock on 5 June.

Gadwalls released in 1972 also suffered heavy hunting mortality. Gadwall ducks made up 9% of the opening day harvest compared to none examined in 1971. From 1973 through 1979 when the evaluation of the stocking experiment ended, gadwalls averaged 1% of the opening day duck harvest on the CMWA.

Waterfowl breeding transects were not conducted in 1973. In 1974, 6 gadwall pairs were counted on the CMWA transect. The number of indicated pairs has varied from 3 to 7 from 1975 to 1979. Broods were observed in 1974 and 1978, establishing the gadwall as a breeding species on the CMWA. While densities of breeding pairs have not reached levels reported for prairie habitat by Borden and Hochbaum (1966), the gadwall ranks sixth numerically among the breeding duck species on the CMWA (Table 1).

#### MANAGEMENT RECOMMENDATIONS

Gadwalls have recently expanded their range in northeastern North America (Henny and Holgerson 1974), Cantin et al. 1976). This expansion can be aided by releas-

TABLE 1. Estimated density of waterfowl breeding pairs recorded on the Crex Meadows Wildlife Area transect, Wisconsin.

Species	Pairs/km <sup>2</sup>				
	1975	1976	1977	1978	1979
Gadwall	0.6	0.6	0.6	0.3	0.5
Mallard ( <i>Anas platyrhynchos</i> )	1.6	2.1	4.9	3.3	3.5
Blue-winged teal ( <i>A. discors</i> )	3.6	4.5	5.0	5.1	4.3
Ring-necked duck ( <i>Aythya collaris</i> )	1.8	1.8	1.3	1.5	3.1
Others <sup>a</sup>	0.7	1.9	2.7	1.4	2.5

<sup>a</sup> Black duck (*Anas rubripes*), Pintail (*A. acuta*), American wigeon (*A. americana*), Northern shoveler (*A. clypeata*), Green-winged teal (*A. carolinensis*), Canvasback (*Aythya valisineria*), and Hooded merganser (*Lophodytes cucullatus*).

ing ducklings into suitable, unoccupied habitat. The gentle-release method used on the CMWA was successful. Since the young birds are highly susceptible to hunting, the release should be made, where possible, in a large area closed to hunting. Special hunting restrictions for the gadwall are not practical due to the difficulty hunters have in identifying the bird (Evrard 1970) and the political resistance to restricting the harvest of a species relatively abundant over a large area. The best approach appears to be liberating a sufficiently large number of ducklings at any one location or time to overcome the heavy first-year hunting mortality.

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# THESES ON CHRISTIAN VIOLENCE

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“What causes wars and fightings among you?”

James 4:1

Christianity is unique among the semitic religions in its disavowal of violence.<sup>1</sup> No stronger statements against violence can be found in religious literature than those by Jesus. Consider the following. “You have heard it said, ‘An eye for an eye and a tooth for a tooth,’ but I say to you, Do not resist one who is evil.”, and, “You have heard it said, ‘Love your neighbor and persecute your enemy,’ but I say to you, Love your enemies and pray for those who persecute you.” (Matt. 5:38, and 43); “Blessed are the peacemakers, for they shall be called the sons of God.” (Matt. 5:39). Based on such teachings, countless observers across the centuries have agreed with the conclusion stated by George F. Thomas, that “In his life and teachings alike, Jesus showed himself to be truly the Prince of Peace.”<sup>2</sup> The example of Jesus and his teachings inspire those who hope for a social order founded on love, cooperation, and the sanctity of human life. But there is a little discussed and oft-ignored tradition of brutality and violence exercised in the name of this teacher.<sup>3</sup> Why? Why have Christians found it easy to sanction and commit violence in Christ’s name, especially when he appears to have eschewed violence?

We are led to raise the question of whether there is not some ethical contradiction in Christianity, either in the teachings of Jesus himself, or in the traditions about Jesus and in the dogma and precedents established by the Church throughout its history. I believe this to be the case, and until we face it, Christian violence will continue. If Christians cannot summon the courage to exorcise

the demons in their own tradition, to pluck out the offending members, they will be powerless to control those surges of violence which have characterized their past. My own study is directed toward that end.

It is a somber fact of history that in the name of Christ, men have murdered and condoned murder, tortured women and children, slaughtered in war, and executed each other without remorse. There have been many types of Christian violence including early acts of violence during the reigns of the first Christian emperors, the infamous *gestae Francorum* reported by the Bishop of Tours, Charlemagne’s brutal Christianizing of the pagans east of the Elbe, anti-semitic pogroms carried out on the way to the Crusades, the Crusades themselves, carried out against Moslems, the Albigensian Crusade in Europe, the Spanish Reconquista, the Inquisition, the trials and burnings for witchcraft and heresy, the violence of Protestant and Catholic during the Reformation, mistreatment of natives and of Africans by Christians in the history of the new world, the holy war of American Protestant ministers in World War One, and contemporary Christian advocates of violence such as the Lebanese Phalange, the Way, the Christian Patriots Defense League, and so on.

No one knows when the earliest act of Christian violence occurred. We have records of Christian mobs doing violence to non-Christians in the second century and any number of official acts of violence with the dawning of the age of Constantine.<sup>4</sup> It is not my purpose in this paper to describe the entire catalog of horrors perpetrated in Christ’s name in the 2000 years since he himself was the victim of Roman violence.

My purpose is to offer for debate several theses about the genesis of Christian violence. The following list of examples of Christian violence is designed merely to sensitize the reader to the seriousness of the phenomena. Let us take, for example, the legendary Christian monarch, Charlemagne, who “. . . for eighteen campaigns waged war with untiring ferocity. Charles gave the conquered Saxons a choice between baptism and death and had 4,500 [unarmed] Saxon “rebels” beheaded in one day; after which he proceeded to Thionville to celebrate the nativity of Christ.”<sup>5</sup>

In the sixteenth century Protestants and Catholics tore one another to pieces. Martin Luther, “stated again and again, especially during the time of the Peasant’s War, that it is impossible ‘to rule the world according to the Gospel.’”<sup>6</sup> Accordingly, he uttered his famous instruction to the princes to cut them down like dogs [etc.]<sup>7</sup> But the Protestants had no monopoly on violence during this period. A Catholic attack on the town of La Garde yielded this report. “The four principle men of La Garde were hanged and the clergyman was thrown from the top of his church steeple.”<sup>8</sup>

A single example will suffice from the seventeenth century. There is a painting above the altar at Notre Dames des Victoires in Quebec, showing an English warship sinking beneath the waves of the St. Lawrence, her sailors drowning, and flying over this scene an angel of the Lord, bearing a shield with the inscription, “Deus providebat.” It commemorates the destruction of Walker’s fleet in 1690. Of course, the casting of wars in the mold of religion is not an isolated event in Christian history. Our Civil War gave us the great marching Battle Hymn of the Republic. At the inception of that tragic struggle, New Yorker George T. Strong, wrote, “Exsurgat Deus!” Calling “for God to rise up, he viewed the conflict as a ‘religious war—more important to mankind than any since the Saracen invasion . . . was beat back by Charles Martel.’ In Georgia,

Charles C. Jones saw it as ‘a national judgment’ that ‘comes from God . . . to accomplish given ends.’”<sup>9</sup>

Our own century also bears witness to Christian violence. The first World War was interpreted in Christian terms on both sides.

Americans did not enter the war until 1917 and the religious community was almost universally pacifist on religious grounds. Then it turned 180° and preached holy war. Turning pages of Christian journals from the year 1917 we find such assertions as, “We must help in the bayonetting of a normally decent German soldier in order to free him from a tyranny which he presently accepts as his chosen form of government.”<sup>10</sup> One might wonder what would have been Jesus’ response to such an assertion. A clergyman did, asking and answering what is perhaps the most bizarre question in the history of Christian ethics. “Would He [Christ] fight and kill? There is not an opportunity to deal death to the enemy that He would shirk. . . . He would take bayonet and bomb and rifle and do the work of deadliness against that which is the most deadly enemy of his Father’s kingdom in a thousand years.”<sup>11</sup> The phenomenon of Christian holy war is not some historic fossil, left behind in the middle ages.

Today we read in the newspapers of evidence of Christian advocacy of violence. The Way is a contemporary sect founded by Paul Wierwolle. A disaffected ex-Way member recently told a reporter, “A leader took me aside and told me not to worry. If people outside the Way were killed [in the coming revolution] he said it was no worse than animals dying because the people aren’t saved and have no souls.”<sup>12</sup> The militaristic tendencies of the new Christian conservatism are accompanied by a kind of Christian xenophobia as well. I recently saw the following graffiti on a wall at a great Midwestern university. “Don’t feel sorry for the starving of the third world. They are the people of Satan and it’s God’s purpose that they starve.”



We are here face to face with the least attractive visage of Christianity, and would do well to ask if these pathetic and reprehensible people are indeed Christians at all.

The only workable definition of Christian I have encountered is that all who call themselves Christians, are. We cannot simply dismiss the violence of Christian history as being the non-Christian part of that history. Nor would those who committed the violence do so. Charlemagne sincerely believed he was the ideal Christian monarch. Making distinctions is unfaithful to the past and, as C. S. Lewis has pointed out, linguistically unworkable.

Now if once we allow people to start spiritualizing and refining, or as they might say, 'deepening,' the sense of the word Christian, it too will speedily become a useless word. . . . It is not for us to say who, in the deepest sense, is or is not close to the spirit of Christ. We do not see into men's hearts. We cannot judge, and are indeed forbidden to judge. It would be wicked arrogance for us to say that any man is, or is not, a Christian in this refined sense. . . . We must therefore stick to the original and obvious meaning. The name *Christians* was first given at Antioch (Acts xi.26) to 'the disciples', to those who accepted the teachings of the Apostles. When a man who accepts the Christian doctrine lives unworthily of it, it is much clearer to say he is a bad Christian than to say he is not a Christian."<sup>13</sup>

In fact, I would not even go so far as to distinguish between "good" and "bad" if by those terms Lewis means faithfulness to the true tradition. There is, nevertheless, a clear distinction, even contradiction, between the various elements of the tradition. I believe Christian advocates of violence are responding to certain other, bona fide elements of their tradition, a tradition which years of study and teaching has convinced me is complex, paradoxical, even a multi-dox.

The hypotheses I advance to account for the paradox of Christian violence can be classified into three groups: historical,

doctrinal and social. In the first I suggest that Christianity inherited from Judaism a violent set of mind. In the second I suggest that certain aspects of Christian doctrine, rooted in the New Testament and elaborated by the Fathers of the Church, contain the seeds of violence. Third, I suggest that the social conditions to which Christianity adapted itself, with which it made its peace, guaranteed that it would be at least in part a religion of violence.<sup>14</sup>

Christianity inherited a violent mind set from Judaism. *Jaweh is a Warrior*, is the title of a recent book.<sup>15</sup> From earliest times the God of Israel was associated with violence. After the crossing of the Red (or Reed) Sea the Israelites sang this song to their deity:

I will sing to Yaweh for he has triumphed  
gloriously;  
the horse and the rider he has thrown into the  
sea.

Yaweh is my strength and my song,  
And he is my salvation;  
this is my God and I will praise him,  
My father's God and I will exalt him.

*Yahweh is a man of war.*

(Exodus 15:1, my emphasis)

Millard Lind points out, "There is no question but that the exercise of military power is the theme of this poem."<sup>16</sup> Yahweh becomes King in this paradigmatic experience—the warrior-god-king of Israel,<sup>17</sup> providing a normative image rich in possibilities made actual in the later course of Christian history. Even before the Exodus, in Egypt, society is divided into God's people and God's enemies, the latter (including non-combatants who are the enemy after all, the "people of Satan" as the graffiti had it) are struck down by the willful violence of Jahweh exercising his powers over nature. "I know that the king of Egypt will not let you go unless compelled by a mighty hand. So I will stretch out my hand and smite Egypt. . . . (Exod. 3:19) Moses, Jahweh's designated, slays an Egyptian. "It may not be insignificant that

according to the tradition Moses was of the house of Levi (Exod. 2:1), a house already associated with violence in the Book of Genesis.<sup>18</sup> One could elaborate this for many pages. The Conquest of Canaan was a series of divinely commanded and aided military campaigns, or at the least it was seen so by the Hebrews (the doubts of current scholars being irrelevant—what we are seeking here is the *imago dei*). It was a conquest “involving a great deal of violence, [a conclusion] based not only on the simplified account of the book of Joshua, but on the archeological evidence as well.”<sup>19</sup> Joshua reads, “So Joshua defeated the whole land . . . he left none remaining but *utterly destroyed all that breathed, as Yahweh God of Israel commanded*. (Josh. 10:40, by emphasis) In the song of Deborah in Judges, Jael is called “most blessed of women” because she:

put her hand to the tent peg  
and her right hand to the workman’s mallet,  
She struck Sisera a blow,  
She crushed his head,  
She shattered and pierced his temple.  
He sank, he fell,  
He lay still at her feet. . . .  
There he fell dead. (Judges 5:24-27)

“Thou shalt not kill” does not apply to the enemies of God. Whatever we can conclude about the image of God *in toto* in the Old Testament, it is in part that of a violent deity who destroys armies, commands his people to commit genocide, and praises single acts of brutality. From the time of the Exodus to the wars of the Maccabees the Jewish God was associated in the minds of his believers with violence.<sup>20</sup> The argument of Vernard Eller, that all this is God’s war and the Hebrews are expected to stand by and let God do it, is not only morally hypocritical—especially from the victims’ point of view—but unfaithful to the Biblical text and without scholarly foundation. His is the valiant effort of a Christian pacifist to recast a tradition he can’t bear to abandon, a tradi-

tion that is not wholly pacifist.<sup>21</sup> Thus, the warrior god is the first part of the violent legacy and Old Testament bequeathed to the Christians.

The second part is the eschatology of late Palestinian Judaism. Roman domination and Persian influence brought about a greatly heightened anxiety and laid the psychological preconditions for violence. The Roman conquest in 63 B.C. ended any realistic prospect that Israel would work out her divine future in the political sphere. “The redemption she hoped for in the future was not [to be] a real historical event, but a fantastic affair in which all history had been brought to an end for good and all.”<sup>22</sup> God was no longer transcendent over history. “. . . another idea of transcendence came instead. God, like his people, was cut adrift from history. . . . He now became universal Lord of Heaven and earth . . . judge of the world.”<sup>23</sup> He would bring about the fearful Last Days, the end of history itself. This awful event was made necessary by the power of sin on earth, for if God no longer operated in history, Satan did. Part of this was the influence of Persian dualism, the notion that at the Last Days the forces of light will lock in global combat with the forces of darkness. “Sin appeared to be an ineluctible power, spreading its tentacles over the whole world, and affecting the heart of the individual. . . .”<sup>24</sup> The Last Days would be accompanied by the coming of a Messiah. Of course, there were many variations on these themes. Some still hoped for divinely-aided political victory for the “one anointed of God to fulfill his purposes, like the ancient kings of Israel—who would overthrow the enemies of God.”<sup>25</sup>

It is difficult for us to perceive how real and concrete was this mass anxiety.

Evil is not to be thought of here as a philosophical abstraction: for the first-century man, it was a personal matter . . . evil existed as personal forces with which the universe, the community, and the individual were all involved . . . evil was a personal being, called

simply 'the serpent,' who introduced to Adam and Eve the idea of questioning the will of God, and then of rebelling against it. In late Judaism the tempter was identified as Satan—*i.e.*, the Adversary. In the Book of Daniel, interstellar space is peopled with demonic beings so powerful that they can delay the messengers of God (Dan. 10). This dualistic conception of evil . . . was probably adopted by the Hebrews during the period of their contact with the Persians, whose religion was characterized by a sharp division of cosmic forces into good and evil, engaged in constant warfare . . .<sup>26</sup>

John the Baptist was only one of the pre-Christian heralds of the Last Judgment. "He felt called upon to announce an immanent crisis in world history. The content of his message is preserved in the Q source (Matt. 3:7-10, Luke 3:7-9). Here such phrases as 'Wrath to come' and 'ax is laid to the root of the trees' indicate that John was proclaiming the event long awaited by the Jews: God's final judgment upon the evils of the world."<sup>27</sup> The final struggle against Satan is on, and it is against the humans who are his helpers. "Satan," write Kee and Young, "is assisted by men who submit themselves to his purpose and thereby gain extraordinary powers. Others are involuntarily possessed by demons. . . . [this doctrine became a petri dish for the culturing of witch-burners.] Jesus's words in Mark 3:27 clearly imply that before the constructive work of establishing the rule of God can be completed the Kingdom of Satan must be destroyed."<sup>28</sup>

The new eschatological doctrines with their concept of a final struggle against Satan and a day of wrathful judgment to come, a judgment in which not only are men sent to everlasting hell, but cosmic violence is employed to destroy earth, all raised the stakes in the conflict between good and evil, including our own participation in it. Anxiety was raised to a high level. Feelings of anxiety, fear and anger are preconditions for violence. When the last judgment failed to occur on schedule, when it was put off again

and again, each delay increasing both the desire for it and the fear of it, the event, with all its symbolic mythology, became suspended in a limbo of the future where it would fuel the hopes and fears and provide a rationale for first century Christians and for others down through history. The Last Judgment is God's Final Battle. Which side are you on?, is the question put by this terrible dualism. *Thus in late Palestinian Judaic eschatology we have both a violent and angry God and his enemies. Coupled with the holy war motif of the Old Testament we have the rationale and the role models for violence, both bequeathed as a legacy to whichever Christians would, in the future, feel the need to avail themselves of them. This argument comprises my first thesis about Christian violence.* The next five theses fall under the heading of Christian doctrine.

Any scholar or teacher who has attempted to elucidate early Christian doctrine knows it is a mass of confusion. Nevertheless, *the root of my second thesis is that the moral and ethical pronouncements of Jesus himself are confusing.*

Jesus' teachings on love, forgiveness, and non-violence may seem clear and unambiguous. For example, he instructed to forgive "seventy times seven" (Matt. 18:22), yet I know of no medieval "witch" who was forgiven 490 times before being burnt after her 491st conviction. The problem with Jesus' non-violent ethic is two fold. First, it has been watered down by interpretation, or simply rejected outright by his followers who wiggle through all manner of rationalizations in the process, as Kee and Young point out. Jesus'

. . . demand is for unimpeachable integrity and singleness of purpose, purity of heart. Discerning listeners—in Jesus' own day and ever since—have been prompted to explain: 'what man is capable of this?' . . . They have claimed that such teaching is utterly unrealistic in our world. . . . Some have said that we are not to take his demands literally. What Jesus meant to do was simply to illustrate the

ideal attitude. . . . Others have insisted that Jesus' words must be taken literally . . . but that they cannot be complied with in this world . . . man can only fulfill them when God finally brings about the consummation of the kingdom. . . . Still others have sought to cope . . . by asserting that they are not practical, applicable, or even relevant to life in this world. They are to be understood only in terms of the coming of God's final judgment. . . . Jesus' ethic has been called an interim ethic . . . in expectation of the immediate end of the world.<sup>29</sup>

These enervating rationalizations appear to be contradictions of Jesus' ethic. Key and Young think they are. But one can only adopt such a position if one remains blind to the second part of the problem and that is Jesus's own statements to the contrary. While he did not adopt the holy war themes of the Old Testament, he did embrace the violent eschatology of late Palestinian Judaism. Indeed, he can be understood in no other terms. Thus, while Jesus' own teachings on pacifism and non-violence may seem clear, they do not exhaust his statements regarding violence.

In Luke 13:49-54, Jesus is quoted in his most violent statement.

I came to cast fire upon the earth; and would that it were already kindled! I have a baptism to be baptized with: and how I am constrained until it is accomplished! Do you think that I have come to give peace on earth? No, I tell you, but rather division; for henceforth in one house there will be five divided, three against two and two against three; they will be divided, father against son and son against father, mother against daughter and daughter against her mother, mother-in-law against her daughter-in-law and daughter-in-law against her mother-in-law.

Matthew's account of this episode leaves out the first two sentences and adds the following to the end,

and a man's foes will be those of his own household. He who loves father or mother more than me is not worthy of me; and he who loves son or daughter more than me is not

worthy of me; and he who does not take his cross and follow me is not worthy of me. He who finds his life will lose it, and he who loses his life for my sake will find it. (Matt. 10: 38-39)

This makes it appear that Jesus is only using the language of violence in a metaphorical sense. He is not, perhaps, counseling physical violence against the members of one's own family, but merely saying that some will 'believe' while others won't, and that Christians must be willing to alienate their closest family members for sake of their religion. The various scriptural accounts are not identical and are subject to comparative interpretation, and they have been subjected to varying interpretations according to the needs of the historical ages in which Christians have lived and sought guidance from the scriptures.

One of the most difficult passages for Christian pacifists to explain is the single violent act of Jesus; although it should be pointed out that in the rejected non-canonical infancy gospels and other New Testament apocrypha, the young Jesus performs several violent acts including murder. Mark, the earliest gospel, reports: "And he entered the temple and began to drive out those who sold and bought in the temple, and he overturned the tables of the money-changers and the seats of those who sold pigeons (Mark 11:15-17). Luke's account, written later, is spare: "And he entered the temple and began to drive out those who sold, saying to them. 'It is written, 'My house shall be a house of prayer'; but you have made it a den of robbers.'" (Luke 19:45-46) The account of John, which is the latest, is more descriptive, adding, "And making a whip of cords, he drove them all, with the sheep and oxen, out of the temple, and he poured out the coins of the money changers and overturned their tables." In the accounts of this action, Jesus is neither meek, nor merciful, nor forgiving. He is intolerant.

Indeed, Jesus is extremely intolerant of

those who do not believe he is a special messenger of God. The famous verses which open the Gospel of John begin with God's love for man, but end with God's condemnation of Man. "For God so loved the world that he gave his only begotten son, that whoever believes in him should not perish but have eternal life. For God sent the Son into the world, not to condemn the world, but that the world might be saved through him. He who believes in him is not condemned; he who does not believe is condemned already, because he has not believed in the name of the only son of God. (John 3:4-19) (Although unclear in some versions, these words are attributed to Jesus in the World Publishing Company's "Rainbow Edition" in which Jesus' words are printed in red ink.) In this teaching, God, unforgiving of unbelievers leaves them a choice of believing or perishing. At the Last Supper, Jesus appears to couple the love ethic with a violent punishment for those who fail to heed it, in what seems to be an inconsistency.

When the Son of man comes in his glory, and all the angels with him, then he will sit on his glorious throne. Before him will be gathered all the nations, and he will separate them one from another as a shepherd separates the sheep from the goats, and he will place the sheep at his right hand, but the goats at the left. Then the King will say to those at his right hand, 'Come, O blessed of my Father, inherit the kingdom prepared for you from the foundation of the world; for I was hungry and you gave me food, I was thirsty and you gave me drink, I was a stranger and you welcomed me, I was naked and you clothed me, I was sick and you visited me, I was in prison and you came to me.' . . . Then he will say to those at his left hand, 'Depart from me, you cursed, into the eternal fire prepared for the devil and his angels; for I was hungry and you gave me no food, I was thirsty and you gave me no drink, I was a stranger and you did not welcome me, naked and you did not clothe me, sick and in prison and you did not visit me.' . . . And they will go away into eternal punishment, but the righteous into eternal life. (Matt. 25:31-36, 41, 42, 43, 46)

This teaching is typical of many of Jesus' utterances. He believed that mankind would separate into two groups, one favored, and the other accused. "He who is not with me is against me." (Luke 10:23) Jesus believed in a *dies irae* when a wrathful God would do violence to that part of mankind who had rejected him. He said to the multitudes, "You brood of vipers! Who warned you to flee from the wrath to come?", and, "Even now the axe is laid to the root of the trees; every tree that does not therefore bear good fruit is cut down and thrown into the fire." (Luke 3:7, 9) Asking the question, "When the Son of man comes, will he find faith on earth?" (Luke 18:8), he in Matthew reports his answer, given in the parable of the weeds of the field.

"He who sows the good seed is the Son of man; the field is the world, and the good seed means the sons of the kingdom; the weeds are the sons of the evil one, and the enemy who sowed them is the devil; the harvest is the close of the age, and the reapers are angels. Just as the weeds are gathered and burned with fire, so will it be at the close of the age. The Son of man will send his angels, and they will gather out of his kingdom all causes of sin and all evildoers, and throw them into the furnace of fire; there men will weep and gnash their teeth. (Matt. 13:36-43)

In Mark, Jesus says, "But woe to him by whom the Son of man is betrayed." (Mark 17:21) Similarly in Luke: "And I tell you, everyone who acknowledges me before men, the Son of man also will acknowledge before the angels of God; but he who denies me before men, will be denied before the angels of God." (Luke 12:8-9) And "He who hates me hates my father also." (John 15:23) Indeed, whoever falls from the teaching will suffer punishments worse than physical mutilation. For example:

Whoever causes one of these little ones who believe in me to sin, it would be better for him if a great millstone were hung round his neck and he were thrown into the sea. And if your hand causes you to sin, cut it off; it is better

for you to enter life maimed than with two hands to go to hell, to the unquenchable fire. (Mark 9:42-48)

Those who do not accept Christ are reminded of the divine violence against Sodom. (Luke 10:10-15 and 17:22-37) In the parable of the vineyard, the fate of those who reject God is thus: "He will come and destroy those tenants, and give the vineyard to others. . . . The very stone which the builders rejected [*i.e.* Christ] has become the head of the corner. Everyone who falls on that stone will be broken to pieces; but when it falls on anyone it will crush him." (Luke 20:16-18) In John's gospel Jesus is reported as saying: "I am the vine, you are the branches. He who abides in me and I in him he it is that bears much fruit, for apart from me you can do nothing. If a man does not abide in me, he is cast forth as a branch and withers; and the branches are gathered and thrown into the fire and burned." (John 15:5-6) The language of Jesus is rich in the imagery of violence, but he also spoke directly and plainly. "You brood of vipers! how can you speak good when you are evil? . . . I tell you on the day of Judgment men will render account for every careless word they utter for by your words you will be justified, and by your words you will be condemned." (Matt. 12:34-36)

Professor Meinhold points out, "In the apocalyptic speeches of Christ the multiplication of wars, the filling of the earth with cries of wars, is a sign of man's deep involvement with the antidivine powers and of his degeneration. War, as an eschatological event, is both cause and result of sin."<sup>30</sup>

The same confusion or lack of ethical clarity characterizes the rest of the New Testament which is not, as Key and Young point out, ". . . a single, unified work, but an anthology of writings serving a variety of objectives and originating in widely scattered parts of the empire over a range in time of about a century. So we must not expect elaborate or systematic treatments of either ethical or theological matters."<sup>31</sup> What

frequently happens, then, is that Christians choose the saying of Jesus or Paul that informs the moment. Ethics is governed by the principle of expediency.

But there was more confusion in the testimony of the early Christian centuries than merely ethical confusion, there was an immense theological confusion that resulted from the efforts to understand a Jewish prophet in terms of both the mystery religions of the east and the rational philosophy of the Greeks. While this may have been an intellectually fertile time, it led to two consequences which have great significance for the history of Christian violence. These are the mutual rejection of Christians and Jews and the long, brutal history of anti-semitism that culminated in the Holocaust, on the one hand. And, on the other hand, it led to the phenomenon of orthodoxy and heresy. Since so much was at stake, *i.e.*, the fate of the ultimate being, God himself, and the fate of all mankind at the last judgment, since the stakes were on a cosmic scale, and the whole business cast in a radical dualism of good people versus the enemies of God, it is easy to understand why so much violence has been done to dissenters (the confusion being so great and so much being at stake). Theses three and four, then, are that the theological confusion led to the creation and subsequent hatred of "The Jews" and of the heretic. Both were nurtured in the virulent, emotional hothouse of early Christian eschatology.

Rosemary Reuther has demonstrated in *Faith and Fratricide* that anti-semitism has its roots in the very core of Christian theology, that Christian scripture created the stereotype of "The Jew," the assassin of God's prophets and finally of God himself.<sup>32</sup> Christianity is an exclusivist religion, deliberately shutting out all who disagree, pronouncing them anathema. The first people shut out were the Jews. Reuther shows that the anti-Jewish trends in Christianity go back to earliest times and are linked to their proclamation of Jesus as the Christ which brought with it a new way of reading the

scriptures. These were interpreted as scriptures. These were interpreted as signs of the coming of Christ and of his rejection by his own people. Gregory Baum, who introduces the book, writes that, “. . . the Christian affirmation of Jesus as the Christ was accompanied by a refutation of the synagogal reading of the Scriptures [*i.e.*, refutation, which Rosemary Ruether calls ‘the left hand of Christology,’ is the source and origin of Christian anti-semitism.<sup>33</sup> Ruether herself writes, “On the one hand, the Church argues that the true meaning of the Scriptures is that of a prophecy of Jesus as the Christ. And, on the other hand, it developed a collection of texts ‘against the Jews’ to show why the authority of the official Jewish tradition should be discounted when it refutes this Christological midrash of its own Scriptures.”<sup>34</sup>

What powered this hostility was the great and unexpected disappointment at the failure of Jesus’ Jerusalem mission to usher in the Last Days. Instead it ended with his execution as a common criminal. How could this happen to someone they believed was the Messiah? Especially when the very fact that it did happen convinced most Jewish people that he wasn’t?<sup>35</sup> The only possible explanation was that it was destined to happen and they had to find proof of it in the Scriptures. Believing as they did, then, “Those who refused to believe in his name would be rejected from Israel and have no part in the community of salvation. Now the Church knew that it and it alone understood the real meaning of the Scriptures.”<sup>36</sup> “Why,” asks Ruether, “was it necessary to emphasize that the Jewish religious tradition not only rejects the gospel, but tries to kill its messengers (including its ‘forerunners,’ the prophets)? We would suggest that this theme in the Christian tradition developed from the crucial need to make religious sense out of the crucifixion itself, *i.e.* to provide a dogmatic necessity for the fact that the Prophet-King-Son of Man is not only to be unheard by an unbelieving people, but that *it was predicted that he should be killed by*

*them.* This was accomplished by reading back into Jewish history a pattern of an apostate Israel which has always rejected the prophets and killed them.”<sup>37</sup> The attitude a believer must adopt toward the perpetrators of this most monstrous sacrilege was clear. “. . . Christianity vilified Judaism outside its converted community as an apostate, sinful, worse than Gentiles, and even of the devil. It regarded the others as fallen outside the true covenant and ranked with the enemies of God. Hypocrites, blind fools, blind guides, whitewashed tombs, serpents, offspring of vipers and children of hell are among the epithets heaped upon rival interpreters (*i.e.*, Jews (of the tradition in the Gospel of Matthew.”<sup>38</sup>

The “Jew,” then, was created by the Christian as the first and worst heretic. As long as the Christians remained an insignificant minority in the Roman empire their violent and arrogant attitudes toward the Jews were inconsequential. When they captured the empire they captured the tools for actualizing their violence against the Jews. It is not far from that position to the First Crusade and its attendant massacres of Jews along the way to the Holy Land. The reasoning went, “why should we concern ourselves with going to war against the Ishmaelites [*i.e.*, the Moslems] dwelling about Jerusalem when in our midst is a people who disrespect our God—indeed, their ancestors are those who crucified him. Why should we let them live and tolerate their dwelling among us? Let us commence by using our swords against them.”<sup>39</sup> Thus the theological conversion of Jesus into the classic eastern type of the dying personal saviour god activated the desire for revenge against those held responsible for his death. That his death was held to be inevitable and pre-destined and that the whole doctrine of the atonement, so central to salvation, would have been rendered meaningless without it, appears never to have occurred to anyone. What the Jews were accused of and were powerless to prevent was the facilitation of the central event of salvation.

The ethical Jesus was submerged by the eschatological Jesus, a trend he himself began, and which gained force with the elaboration of Christian theologies and the heretical controversies that inevitably followed from that elaboration.

The most common cultural pattern for religion to take is mythical, that is, particular deities and their acts are not significant in and of themselves but rather point to a greater reality behind their mere appearance. Thus several versions of an event can be told without any threat or challenge to the validity of the ultimate truth which each version represents. Thus Egyptian creation stories signify several particular geographic locations which were the first place land appeared as the primeval watery chaos subsided.<sup>40</sup> Rationally speaking this is a contradiction in terms, since only one could be the first. However, the validity rests not with the historic event, but rather with the great message behind it, *i.e.*, that the universe is indeed a cosmos, a divinely ordered system. And in the mythic religions, the greatest message is the fundamental unity of the cosmos, including the ultimate union of man and God.<sup>41</sup> "Myth," according to Alan Watts, "is to be defined as a complex of stories—some no doubt fact, and some fantasy—which, for various reasons, human beings regard as demonstrations of the inner meaning of the universe and human life. Myth is quite different from philosophy in the sense of abstract concepts, . . ."<sup>42</sup> In a mythic approach to religion the concept of heresy makes no sense, and many different paths are recognized as leading to God or the Ultimate Unity.

Christianity partakes of the mythic approach, especially as it was expressed by the great mystics of the Middle Ages. But, says Watts, it unfortunately tries to treat myth as fact, resulting in deep ideological confusion.

The confusion has its roots in the fact that Christian dogma is a blend of Hebrew mythology and history with Greek metaphysic and science. . . . As a result, then, Christian dogma

combines a mythological story, which is for the most part Hebrew, and a group of metaphysical 'concepts' which are Greek, and then proceeds to treat both as statements of fact . . . in other words, it talks about mythology and metaphysic in the language of science. The resulting confusion has been so vast, and has so muddled Western thought, that all our current terms, our very language, so partake of the confusion that they can hardly straighten it out.<sup>43</sup>

This muddle had more than intellectual significance, for it was one cause of several that, a thousand years later, led to the roasting alive of young women for the "crimes" of heresy and witchcraft.

"Almost from the beginning," writes Watts, "Christian orthodoxy began to insist on the scientific rather than the metaphysical or mythical interpretation of the divine revelation."<sup>44</sup> Christianity became a peculiarly legalistic or creedal religion that put its adherents to the test of words. The influence of Hellenistic rationalism on the minds of the Fathers led them to put the great question of religion in the form, "what must the true Christian believe?," and to heatedly argue and debate ever more subtle points of doctrine until a welter of theological ideas rushed hither and thither throughout the Mediterranean civilizations. Cross-currents, tides, up-wellings, ebbed and flowed as a great intellectual plasma for several centuries. Complicating the picture was the welter of texts being read as scripture, more than four times what eventually found its way into the canon. For the first four centuries there were many Christian pathways to God, but this multiphase situation was vigorously opposed by many who early sought to reduce it all to deceptively simple creeds. Even after the canon was fixed at twenty seven books, they contained too much material of a polyglot nature to serve as a "scientific" rule of faith and, writes Oscar Cullmann (*The Earliest Christian Confessions*) "the essential content had to be extracted."<sup>45</sup> These creeds were mainly theological and not ethical



statements. They concentrate on Jesus as a divine being rather than on Jesus as a teacher. Thus evolved a number of bitterly contested positions about who Jesus was and what it all meant in cosmic terms. Ideas barely mentioned in the scripture or not at all were elaborated into complex theological edifices, such notions as the pre-existence of Jesus, the incarnation, the divine sacrifice as atonement for the sins of all mankind, the sacrament of the Eucharist as the physical body and blood of Christ and the whole complex and fundamentally illogical doctrine of the trinity, the idea of powers of evil and Christ's relationship with them, the last judgment, and so forth, evolved over centuries and attempts were made to codify them in brief, trenchant symbols fully understandable only by professional intellectuals. To the illiterate masses, among whom we must number most Christians for most of Christian history, it was impossible to make sense of it. Yet it was crucial! One's eternal fate rested on it, a fate either blissful or, depending on knowing the right answers to the theological puzzle, incredibly violent.

Indeed, the doctrine of an afterlife led in some cases to a devaluation of human life in the here and now. What counted was one's eternal fate, and this life, this body and its physical pains were only a means to the end of eternal life. Thus people could literally be killed in the belief it was for their own good, for they would be sent on to divine judgment. The most notorious of such cases is the statement attributed by Caesar von Heisterbach to Arnald-Almaric, a leader of the 13th century Crusades against the Albigensian heretics in southern France. On ordering the massacre of the people of Beziers, Arnald-Almaric is reputed to have said, "Kill them all, God will look after his own."<sup>46</sup>

How was it that the sword came to be wielded for Christ, against men, women, and even children? I believe the long road of violence led out of the doctrines of late Palestinean Judaism and of early, Hellenized Christianity, with their peculiar emphasis on exclusivity.

Those who pursued the creation of an orthodoxy, and it was done from many sides of the sea, including the losers who ended up being declared heretics, generally agreed that Christianity was an exclusionist religion.

Christianity is a monopolistic faith in that, like later Judaism and Islam, it claims to be the one true faith, a faith destined to prevail for all on earth. The Christian wants to spread Christianity and he has often spread it with the sword; moreover, he wants the right kind of Christianity, his own. . . .<sup>47</sup>

Christianity evolved from an ideologically fluid religion to one in which creedal orthodoxy was favored, yet, at the same time, it represented a gigantic fertile syncretism of Greek, Persian, Hebraic and Gnostic ideas which have for two thousand years resisted efforts to reduce their living complexity to dead formula. What is perhaps the most multi-faceted collection of powerful religious ideas in the world was nevertheless, subjected to the creedalizing process. The effort to state the ineffable in scientific terms led to the mutually generating phenomena of orthodoxy and heresy. Not only was this development an intellectual necessity, *sui generis*, but the social and political matrix of the believers also fostered it. So important was the formulation of this true creed for social stability, that men were fighting over it in the late third century. "At least as early as the Arian controversy at the end of the third century Christians were resorting to bodily violence to further the work of God."<sup>48</sup> It threatened to disrupt the empire, and Constantine was forced to intervene.

The social context and causes of Christian violence became readily apparent with the identification of Church and State in the early fourth century. I have already alluded to the mutual rejection of the infant Church and the Jews, a rejection made necessary by orthodox Christology, or what eventually became orthodox Christology after the bishops had triumphed over the Gnostic churches. But there was a social dimension

as well. The two churches became two separate communities, competing for converts in the same towns and cities of the empire. The peculiar Christology of the orthodox, and the social competition for converts, laid the foundation for twenty centuries of both latent and manifest anti-semitic violence which, by the twentieth had become so interwoven into the social fabric of Europe as to generate the Holocaust. This was possible because Christianity captured the state and by means of it, the majority of the population. From Constantine to our own day the cross and sword of state have frequently been conjoined and the state has been the form in which it presented itself to the people. However, the first struggle over the social forms in which Christianity was to express itself in late antiquity was the struggle between the Gnostics' open-ended theologies and proto-democratic churches and their opponents, the creedalizing bishops who eventually won and established their own political authority as the proponents of the "true" faith within Christendom.

Elaine Pagels has demonstrated in *The Gnostic Gospels* that the struggle to reduce Christian faith to an authoritarian Creed, thus excluding the theologically rich alternatives, was as much a social struggle for political domination of the Christian masses, as it was an ideological struggle. She writes,

Traditionally, historians have told us that the orthodox objected to gnostic views for religious and philosophical reasons. Certainly they did; yet investigation of newly discovered gnostic sources suggests another dimension of the controversy. It suggests that these religious debates—questions of the nature of God, or of Christ—simultaneously bear social and political implications that are crucial to the development of Christianity as an organized religion.<sup>49</sup>

One of the areas of disagreement was over the nature of Christ's resurrection. The Gnostics held it to have been a resurrection in spirit only. The orthodox bishops held it

to be a bodily resurrection made manifest to the apostles from whom authority among Christians was passed in apostolic succession to themselves. Pagels observes, ". . . we can see, paradoxically, that the doctrine of bodily resurrection also serves an essential *political* function; it legitimizes the authority of certain men who claim to exercise exclusive leadership over the churches as the successors of the apostle Peter."<sup>50</sup>

Another institutional question was that of the role of women within the Church. The Gnostics admitted women to full membership as priests. This greatly offended the orthodox, male, bishops such as Tertullian, who suspects they not only preach and cure but even perform the office of baptism. "These heretical women," wrote the bishop, "how audacious they are! They have no modesty; they are bold enough to teach, to engage in argument, to enact exorcisms, to undertake cures, and, it may be, even to baptize!"<sup>51</sup> Tertullian charged the churches otherwise. "It is not permitted for a woman to speak in the Church, nor is it permitted for her to teach, nor to baptize, nor to offer [the eucharist], nor to claim for herself any share in the *masculine* function, not to mention any priestly office."<sup>52</sup> A thousand years later the Church would make as one of its justifications for the slaughter of the Albigensians the argument that they allowed women to perform priestly functions.

Pagels also points out that the two kinds of Christians split on the issue of martyrdom, with the bishops encouraging it and gnostic apologists opposing it as a ghastly blasphemy. The gnostic author of *The Testimony of the Truth*, ". . . ridicules orthodox teachers who, like Ignatius and Tertullian, see martyrdom as an offering to God and who have the idea that God desires 'human sacrifice:' such a belief makes God into a cannibal."<sup>53</sup> Pagels argues that the orthodox bishops believed the attack from the state could only be met by an institutional consolidation under (their) strong leadership, and could thus brook no opposition, especially from the Gnostics who were

attacking the Church's most effective testimonial act, the act of martyrdom. Increasingly the bishops coerced their followers by threat of hell, and by withholding the eucharist, into conformity to an ever more rigid doctrine, hierarchy, ritual and canon. "The bishops drew the line against all who challenged any of the three elements of this system: doctrine, ritual, and clerical hierarchy—and the Gnostics challenged them all."<sup>54</sup> Thus did the church of Jesus, who had said, "Come unto me *all* ye who are heavy laden," (Matt. 11:28) become an excluding church, shutting out those Christians who had a different understanding of the sacred mystery, or who preferred congregational autonomy, or who admitted women to full participation.

The way in which these "orthodox" Christians dealt with this first "heresy" set the pattern for the ages to follow. They equated a particular form of Christian organization—theirs—with the right statement of the faith, and whoso rejected one was held to have rejected the other. The bishop Ignatius put it unequivocally:

It is not legitimate either to baptize or to hold an *agape* [cult meal] without the bishop . . . To join with the bishop is to join the Church; to separate oneself from the bishop is to separate oneself not only from the church, but from God himself.<sup>55</sup>

Thus did the Church early on equate itself with God. When one recalls that the personality and will of God imaged in the Judaic and Christian scriptures included enemies and a violent punishment of these enemies, it becomes more understandable how it was that the bishops, acting for their God, in his place, could transform their own violent emotions and language into overt violence against those who disagreed with them. Once they captured the state of Constantine, and all of its successors, they would translate their hostility into acts of violence against those whom they would call "heretics."

The problematic relation between Christ

and culture was sketched many years ago by H. Richard Niebuhr. He pointed to the polarity between the claims of Christ and the claims of society, between the One and the many, the eternal and the temporal, the absolute and the relative, the universal and the specific, the single-mindedness of Christ (mind God, all else will be taken care of) and the many concerns necessary to a functioning society. Polytheistic and mythic religions are not confronted by this problem. Christianity is. And it is complicated by the fact that the universal, absolute, divine message of Christ was delivered in the relativistic and culture-bound person of Jesus of Nazareth, thus confusing the issue of how particular Christians located in particular cultures at specific moments in history should act. Niebuhr suggests that,

an infinite dialogue must develop in the Christian conscience and the Christian community . . . The dialogue proceeds with denials and affirmations, reconstructions, compromises, and new denials. Neither individual nor church can come to a stopping place in endless search for an answer which will not provoke a new rejoinder.<sup>56</sup>

The various positions actually taken by the Church, *i.e.*, whether it rejected a particular cultural context in which it found itself, or whether it affirmed the culture and its claims, depended in part on how much power it could wield in the social world. It also depended on which social classes and ethnic groups were in control of the Church hierarchy at the time. What did not change was the Church's implacable hostility toward those who did not agree with it, whether they, or the church itself, were in, or out, of power.

Before the church came to power and when it was a lower class phenomenon (slaves, fishermen, etc.), it violently repudiated Roman culture and, in the language metaphor employed in the book of Revelations, looked to the day when Babylon, the whore-monger, (*i.e.* Rome), would be destroyed by the cosmic assault of Christ

himself. (Rev. 2:19-29,6,8,9,etc.) Again, note the violence of early Christians' eschatology. "So the four angels were released . . . to kill a third of mankind." (9:15). When the church stood outside the gates of power it cursed the social order and called down doom upon it. Then came the Edict of Milan (313), when those gates opened and the powerful embraced the church, the social order was sanctified and, as was the case earlier with the hierarchy itself, the social order and God were equated. Meinhold reports,

Soon after the edict of tolerance of 313 . . . the Synod of Arles decreed that soldiers who deserted must be excommunicated from the Church . . . The monogram of Christ was affixed to the helmet of the soldiers and to the standards of the emperor's armies. With these changes the church indicated she was now ready to honor the profession of soldier and to encourage military service by Christians. From now on the wars which the Christian emperors were waging were considered wars for the propagation of the Gospel. . . .<sup>57</sup>

Clearly, "the relationship between church and state changed radically under Constantine the Great (306-360) . . . The church, on her part, gave up her negative attitude toward the state. The state had become her friend and now provided her with an opportunity for missionary work . . ."<sup>58</sup> Church and state began to merge as Christianity, the universal, eternal and absolutist religion made compromise with the particular, temporal and relative society of Byzantium. Christ became lost in, or at least identified with a particular culture, and what is more, the needs and prerogatives of Church and state were so woven together as to be incapable of disentanglement. ". . . the imperial church, which was closely identified with the court of the Eastern Roman Empire, patterned her organization closely after that of the state. Her laws were the laws of the state."<sup>59</sup> In 346 A.D. the pagan temples were closed and the death penalty decreed for anyone found performing the old sacrifices.<sup>60</sup>

The merger between Christianity and the state during the age of Constantine became ever more firmly established. When the emperor Theodosius installed Nestor as Bishop of Constantinople, the latter preached a sermon in which he told the emperor, "Give me, my prince, the earth purged of heretics, and I will give you heaven as a recompense. Assist me in destroying heretics, and I will assist you in vanquishing the Persians."<sup>61</sup> Nestor clearly believed himself to be the Vicar of a god who was engaged in deadly warfare against enemies at home and abroad, and he makes alliance with the state to use its weapons of death against all who could not (would not) assent to a particular creedal formulation of faith.

Still, the problem of which creed was valid plagued the church and was the occasion for much internal violence.

Being a Christian, the emperor Constantius found out, was not a clear cut thing. At first he supported the Arians. When he replaced an orthodox bishop with an Arian prelate, riots broke out and three thousand persons lost their lives. Durant speculates that "probably more Christians were slaughtered by Christians in these two years (342-343) than by all the persecutions of Christians by pagans in the history of Rome."<sup>62</sup>

Certain of the Donatist heretics, in particular, evolved a cult of religious violence. These were priests who decried the efficacy of sacraments administered by priests who were in a state of sin. The state church turned immediately to the weapons now at its disposal and, using imperial troops, forcibly removed them from their churches. Reacting to the Church, which was now identified not only with the state but with the wealthy as well, some of them became Christian revolutionaries.

Bands of revolutionaries, at once Christian and communist, took form under the name of Arcumcelliones, or prowlers; they condemned poverty and slavery, cancelled debts and liberated slaves and proposed to restore the

mythical equality of primitive man. . . . Usually they contented themselves with robbery; but sometimes, irritated by resistance, they would blind the orthodox or the rich by rubbing lime into their eyes, or would beat them to death with clubs; or so their enemies relate. If they in turn met death they rejoiced, certain of paradise. Fanaticism finally captured them completely; they gave themselves up as heretics, and solicited martyrdom; they stopped wayfarers and asked to be killed; and when even their enemies tired of complying, they leaped into fire, or jumped from precipices, or walked into the sea.<sup>63</sup>

In a curious inversion of violence, these angry men at last turned upon themselves.

For a brief moment, the emperor Julian (361-363) tried to undo the alliance between Christianity and the state. He was killed on the Persian front. The historian Libanius believed he was assassinated by one of his own, Christian troops. Sozomen, another Christian observer, praised the assassin, "who, for the sake of God and religion, had performed so bold a deed."<sup>64</sup> Julian was the last apostate. Ever after the Church would make free use of the sword of state. The violence that was latent in Christian doctrine, rooted in its Judaic foundations, potential in its exclusion of all but one pathway to God, explicit in its eschatology, made necessary by its legalistic creedalism, was activated by its alliance with the state.

Another aspect of the Christ and culture problem was that the Christian leadership was variously captured by different ethnic groups and social classes whose position in society made them prone to violence, or whose particular historic traditions cherished warrior values. I have already noted that the early church was sometimes represented by the spokesmen of the exploited and alienated lower classes, hostile to the then-pagan ruling classes. And it is common knowledge that, once Christianized, the ruling classes came to dominate the church, especially in the Middle Ages in Europe, where the Christian social sanction

of the feudal order gave Marx occasion to characterize Christianity as the "opiate of the masses."<sup>65</sup> The powerful and rich had much to defend against the lower classes and were not above using religion to do so. One need think only of Martin Luther, siding with the Princes during the great peasant rebellions of 1525. He specifically instructed the Princes, "For a prince or a lord must remember in this case that he is God's minister and the servant of his wrath (Romans, xiii), to whom the sword is committed for use upon such fellows. . . ."<sup>66</sup>

The Princes with whom Luther sided had had a long heritage of Christian violence. They were, or claimed to be, descendants of teutonic warriors and Vikings whose entire male-dominant social order was organized around military virtues.

The transformation of Christianity into a full blown warrior religion by the Normans is nowhere more penetratingly analyzed than in Henry Adams' *Mont-Saint-Michele and Chartres*. High on a summit overlooking the Atlantic the Normans raised a great abby church in the early twelfth century. Atop it they placed a statue of the archangel Michael.

Standing on the summit of the tower that crowned his church, wings upspread, sword uplifted, the devil crawling beneath, and the cock, symbol of eternal vigilance, perched on his mailed foot, Saint Michael held a place of his own in heaven and on earth which seems . . . hardly to leave room for the Virgin of the Crypt at Chartres, still less for the Beau Christ of the thirteenth century at Amiens. The Archangel stands for Church and State, and both militant. He is the conqueror of Satan . . . His place was where the danger was the greatest; therefore you find him here. For the same reason he was, while the pagan danger lasted, the patron saint of France. So the Normans, when they were converted to Christianity, put themselves under this powerful protection.<sup>67</sup>

Here we do not have "the peace which passeth understanding."

Here in the great hall of the abbey Church the Duke (William the Conquerer) and his men listened to their favorite secular work, the *Chanson du Roland*. In the climactic death scene of the poem we are not very far from the old Viking faith.

God the Father was the feudal seigneur, who raised Lazarus—his baron or vassel—from the grave . . . God the Father, as feudal seigneur, absorbs the Trinity and, what is more significant, absorbs or excludes also the Virgin, who is not mentioned in [Roland's] prayer. To this seigneur, Roland, in dying, proffered his right hand gauntlet. Death was an act of homage. God sent down his archangel Gabriel as his representative to receive the homage and accept the glory.<sup>68</sup>

Thus dies the archetypal hero of medieval literature—a Christian warrior, slain while slaying Jahweh's enemies, the merciful Mary and Christ not mentioned by the poet. Such was the Christian religion of the Normans whose case is one more evidence for the insights offered by H. Richard Neihbuhr in *Christ and Culture*. Culture captured Christ. These warriors were indeed men of God.

That the church was a thoroughly masculine institution has been alluded to elsewhere. If women were allowed in they were cloistered. The Churchman's relations with women (scandal-mongers of the Reformation notwithstanding) were either relations of fantasy, as was perhaps the source of psychological energy that powered the cult of the Virgin in the high middle ages; or, they were the relations of violence which resulted in the extermination of millions of women Churchmen thought to be out of step with true Christianity.<sup>69</sup> These unfortunate females were the so-called witches. In a classic case of psychological projection, the celibate clergy transferred their own repressed desires, guilt and anger onto females.

According to the church, all of the witches power was ultimately derived from her sexuality. Her career began with sexual intercourse

with the devil and wild orgies at the Sabat . . . The *Malleus Maleficarum*, or *Hamer of Witches*, stated that all witchcraft comes from carnal lust which in women is insatiable.<sup>70</sup>

The authors of the *Maleus* were subject to delusions such as the following:

. . . what is to be thought of those witches who in this way sometimes collect male organs in great numbers, as many as twenty or thirty members together, and put them on a bird's nest or shut them up in a box, where they move themselves like living members, and eat oats and corn, as has been seen my many and is a matter of common report.<sup>71</sup>

It was this sort of evidence that caused historian G. Rattray Taylor to exclaim that the whole of Medieval Europe was "one vast insane asylum."<sup>72</sup> That is, of course, a gross exaggeration, but it should not blind us to the facts of neurotic male aggression directed against women. But, whether the most pathetic example of Christian violence against the helpless is the Saxon prisoner bowing his head to the sword of the executioner, or the old women being tied to a stake by the spokesmen of Christ, in each case, a male dominated group is responsible. Masculinity is a common thread running through the history of Christian violence, whether it be an expression of dominant norms, as is the case of the warriors of Mont-Saint-Michele, or mental illness, as with the witch-hunters, or whether, as some recent research suggests, it be genetic.<sup>73</sup> Men are violent, and the history of the Christian religion has been in the main the history of Christian men.

My purpose in this paper has been to suggest that in spite of the fact that some of Jesus' exhortations are to love and non-violence, that historic Christianity is a religion afflicted with violence, and to offer several theses toward an explanation of this curious and usually shunned contradiction. These theses have included the following ideas: that the Judaic foundation of Christianity contains a strong tradition of divine violence; that late Roman Palestinian

eschatology as developed by Christianity contains strong overtones of violence and eagerness for revenge on unbelievers; that the Christian assertion and Jewish rejection of Jesus as Messiah provided the framework for 2000 years of anti-semitic violence culminating in the Nazi genocide of the twentieth century; that the confusion of traditions (Judaic, Greco-Roman, Gnostic, *et alia*) in early Christian thought led to a felt need for creedal clarity, which rendered orthodox Christianity exclusionist, thereby defining and identifying those against whom it is permitted to exercise the anger of the wrathful God; and that the Christian movement was socialized in various ways that made the contradiction of its love ethic an historic necessity. Among the latter are included the contest with the Gnostics which began, among other things, the long and violent history of Christian sexism, culminating in the witch craze of 1500-1700; the confusion of Christianity with the needs of a particular social class, whether underdogs or rulers, and the infusion into Christianity of all the hatreds and passions of the class struggle; the capture of the hierarchy by the Germanic warrior tribes whose patron, the Archangel Michael, perfectly represented their militant Viking-style Christianity and whose ethos informed the Crusades; the capture of the church by males generally, and, finally, and most important, the alliance of Church and State. It may well be that this last is the sufficient cause for Christian violence and all the others are but necessary causes. That the socialization of the church into the norms of violence proved so easy and was almost unopposed suggests that the potential for violence, and the acceptance of violence, lies deeply buried in Christian doctrine. If so, this is a tragedy because much that is good is also rooted there.

#### NOTES

<sup>1</sup> Vernad Eller. *War and Peace from Genesis to Revelation* (Scottsdale, Pa.: Herald Press, 1981), p. 11

<sup>2</sup> George F. Thomas. *Christian Ethics and Moral*

*Philosophy* (New York: Charles Scribner's Sons, 1955), p. 348.

<sup>3</sup> Harry Girvitz notes how little work has been done on the topic of violence and quotes Hannah Arendt who "also finds it surprising 'that violence has been singled out so seldom for consideration.'" I found almost nothing under this heading in card catalogues, literature indices or book indices, the more so in the area of religions, church history and ethics. "An Anatomy of Violence" in Sherman Stanage, *Reason and Violence* (Totowa, N.J.: Littlefield, Adams, 1974), p. 183.

<sup>4</sup> Thomas, *op. cit.*

<sup>5</sup> Will Durant. *The Age of Faith* (New York: Simon & Schuster, 1950), p. 462.

<sup>6</sup> Peter Meinhold. *Caesars or Gods?: Conflict of Church and State in Modern Society* (Minneapolis: Augsburg Pub. House, 1962), p. 106.

<sup>7</sup> Martin Luther, "Against the Robbing and Murdering Horde of Peasants," in Durant, *The Age of Faith* (New York: Simon & Schuster, 1957), p. 390. To wit "Therefore let everyone who can, smite, slay, and stab, secretly or openly . . . It is just when one must kill a mad dog. . . ."

<sup>8</sup> Amos Blanchard. *Book of Martyrs* (N.G. Ellis: Kingston, U.C., 1842), p. 121.

<sup>9</sup> Thomas B. Allen (ed.). *We Americans* (Washington, D.C.: National Geographic Society, 1976).

<sup>10</sup> "The Advocate of Peace" in Ray H. Abrams, *Preachers Present Arms* (New York: Round Table Press, 1933), p. 160.

<sup>11</sup> *Ibid.*, p. 68.

<sup>12</sup> Paul Maccabee. "The Way Invades Minneapolis," *Twin Cities Reader*, Vol. 6, No. 10, March 19-26, p. 8.

<sup>13</sup> C. S. Lewis. *Mere Christianity* (New York: Macmillan, 1952), p. 11. Historian Crane Brinton has arrived at a similar conclusion. "Since for centuries all Westerners were in a formal sense Christian, the actual conduct of men called 'Christians' has run the gamut of Western capacities, which are many and varied. It is at least clear that many different beliefs, many different human personalities, many kinds of conduct . . . have been given 'Christian' as an attribute. . . . I shall rarely mean by *Christian* all men known as Christians. I shall try to make clear when I am dealing with most, many, or even average ordinary Christians, and when I am trying to set up a Christian type, ideal, or pattern." *A History of Western Morals* (New York: Harcourt, Brace & Co., 1959), p. 149.

<sup>14</sup> Phillip Hallie. "Satan, Evil and Good in History" in Sherman Stanage (ed.) *Reason & Violence* (Totowa, N.J.: Littlefield, Adams & Co., 1974), p. 59, reminds us, "One does not do evil out of the blue. One does it under many pressures . . . It is a part of personal and public history, a resultant of many forces, as they say in physics."

<sup>15</sup> Millard C. Lind. *Jawah Is A Warrior* (Scottsdale, Pa.: Herald Press, 1980).

- <sup>16</sup> *Ibid.*, pp. 48-49.
- <sup>17</sup> *Ibid.*, p. 50, "Yahweh the warrior becomes Yahweh the king."
- <sup>18</sup> *Ibid.*, p. 62.
- <sup>19</sup> *Ibid.*, p. 65.
- <sup>20</sup> *Ibid.*, p. 65.
- <sup>21</sup> Eller, *op. cit.* cf. Chapter 3 "It's His war. Let Him fight it!" and elsewhere. This is Eller's thesis.
- <sup>22</sup> Rudolph Bultman. *Primitive Christianity In Its Contemporary Setting* (Philadelphia: Fortress Press, 1956), pp. 60-61.
- <sup>23</sup> *Ibid.*, *loc. cit.*
- <sup>24</sup> *Ibid.*, p. 70.
- <sup>25</sup> H. C. Key and F. W. Young. *Understanding the New Testament*, 2nd ed. (Englewood Cliffs, N.J.: Prentice Hall, 1965), p. 47.
- <sup>26</sup> *Ibid.*, pp. 57-58.
- <sup>27</sup> *Ibid.*, p. 80.
- <sup>28</sup> *Ibid.*, p. 58.
- <sup>29</sup> *Ibid.*, pp. 136-137.
- <sup>30</sup> Meinhold, *op. cit.*, p. 124.
- <sup>31</sup> *Ibid.*, pp. 66-67.
- <sup>32</sup> Rosemary Ruether. *Faith and Fratricide: The Theological Roots of Anti-semitism* (New York: Seabury Press, 1979).
- <sup>33</sup> Gregory Baum in Ruether, *op. cit.*, p. 12.
- <sup>34</sup> Ruether, *op. cit.*, p. 65.
- <sup>35</sup> *Ibid.*, p. 69.
- <sup>36</sup> *Ibid.*, p. 72.
- <sup>37</sup> *Ibid.*, p. 90.
- <sup>38</sup> *Ibid.*, pp. 74 & 75.
- <sup>39</sup> Slomo Eidelberg (ed.). *The Jews and the Crusaders: The Hebrew Chronicles of the First and Second Crusades* (Madison: Univ. of Wis. Press, 1977), p. 26.
- <sup>40</sup> John Wilson in Henri Frankfort (Ed.) *Before Philosophy* (Baltimore: Penguin, 1949), p. 80.
- <sup>41</sup> *Ibid.*, p. 36. This is also Alan Watts' point in *Myth and Ritual in Christianity* (Boston, Beacon Press, 1968), prologue.
- <sup>42</sup> Alan Watts, *op. cit.*, p. 7.
- <sup>43</sup> *Ibid.*, p. 62.
- <sup>44</sup> *Ibid.*, p. 70.
- <sup>45</sup> Oscar Cullman. *The Earliest Christian Confessions* (London: Latterworth Press, 1949), p. 11.
- <sup>46</sup> Zoe Oldenbourg. *Massacre at Montsegur* (New York: Minerva Press, 1968), p. 116.
- <sup>47</sup> Crane Brinton. *A History of Christian Morals* (New York: Harcourt Brace & Co., 1959), p. 150.
- <sup>48</sup> *Ibid.*, p. 161.
- <sup>49</sup> Elaine Pagels. *The Gnostic Gospels* (New York: Random House, 1979), p. xxxvi.
- <sup>50</sup> *Ibid.*, p. 6.
- <sup>51</sup> *Ibid.*, p. 60.
- <sup>52</sup> *Ibid.*, p. 60.
- <sup>53</sup> *Ibid.*, p. 92.
- <sup>54</sup> *Ibid.*, p. 118.
- <sup>55</sup> *Ibid.*, p. 105.
- <sup>56</sup> H. Richard Niebuhr. *Christ and Culture* (New York: Harper, 1956), pp. 39-40.
- <sup>57</sup> Meinhold, *op. cit.*, p. 131.
- <sup>58</sup> *Ibid.*, p. 38.
- <sup>59</sup> *Ibid.*, p. 38.
- <sup>60</sup> Leo Pfeffer. *Church, State and Freedom* (Boston, Beacon Press, 1953), p. 13.
- <sup>61</sup> *Ibid.*, p. 13.
- <sup>62</sup> Durant, *op. cit.*, p. 47.
- <sup>63</sup> Meinhold, *op. cit.*, p. 8.
- <sup>64</sup> *Ibid.*, p. 20.
- <sup>65</sup> Karl Marx, actually "Die Religion . . . ist das Opium des Volkes," from his *Kritik der Hegelschen Rechtsphilosophie*, the introduction.
- <sup>66</sup> Will Durant. *The Reformation* (New York: Simon and Schuster, 1957), p. 390.
- <sup>67</sup> Henry Adams. *Mont-Saint-Michelle and Chartres* (New York: Mentor, 1961), p. 15.
- <sup>68</sup> *Ibid.*, pp. 42-43.
- <sup>69</sup> Mary Daly. *Gyn/Ecology* (Boston: Beacon Press, 1978). For these and other references on witchcraft, I am indebted to Deean Copeland.
- <sup>70</sup> Deean Copeland, "The European Witch Craze of the 15th-17th Centuries," unpublished manuscript, p. 2.
- <sup>71</sup> Daly, *op. cit.*
- <sup>72</sup> As quoted in Url Lanharn's *Origins of Modern Biology* (New York: Columbia University Press, 1968), p. 77.
- <sup>73</sup> Melvin Konner. "She and He," *Science '82*, Vol. 3, No. 7, Sept. 1982, p. 57.



# THE LOSS OF AN ENTIRE WETLAND HABITAT AND ITS WILD BIRD POPULATIONS<sup>1</sup>

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The loss of avian habitats by natural means has been occurring from the time of the origin of birds in the early Jurassic 150,000,000 years ago to the present. Probably never in that long and occasionally violent period did greater losses take place than those caused during the last few centuries by technology in the hands of man.

In recent years we have become acutely aware of endangered bird species. Protective legislation in the form of restrictions on the capture, killing, or interference with critical species have been the main measures employed to reduce further losses. But when the food and cover needed for animal survival is seriously altered, the carrying capacity of the habitat is reduced, and when these habitat attributes are destroyed, the animal population is lost.

Exploitation of avian habitats in the name of progress by industry, agriculture, or recreation is at the root of the endangering process. Wherever man alters land, water, animals or plants to achieve individual or collective advantage, those birds that are obligate to that environment will be in jeopardy.

Loss of avian habitats has been justified on the grounds that the loss was necessary to benefit man. Today after many such habitats are already lost and the welfare of many birds is critical, we attempt to understand and, on occasion, to rectify the situation. One of the key aspects to the understanding is to know what and how much has been lost. Often there are few such data and even

less information on the cause or the motivation for the habitat destruction.

The objective of this report is to record the loss of bird life brought about by the destruction of an aquatic habitat in an agricultural environment.

The location of this aquatic habitat, 3 miles (5 km) north of Sun Prairie, first appears on Ligousky's 1861 *Map of Dane County* (Wisconsin) as Lake Brasee (L. Brasee). It has been variously measured as 164 (65.6 ha), 122 (48.8 ha), and 170 (68 ha) acres, apparently depending on the season of the year when it was measured. It had about 2.3 miles (3.7 km) of shoreline in most years, and was 1,050 m long and 810 m wide at its greatest dimensions (Figure 1). In periods of drought and low watertable, part of the lake was dry and put into crops. I heard unsubstantiated reports that the lake "drained naturally" in some years and then subse-



Fig. 1. Aerial view of Braze Lake prior to drainage. The long axis of the lake is oriented N-S.

<sup>1</sup> This paper was read before the International Ornithological Congress in Moscow, USSR, in August, 1982.

quently over several years gradually returned to its status as a lake. It was also alleged to have been spring fed, but I found no spring flowing into the lake. The main source of water was from ground water and surface drainage. There is no stream in or out of the wetland. Water was lost mainly during the summer, by evapotranspiration. Its maximum depth in June 1950 was about 4½ feet (1.4 m).

The emergent vegetation along the shoreline was sedge (*Eleocharis*, *Scirpus*, *Carex*, and *Cyperus*), cattail (*Typha*), and bullrush (*Juncus*). In the water area, arrowhead (*Sagittaria*), pondweeds (*Potamogeton* sp.), particularly sago pond weed (*P. pectinatus*), Bur reed (*Sparganium* sp.), and Duck weed (*Lemna minor*) were common.

The main landowner petitioned the state ca. 1954 for permission to drain the lake so the land could be used for agriculture. The Wisconsin Department of Natural Resources brought legal action to prevent the drainage. I testified as a wildlife ecologist in support of the state's position that the lake had greater public value as a natural area than as corn-field that would profit only two or three landowners. The court, however, ruled in favor of the landowners, and the lake was drained the following year.

Bird disappearance was almost immediate. Although no species counts were made in the years following drainage, observation indicated that the most water-obligate birds (e.g., black tern, coot, ducks) disappeared first. Some red-winged blackbirds, and even yellowheaded blackbirds returned for at least three years before abandoning the marsh area completely.

One of the important ornithological aspects of Brazee Lake was the largest known colony of yellow-headed blackbirds in southern Wisconsin. These large handsome blackbirds were the primary species in a study of all the marsh birds which I began in 1947. A lake-edge study area of 1.32 ha (Figure 2) was set up on the west side of the lake. This was facilitated by a road that

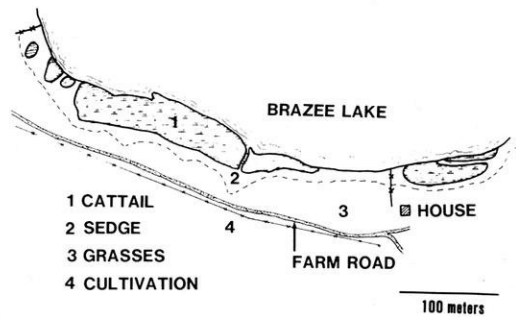


Fig. 2. The wetland study area where the yellow-headed blackbird colony was located.

paralleled the shore of the marsh and by a line of telephone poles leading to a farm house on the far southwest edge of the lake. Numbers were painted high on each telephone pole large enough to be seen from the widest part of the study site. Nests found in the marsh were located by orienting to the numbered poles.

Life-history data, ecology, and behavior data were recorded by a field staff of three persons. All nests were marked and examined twice a week and occasionally more often. Data on the breeding ecology of the marsh birds are not germane to this paper but the five-year nest total for yellow-headed blackbirds was 246.

All other bird nests found in the study area were also recorded during the field work. In all, 646 nests of 15 species were examined (Table 1). This amounts to 127 nests per ha in the year with the largest bird population and 76 per ha in the year of the lowest density, averaging 96 per ha over the 5-year period.

The data in this paper have not been published previously primarily because those of us interested in the lake and its marshy shores had hoped that the cropping scheme would fail, the lake would reclaim its own, and we could initiate periodic studies in this wetland. This has not occurred in spite of several crop failures, because outside financial support from the federal government and nonfarm income allowed the farmers to

TABLE 1. Active nests in the study area.<sup>1</sup>

Species	1947	1948	1949	1950	1951	Total
Yellow-headed Blackbird <i>Xanthocephalus xanthocephalus</i>	56	69	56	39	26	246
Black Tern <i>Chlidonias niger</i>	11	38	56	8	28	141
Coot <i>Fulica americana</i>	25	14	13	19	20	91
Common Gallinule <i>Gallinula chloropus</i>	11	14	7	13	12	57
Ruddy Duck <i>Oxyrua jamaicensis</i>	6	12	3	5	6	32
Pied-billed Grebe <i>Podilymbus podiceps</i>	0	11	2	1	12	26
Red-winged Blackbird <i>Agelaius phoeniceus</i>	5	5	2	1	5	18
Marsh Wren (long-billed) <i>Cistothorus palustris</i>	1	2	0	14	1	18
Least Bittern <i>Ixobrychus exilis</i>	0	3	1	0	2	6
Total	115	168	140	100	112	635

<sup>1</sup> Six other species had less than 6 nests each in the 5-year study.

continue the cropping program. Even in 1982 only part of the lakebed was suitable for corn production. Corn and silence dominate this once sound-filled, dynamic avian environment.

Technology has provided the means, and financial advantage the motive, for man to destroy the environment of wild creatures. Birds are only one, albeit major, example of dwindling habitat in this process we regard as progress.

Public lethargy and court rulings in favor of an individual's right to destroy what was legally his place the integrity of many bird habitats in jeopardy. Although some avian habitats are naturally transient through plant succession and ecological change, the responsibility of the wildlife manager and concerned laymen is to aid and abet factors holding a habitat in a given stage to promote the welfare of the avian species that rely on a static or slowly changing environment. Avian habitats are lost when gross physical change alters the ecological attributes or the plant succession of a bird's habitat.

The most insidious aspect of such loss of avian habitat, in particular wetlands, is that the loss usually represents a financial gain for *someone, somewhere*. The *someone* is often not in need of financial help and may be *somewhere* far from the site of the habitat destruction—out of sight and out of mind. Humanity is loath to accept responsibility for its own environment as well as that for wild creatures. This reluctance is difficult to understand because we in the USA and perhaps elsewhere in the world can recognize and identify the loss but are inept to do anything but record the damage.

In June 1982 the National Wildlife Federation (of USA sportsmen organizations) wrote in a major report:

“It is estimated that we have lost at least 40 percent of the original wetlands in the lower 48 states. Of the approximately 148 million acres of wetlands we have now, we lose more than 300,000 [120,000 ha] each year. Some experts estimate that the loss is as high as 600,000 [240,000] acres each year. In the United States, coastal marshes have been disappearing at a

rate of about one-half percent per year. One million acres of coastal marsh have been lost since 1954. By the year 2000, if the present rate of marsh loss continues, an additional one million acres will have been destroyed.

A look at wetland losses across the country paints a stark and disturbing picture of the fate of wetlands—and equally, the fate of much of our wildlife.”

In the Midwest where this Wisconsin study took place, the situation is even worse. Precise data are not available, and current state law has removed most restraints on drainage. The report continues:

“Marshes along the Great Lakes have decreased 70 percent. These marshes not only provide habitat for fish and wildlife (for example, spawning habitat for northern pike), but they also help to prevent shoreline erosion and minimize the destructive effects of storms.”

Apart from the loss of birds through the loss of their habitats, destruction of wild environments is often irreversible. Lack (*Jour. An. Ecology*, Vol. 34, 1965) makes a case for basic understanding of the biota itself. He states (p. 229):

“There is therefore an urgent need for the conservation of natural habitats because, apart from their beauty, it is only here that some of the fundamental problems of biology can be studied. Partly, but only partly, I therefore think that the popular emphasis in conservation propaganda on rare or threatened species is misplaced. It evidently pleases many people that Pere David's deer *Elaphurus davidianus* survives in zoos, or that two pairs of ospreys *Pandion haliaetus* bred last year in Scotland, but I would cheerfully lose these and other scarce animals altogether if, in return, we could conserve examples of the most important natural habitats with their associated animals; and for the study of higher vertebrates, such as birds, extensive areas are required.”

Fundamentally, Lack was correct in his assessment almost twenty years ago. Although I would not cheerfully accept the demise of any bird species, I too feel that as

biologists we have paid too little attention to the role of lost or degraded habitats in appraising the plight of those birds (and other animals) that are becoming rare or that are truly endangered.

The loss of wetland habitats is easily rationalized because in their natural state they have little commercial value and often impede commercial schemes to achieve financial advantage. Wetlands are easily changed or destroyed by drainage, filling, sometimes by flooding, and more recently by pollution. Agriculture, urbanization, land fills (trash dumps), road systems, and hydro-electric schemes have taken a drastic toll of wetland habitats.

In the United States an Environmental Protection Agency report (1980) estimates that 120,000 ha of wetlands are lost annually. No data are available on the loss of birds by this loss of aquatic habitat. What I report here is a shameful microcosm that focuses on the need to protect all wetlands for the benefit of the wildlife resources and the public amenities associated with natural environments. We have yet to provide the legal and economic mechanisms to protect our wetlands, which recent studies have shown to have immense public value in protecting water quality and ground water recharge, and in reducing flood damage, as well as for wildlife habitat. Some form of compensation to the landowner might deter the drainage rig and plow and thus save many valuable wetlands.

#### ACKNOWLEDGMENTS

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# ASPEN UTILIZATION BY BEAVER (*CASTOR CANADENSIS*) IN NORTHERN WISCONSIN

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## *Abstract*

Johnson, Reed B. 1983. Aspen utilization by beaver (*Castor canadensis*) in northern Wisconsin. A quantitative survey of the feeding relationships of beaver at two ponds showed quaking aspen (*Populus tremuloides*) was the main food. Approximately 44 g/day (dry wt) of aspen inner bark were eaten by each adult beaver. Mixed coniferous-deciduous forest, with ample aspen, birch and willow, existed at both sites. The relationship between tree size cut and the amount of inner bark utilized was also examined. It was found that 1) proportionally more inner bark remained unutilized in larger trees which were cut, 2) generally, trees 3 to 5 in. in diameter were most likely to lodge in other trees when felled and thus remain unutilized, 3) approximately 9 to 12% of the available food from cut aspen was unutilized at each site.

Exploitation of beaver (*Castor canadensis*) was largely responsible for the early exploration of the northern United States and Canada by fur trappers. After near extirpation by overtrapping beaver have recovered well. Today populations have reached such levels that they are considered a nuisance in many areas.

The beaver has a great ecological impact upon the surrounding environment. Damming of streams floods valuable lowland forests, and occasionally, roads. Forest structure and composition near the ponds are altered by the cutting of large numbers of trees. Beaver meadows are formed when dams of abandoned ponds decay, lowering the water levels and allowing marsh vegetation to invade (Kendeigh 1974:84).

Whether one considers beaver a potentially valuable natural resource or a nuisance, it is important to have quantitative knowledge of the animals' food habits. A study was carried out from 14 May to 21 August, 1981, to observe feeding ecology of beaver in northern Wisconsin. Areas surrounding two beaver ponds were surveyed for forest composition, beaver food gathering strategies and food types. Various

relationships between tree size and food utilization were examined in detail.

## STUDY AREAS

The study was conducted on two active ponds in T39N, R4E, Sects 21 and 22, Oneida Co., Wisconsin. Pond 1 was located on a small stream about 1 mi SSE of Squaw Lake. The feeding area at this pond was roughly 300 yds W of the lodge. Pond 2 was located on Stone Creek about 1.5 mi N of Stone Lake. There were two feeding areas located on the west side of the pond about 100 yds S and 250 yds N of the beaver lodge.

## METHODS

The quarter method (W.S. Brooks, pers. comm.) was used to determine the forest composition of feeding areas and surrounding forest at pond 1 and one feeding area at pond 2. The other feeding area at pond 2 was not surveyed for forest composition as it had recently been commercially harvested, so no mature trees existed in this area. Transect lines and sampling points along those lines were approximately 25 yds apart. Live trees and beaver cut stumps were counted only if

at least 3 in. dbh (diameter breast height) or at the height of the cut, respectively.

To determine the total annual quantity of inner bark eaten, height and diameter at cut were measured for all trees that had been cut by beaver within the last two years. Approximate age of the cut was determined by peeling bark from the stump and observing wood appearance. Those stumps more than two years old were not recorded.

Populations of two adult beaver and several young were observed at each pond. Calculations were based upon populations of three adult beaver per pond, the third "adult" allowing for the young which consume approximately the same amount of food annually as a single adult.

To determine the quantity of potential food per tree, a quaking aspen (*Populus tremuloides*) of the average size used by beaver was cut about 12 in. above the ground. From base to branches, 15 in. sections were cut and measured for diameter at both ends. The outer cork was shaved from these sections with a knife and the inner bark (cambium and phloem) was peeled off and stored in labeled plastic bags for later dry weight measurements. Approximately 10 to 15% of the branches were peeled and the inner bark similarly stored. Bark was dried for 48 h at 90°C and weighed immediately.

To determine the quantity of unutilized food per cut tree at each pond, measurements of the length, and diameter at the base and top of the untouched logs were recorded. At each feeding area the number of aspen trees lodging in other trees when cut were counted and their base diameters taken.

#### RESULTS AND DISCUSSION

Rue (1964: 42) stated that every beaver pond has an occupation time limit regulated by food availability. Beaver prefer to feed near water both for safety from predators and for ease in food transport. At both ponds, feeding activity was always within 100 ft of the water. Several strategies have

been developed by beaver to increase ease in procurement of food sources. The water level may be raised by increasing the size of the dam or building alternate dams, thus bringing more food within reach. This process is efficient, but limited by danger of flooding the lodge if the water levels are raised too much. An alternate strategy is the digging of canals to a food source. Both techniques were employed at one of the ponds. The canals measured were about 24 in. wide and 6 in. deep. Water levels were probably higher at the time they were in use, thus increasing their effective depth. At one site, a main canal along the forest edge was approximately 180 yds in length.

Feeding areas at both ponds were in mixed deciduous-coniferous forest, with different species dominating at each. The importance value (IV = sum of relative frequency, relative density and relative dominance), used in comparing the relative importance and influence of the different tree species, indicates that paper birch (*Betula papyrifera*), balsam (*Abies balsamea*) and quaking aspen in that order were the dominant species at pond 1 (Table 1). Spruce (*Picea* sp.), aspen and birch dominated at pond 2 with maple (*Acer* sp.), alder (*Alnus rugosa*), tamarack (*Larix laricina*), and white pine (*Pinus strobus*) present in lesser amounts (Table 1). The difference in species composition at the two ponds is probably due to different environmental conditions or different histories.

Aspens (*Populus* spp.) are the preferred food of beaver (Rue 1964). The proximity of water to the large population of aspen explains beaver presence in these areas. Other foods noted were willow (*Salix* spp.), alder, birch, various ferns, sedges, grasses and aquatic plants. The woody plants mentioned were important not only as food, but were extensively utilized by beaver as construction materials.

The feeding patterns of beaver change seasonally, with preference for woody vegetation in the fall, winter and early spring, and

TABLE 1. Forest Composition of Feeding Areas at Ponds 1 and 2.\*

	N		Frequency (%)		AVG. DBH (in)		Importance Value (IV)	
	Pond 1	Pond 2	1	2	1	2	1	2
Alder ( <i>Alnus rugosa</i> )	0	2	0	20	0	3.3	0	14
Aspen ( <i>Populus tremuloides</i> )	4	9	33	50	7.3	3.5	28	48
Cut Aspen	9	2	31	20	4.2	3.3	38	13
Balsam ( <i>Abies balsamea</i> )	13	1	54	10	9.2	3.1	96	6
Birch ( <i>Betula papyrifera</i> )	24	9	92	70	6.0	6.8	127	67
Maple ( <i>Acer</i> sp.)	0	4	0	30	0	3.2	0	23
Spruce ( <i>Picea</i> sp.)	2	10	15	80	3.7	5.0	12	83
Tamarack ( <i>Larix laricina</i> )	0	2	0	10	0	12.3	0	25
White Pine ( <i>Pinus strobus</i> )	0	1	0	10	0	18.5	0	25
Total	52	40					300	300
		Pond 1		Pond 2				
* Mean Distance (MD)		8.92 ft		11.83 ft				
Mean Area (MA)		81 ft <sup>2</sup>		140 ft <sup>2</sup>				
Total Density (TD)		538 trees/A		311 trees/A				

for herbaceous foods during spring and summer. In Ohio, Svendsen (1980) estimated that non-woody vegetation accounted for 90% of the feeding time during the summer and 40 to 50% in early spring and fall. In Pennsylvania, however, Brenner (in Svendsen 1980) found that only 33% of the vegetation consumed per day in spring and summer months was herbaceous material. I found no information regarding herbaceous feeding by beaver in Wisconsin.

By correlating data on the amount of inner bark per tree (Fig. 1) with diameters and numbers of the cut stumps, I determined that, for both ponds, a single adult beaver ate an average of approximately 44 g (dry wt) of aspen inner bark per day. Aldous (1938) estimated that beaver eat 640-670 g wet wt per day, which is equivalent to 160-220 g dry wt of inner bark per day. My

consumption estimates are probably the more accurate of the two because Aldous's estimates were based on aspen eaten by captive beaver that had no herbaceous vegetation to supplement their diet. Further, Aldous's weights included the cork layer and the wood in twigs and branches under 0.5 in. diameter. The present study excluded the cork layer and the wood of twigs which are of little nutritional value even if consumed.

At both ponds, cut trees were present on which the inner bark was partially or totally unutilized. By measuring the unused portions of cut trees, the weight of unutilized inner bark was estimated. A correlation of stump diameter to unused log length indicated that, as stump diameter increases, so does the length of unutilized log, and thus also the quantity of unutilized inner bark (Fig. 2).

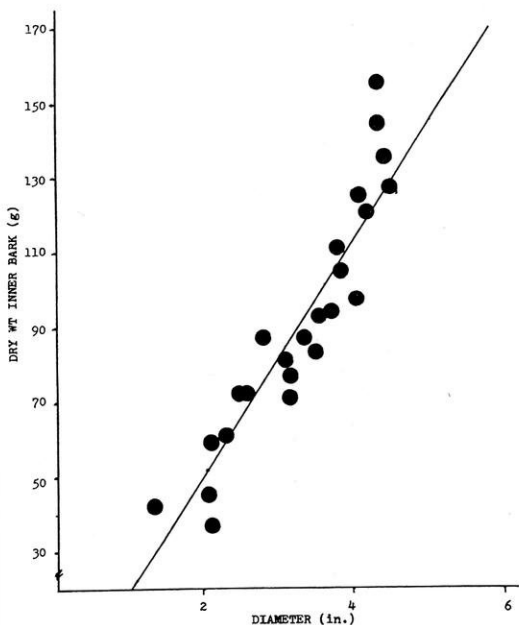


Fig. 1. The amount of phloem per 15 in. section versus the base diameter of the section.

Nixon and Ely (1969) found that in trees under 2 in. dbh less than 1% was wasted. Aldous (1938) estimated that in aspen with a stump diameter (sd) of 1 in. there was 80% utilization and in trees of about 6 in. sd there was 35% utilization. Rue (1964: 109) estimated that the utilization of trees 4 to 6 in. in diameter was approximately 36%. There was a greater percentage of total utilization of the available food in the 1 to 3 in. sd trees, but the quantity of food per tree was small compared with that obtainable from larger trees. However, the latter were only partially utilized. Aldous (1938) found that a 7 in. tree, half utilized, would provide approximately the same amount of food as four 3 in. trees totally utilized. The present study confirms Aldous' estimate.

According to Aldous (1938), beaver prefer the relatively corkless bark of the small branches and limbs to that of the trunk. At both ponds the small branches of trees were generally totally utilized. Because the ratio of crown to trunk increases with trunk diam-

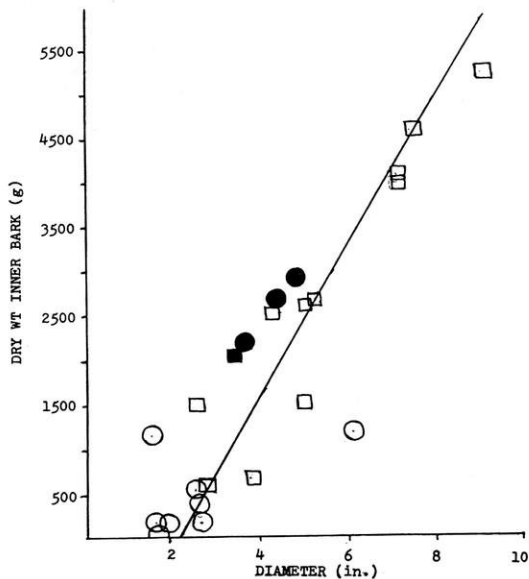


Fig. 2. The amount of unutilized inner bark of various sized log sections (open), and lodged trees (solid) at pond 1 (□) and pond 2 (○).

eter, there is more preferred food available in larger trees even though there is more actual waste. However, larger trees are generally cut only after the small ones are used. Jenkins (1980) noted that beaver cut relatively more small trees as distance from water increased. That pattern was observed in the present study. Aldous (1938) observed that the degree of wastage in large trees is determined both by distance from water and by terrain. I also found relatively more trees were cut in the 1 to 3 in. sd class than in larger classes (Table 2).

Several reasons exist for the preference for, and more complete utilization of, smaller trees. Large trees take proportionately more time and energy to process, whereas small trees can be cut and carried to water after felling. Also, the large tree has a more extensive cork layer which is not utilized by the beaver for food. It would not be energy efficient to strip off the cork to get at the edible bark. Further, beaver prefer to feed in the water and a large tree, even if cut



TABLE 2. The Number and Diameter of Aspen Trees Cut at the Feeding Areas of Ponds 1 and 2 in the Last Two Years.

		Diameter Class (in)						6-7
		0-1	1-2	2-3	3-4	4-5	5-6	
Number of Trees	Pond 1	2	30	24	6	3	1	0
	Pond 2	1	23	26	5	3	1	2

\* Mean diameter cut at Pond 1 = 2.4 in  
Pond 2 = 2.5 in

into sections, is very cumbersome for a beaver to transport to the water.

Beaver do not plan the direction a tree falls when cut. Occasionally, a falling tree will become lodged in other trees and thus, suspended out of the beavers' reach, will remain unutilized. Compared to the number of trees cut, relatively few trees become permanently lodged. At both ponds, all lodged trees had a diameter of between 3 and 5 in. (Fig. 2). Apparently, trees under 3 in. sd were light enough in weight that the beaver could dislodge them, while trees over 5 in. sd were heavy enough to crash through most obstructions. Trees in the 3 to 5 in. class, however, became lodged and could not be pulled down. Generally the trees located near water lean toward the water or have more foliage in that direction because of reduced canopy and more sunlight so that when cut, the tree falls toward the water. This fact may influence the inverse relationship noted above of tree size to distance from water.

The total percentage of unutilized inner bark at both ponds, including lodged trees, was approximately 9-12% of the food available from cut aspen per year. This indicates that the beaver uses its food source efficiently. On the other hand, Aldous (1938) calculated that beaver waste 64% of the food available from cut aspen. It should be noted however, that his data involved a greater number of large trees than were

found in the present study. Therefore, the relative efficiency of resource utilization probably varies from site to site, decreasing as forests mature and/or older trees become more prevalent.

#### ACKNOWLEDGMENTS

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# THE REVEGETATION OF A SMALL YAHARA VALLEY PRAIRIE FEN

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## *Abstract*

Following sewer construction in winter, 1971-72, the revegetation of exposed dredged peat was compared with an undisturbed portion of a 3-ha prairie fen near the Yahara River in Cherokee Marsh City Park, Madison, Wisconsin. In the absence of alien species and hydrologic alteration, and with prompt manual removal of the initial one-time massive invasion of willows and cottonwoods, full plant cover was restored in two seasons, and 49 of the 71 enduring vascular plant species had returned at reasonable to full frequency by 1979. Presumably germinating mostly in the disturbance year, the three behavioral groups were "true pioneers," "climax opportunists," and "climax dominants or associates." In the undisturbed portion, some climax species exhibited rotation in apparent dominance, varying in degree of vigor and flowering from year to year, possibly with influence from weather, animals and fire. The pioneering woody species are seen as local or temporary dominants in an otherwise sedge-grass-dominated system maintained primarily by consistent groundwater input.

## INTRODUCTION

Defined as calcareous peatlands, fens vary floristically with climate. In eastern North America, fens in the cool humid forest regions have trees—especially white cedar (*Thuja occidentalis*) (Boelter & Verry 1977; Frederick 1974; Muenscher 1946). South of Curtis' (1959) "tension zone," virgin Wisconsin fens—even today—generally lack trees and dense shrub cover. Curtis ascribed this difference chiefly to prevalent presettlement prairie fires and early post-settlement hay-mowing, but he also mentions agricultural drainage as a factor favoring woody invasions. Vogl (1969), demonstrating woody and charcoal layers in sedge peat in S.E. Wisconsin, postulated that regional agricultural drainage after the 1930's prevented high water from returning, following drouth, peat fires, and livestock grazing impact, to account for the prevalent woody species' dominance in many of these peatlands reported in the 1950's by White (1965). A possible reason for the former lack

of woody dominance in the moist undisturbed fens in the relatively dry prairie and oak grove regions is the ability of dense grasses and sedges (no doubt stimulated by frequent fires) to out-compete all invading seedlings, whereas in the humid north and east it is the wet (unoccupied and not inundated) mossy logs and stumps on which seedlings may quickly rebuild the forest after fire or windthrow. Preliminary studies by Kogler (1979) do not refute the hypothesis that red osier dogwood (*Cornus stolonifera*), typical of almost all woody species of southern Wisconsin, can be controlled in peatlands by high water tables which favor competitive sedge dominance and lower soil oxygen and nutrient availability. Sytsma and Phippen (1982) related patterns of fen succession to carr and forest to a complex of water availability and human impacts, with a persistent trend toward diversity rather than successional convergence, thus confirming the conclusion of Heinselman (1970). The importance of this habitat diversity to faunal as

well as floral richness is seen in the drastic changes in the avifauna of Wingra Fen recorded between 1912 and 1968 as woody plant invasion progressed (Zimmerman, 1983).

Associated with porous sloping substrates—usually sandy or gravelly ice-contact deposits and glacial lake shores—the fens of southern Wisconsin and adjacent states are classified as groundwater slope wetlands by Novitzki (1982). They derive their steady

flow of water, rich in calcium and magnesium bicarbonates and sulfates (Curtis 1959), from permeable glacial debris containing dolomites such as that spread southward in eastern Wisconsin by the Green Bay and Lake Michigan Lobes of the Wisconsin Ice Sheet (Martin 1936; Reed 1983). Some of the water may also come from underlying porous bedrock such as the Cambrian sandstones that supply many of the Yahara Valley springs and wetlands (figure 1). The

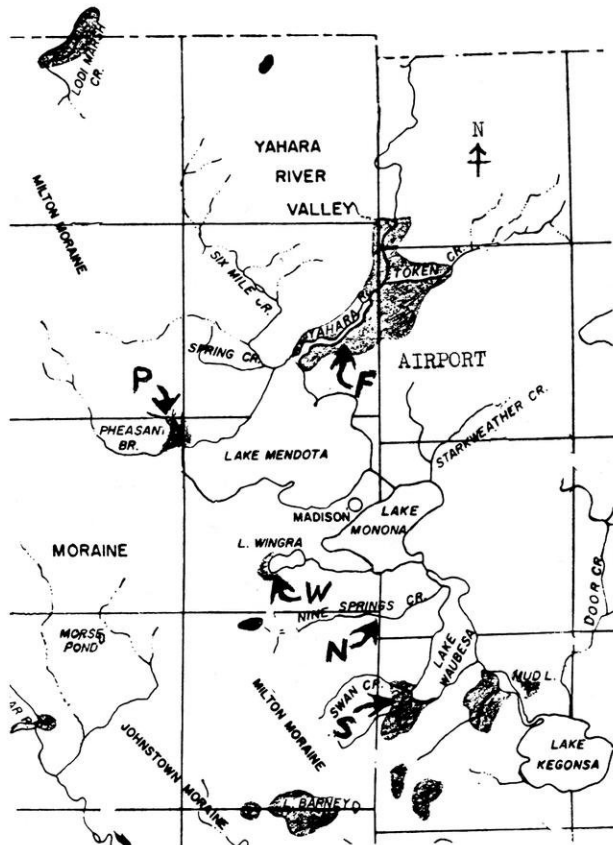


Fig. 1. Yahara Valley, Central Dane County, Wisconsin (after Bedford et al. 1974), showing locations of some of the prairie fens.

LEGEND: F = Wheeler-School Roads Fen (within shaded area indicating the extent of the Cherokee Marsh Fen Complex)

W = Wingra Fen in the UW-Madison Arboretum on Lake Wingra

S = Fen hump in the South Waubesa Wetlands Complex

N = Nine Springs Creek Fens

P = Fen in Pheasant Branch Wetland Complex

SCALE: 1:300,000 (1" = 4.5 miles; 1 cm = 3 km)

Each square is one township (6 mi on a side)

uninterrupted artesian waterlogging assures minerotrophic peat buildup, despite some humification, sometimes 1-2 m above the surrounding terrain (Moran 1981; Kratz and Winkler 1982). The steady upward discharge of water under pressure also assures in summer that the peat remains cooler than the surrounding soil and air, and that the dissolved salts accumulate. In addition to evaporation and mineral incorporation into incompletely decayed plant matter, the upward gradient of increasing temperature and decreasing pressure may enhance the transport and deposition of calcium (Reed 1983).

The result is a substrate suitable only for an unusual assortment of plants adapted for the triple root stress of low oxygen avail-

ability, low temperatures, and skewed nutrition (Van der Valk 1977). Our fen flora includes certain disjunct wetland species of northern climates (*Scirpus cespitosus*), salt marshes (*Triglochin maritima*), wet limestone ledges (*Gentiana procera*), and even Sphagnum bogs (*Sarracenia purpurea*) (Moran 1981; Mandossian 1965). In Table I, the species are keyed to their affiliations. "Calcophilous" plants of fens, characterizing high-lime substrates, might better be called calcicoles, since they may be tolerant of a low availability of, say, phosphorus, rather than needful of a high level of Ca or Mg. Where surface peat isolation from groundwater, and prolonged leaching by pluvial climate precipitation, produce a

TABLE 1. Prairie Fen plants observed in the 5-ha Wheeler-School Roads Yahara Fen in the years 1972-79. (For starred species see text.)

Figures in the 5 columns are the % frequency in 1-m<sup>2</sup> quadrats; x = present in the zone but not in any quadrat; 0 = not observed in the zone.

Floristic affiliations: G = prairie grassland. W = general wetland. B = bog. C = (wet) calcicole.

DZ = Disturbed zone = 10m × 200m strip of peat spoils 1-20 cm thick, deposited in winter, 1971-72,

UZ = Undisturbed zone = similar-sized adjacent strip of virgin fen.

COLUMN	1	2	3	4	5
ZONE	DZ	DZ	DZ	UZ	UZ
YEAR	1972	1976	1979	1976	1979
# QUADRATS	8	5	16	10	16

Group A: Competition-tolerant perennial (cespitose and/or clonal) "climax herbs—dominants & associates" (symbol T in summary).

Species <sup>1</sup>	English Name	1	2	3	4	5
* <i>Andropogon gerardi</i> —G	Tall bluestem grass	12	20	24	80	84
* <i>Carex sterilis</i> —C	Small tussock sedge	36	20	60	80	90
<i>Lysimachia quadriflora</i> —G	Prairie loosestrife	12	60	72	90	90
<i>Muhlenbergia glomerata</i> , and <i>M. mexicana</i> —C	Fen muhlenbergia and "Anthill grass"	x	20	42	80	84
<i>Viola cucullata</i> —W	Marsh blue violet	48	60	48	70	54
<i>Cladium mariscoides</i> —C	Twig rush sedge	0	0	6	20	42
** <i>Carex stricta</i> —W	Tussock sedge	12	80	54	100	30
<i>Solidago uliginosa</i> —B	Bog goldenrod	0	40	0	80	30
** <i>Carex lasiocarpa</i> —B	Wiregrass sedge	0	0	36	10	24
** <i>Carex aquatilis</i> —C	Water sedge	x	0	12	40	12
<i>Valeriana ciliata</i> ( <i>edulis</i> )—G	Valerian	0	0	0	x	12
<i>Carex leptalea</i> —C	Scaly sedge	0	0	0	0	12
<i>Spiranthes cernua</i> —G	Ladies' tress orchid	0	0	0	x	12
<i>Carex prairea</i> —C	Sedge	0	0	0	40	6
<i>Hypoxis hirsuta</i> —G	Yellow star grass	0	0	0	x	0

*Group B: Competition-intolerant herbs.*

O = "climax opportunists" persisting in climax fen.

P = "true pioneers" requiring major disturbance.

LIFE FORM: A = annual or biennial.

S = caespitose (short-lived?) perennial.

R = rhizomatous clonal perennial.

<i>Species</i> <sup>1</sup>				<i>English Name</i>	1	2	3	4	5
<i>Asclepias incarnata</i> *	W	O	S	Marsh milkweed	x	60	42	30	24
<i>Aster juncifolmis</i>	C	O	R	Rush-leaf aster	12	0	24	50	24
<i>Aster lucidulus</i> *	W	O	R	Lavender marsh aster	24	80	78	10	6
<i>Aster novae-angliae</i> *	W	O	S	New England aster	x	0	x	10	6
<i>Aster simplex</i> *	W	O	R	White marsh aster	x	0	18	10	0
<i>Aster umbellatus</i>	C	O	R	Flat-top white aster	0	x	0	x	x
<i>Bidens cernua</i>	W	P	A	Nodding bur marigold	x	x	0	0	0
<i>Bidens coronata</i> *	W	O	A	Slender bur marigold	x	20	6	x	x
<i>Bromus kalmii</i> *	C	O	S	Kalm's brome grass	x	20	12	50	12
<i>Calamagrostis canadensis</i>	W	P	S	Bluejoint grass	x	0	6	x	0
<i>Campanula aparinoides</i>	W	O	S	Bedstraw bellflower	x	0	48	30	24
<i>Cardamine bulbosa</i>	W	O	S	Marsh cardamine	0	0	0	x	0
<i>Carex hystricina</i>	C	P	S	Hedge-hog sedge	x	20	0	x	0
<i>Carex sartwellii</i>	W	O	R	Sartwell's sedge	12	0	6	0	x
<i>Carex tenera, bebbii</i>	W	O	S	Slender and Bebb's sedges	x	0	0	0	6
<i>Carex tetanica</i>	W	O	R	Sedge	0	0	12	30	x
<i>Carex</i> spp.				Unidentified Sedges	48	—	—	—	—
<i>Cirsium muticum</i> *	C	O	A	Marsh thistle	x	20	42	50	18
<i>Cyperus erythrorhizos</i>	W	P	A	Redroot galingale	x	x	x	0	0
<i>Cyperus rivularis</i>	W	P	A	Low galingale	x	0	6	0	0
<i>Drosera rotundifolia</i>	B	O	S	Roundleaf sundew	0	0	0	10	0
<i>Dryopteris thelypteris</i>	W	O	R	Marsh fern	12	0	24	60	24
<i>Eleocharis acicularis</i>	W	P	R	Tiny spike rush	0	40	0	0	0
<i>Eleocharis elliptica</i>	W	O	R	Peatland spikerush	12	0	24	0	24
<i>Eleocharis obtusa</i>	W	P	A	Annual spike rush	36	0	0	0	0
<i>Epilobium coloratum</i>	W	P	S	Willow-herb	12	x	0	0	0
<i>Equisetum arvense</i>	W	O	R	Horse-tail	12	40	72	0	0
<i>Erigeron philadelphicus</i>	W	O	A	Philadelphia fleabane	x	20	x	0	6
<i>Eriophorum angustifolium</i>	B	O	R	Cotton-grass	0	0	0	x	12
<i>Eupatorium maculatum</i> *	W	O	S	Joe-pye-weed	24	20	6	80	24
<i>Eupatorium perfoliatum</i> *	W	O	S	Bone-set	72	60	36	20	x
<i>Galium labradoricum</i>	C	O	S	Boreal bedstraw	0	0	0	60	0
<i>Gentiana procera</i> *	C	O	A	Lesser fringed gentian	x	x	x	x	x
<i>Gerardia paupercula</i>	C	O	A	Pink gerardia	x	60	6	x	0
<i>Glyceria striata</i> *	W	O	S	Manna grass	84	80	78	x	12
<i>Hierochloa odorata</i>	C	O	R	Sweet grass	12	x	x	0	0
<i>Hypericum virginicum</i> ( <i>Triadenum fraseri</i> )	B	O	S	Bog St. John's Wort	12	20	6	10	0
<i>Impatiens capensis</i> (biflora)	W	P	A	Orange jewelweed	0	20	0	0	0
<i>Iris virginica</i> (shrevei)	W	P	R	Blue flag	0	0	6	10	0
<i>Juncus dudleyi</i>	W	O	S	Low-prairie rush	x	40	12	0	6
<i>Juncus brevicaudatus</i>	C	O	A	Fen rush	0	x	0	0	6
<i>Juncus torreyi</i>	C	P	A	Torrey's rush	x	60	18	0	0
<i>Lathyrus palustris</i>	W	O	R	Marsh pea	0	0	0	20	0
<i>Leersia oryzoides</i>	W	P	A	Rice cutgrass	0	60	0	0	0
<i>Lobelia kalmii</i>	C	O	A	Kalm's Lobelia	36	60	6	10	0
<i>Lobelia siphilitica</i>	C	P	S	Great blue Lobelia	0	x	0	0	0
<i>Lycopus americanus</i>	W	O	R	Water horehound	72	100	36	40	12
<i>Lycopus uniflorus</i>	W	O	R	Water horehound		60	60	70	30

Species <sup>1</sup>			English Name	1	2	3	4	5	
Oxypolis rigidior	G	O	A	Cow-bane	0	0	0	0	6
Panicum flexile	C	P	A	Fen panic grass	0	0	12	0	0
Parnassia glauca*	C	O	S	Grass of Parnassus	0	0	18	90	36
Pedicularis lanceolata*	C	O	S	Lousewort	x	20	48	0	x
Potentilla palustris	B	O	R	Bog cinquefoil	0	0	0	x	0
Pycnanthemum virginicum	G	O	S	Mountain mint	12	0	0	0	0
Rhynchospora capillacea	C	P	A	Fen beak-rush	0	20	0	0	0
Rumex orbiculatus (britannicus)	W	P	A	Marsh dock	12	0	0	x	0
Scirpus atrovirens	W	P	S	Black-green bulrush	x	20	0	0	0
Scirpus validus	W	P	R	Roundstem bulrush	48	40	60	20	12
Scutellaria galericulata	W	O	R	Skullcap	x	20	0	0	0
Solidago gigantea*	W	O	R	Smooth goldenrod	48	20	90	30	30
Solidago riddellii*	C	O	S	Riddell's goldenrod	12	40	90	40	30
Spartina pectinata	G	O	R	Cordgrass	0	0	0	x	0
Sphenopholis intermedia	C	O	S	Wedge grass	12	60	0	0	0
Thalictrum dasycarpum	W	O	S	Tall meadowrue	0	0	0	10	6
Triglochin maritima	C	O	R	Arrowgrass	0	0	0	x	x
Typha (mostly latifolia)	W	P	R	Cattail	24	60	84	0	6
Utricularia intermedia	C	O	R	Small bladderwort	0	0	0	x	0
Verbena hastata	W	O	S	Marsh Vervain	12	0	0	x	0
Moss (Amblystegium sp.?)	W	O	R	Marsh Moss	x	NA	6	NA	42

Group C: Woody species enduring wet peat (symbol Y in summary). (Most of the invading willows and cottonwoods were manually removed from the disturbed zone by the end of 1973.) The dogwood in the disturbed zone consisted of 6 mature bushes until 1979, when numerous 1-4-year-olds appeared.

Species <sup>1</sup>			English Name	1	2	3	4	5	
Betula pumila	T	O	S	Bog birch	0	0	0	10	24
Cornus stolonifera	W	O	R	Red osier dogwood	0	40	90	50	48
Populus deltoides	W	P	S	Cottonwood	96	x	0	0	0
Ribes americanum	W	O	S	Black currant	0	0	6	0	0
Rubus spp.	W	O	R	Raspberries	x	0	0	0	0
Salix bebbiana	W	O	S	Bebb's willow	x	20	24	10	12
Salix candida	T	O	S	Sage willow	0	0	6	60	36
Salix discolor	W	O	S	Big pussy willow	x	0	24	0	6
Salix interior	W	P	R	Sandbar willow	x	20	30	0	0
Salix nigra	W	P	S	Black willow	x	x	0	0	0
Salix petiolaris	W	O	S	Red and green willow	x	20	42	20	42
Salix spp.				Unidentified willows	84	x	—	—	—
Viburnum trilobum (opulus?)	W	O	S	Highbush cranberry	0	0	6	0	0

SPECIES SUMMARY <sup>2</sup>	BEHAVIOR T O P	AFFILIATION G W C B	LIFE FORM A S R Y	TOTAL IN FEN	REASONABLY RESTORED
Group A					
Climax Herbs	16 — —	5 2 7 2	— 11 5 —	16	10 of 16 T's
Group B					
Intol. Herbs	— 48 19	3 38 22 4	18 25 24 —	67	35 of 48 O's
Group C					
Woody Spp.	2 7 3		— 9 3 12	12	4 of 7 O's
TOTALS	18 55 22	8 40 29 6	18 45 32 12	95	49 of 71 T+O

<sup>1</sup> Scientific names after Fernald (1950).

<sup>2</sup> See text for discussion of additional upland alien invaders mostly considered temporary.

“poor fen,” additional bog species may characterize the fen, as noted by Schwintzer (1978) for northern Michigan. Our most characteristic “poor fen” species is *Carex*

*lasiocarpa*, whose floating mats may support either fen or bog plants, or mixtures, according to local water chemistry. Fen plants are not tolerant of prolonged, or even inter-

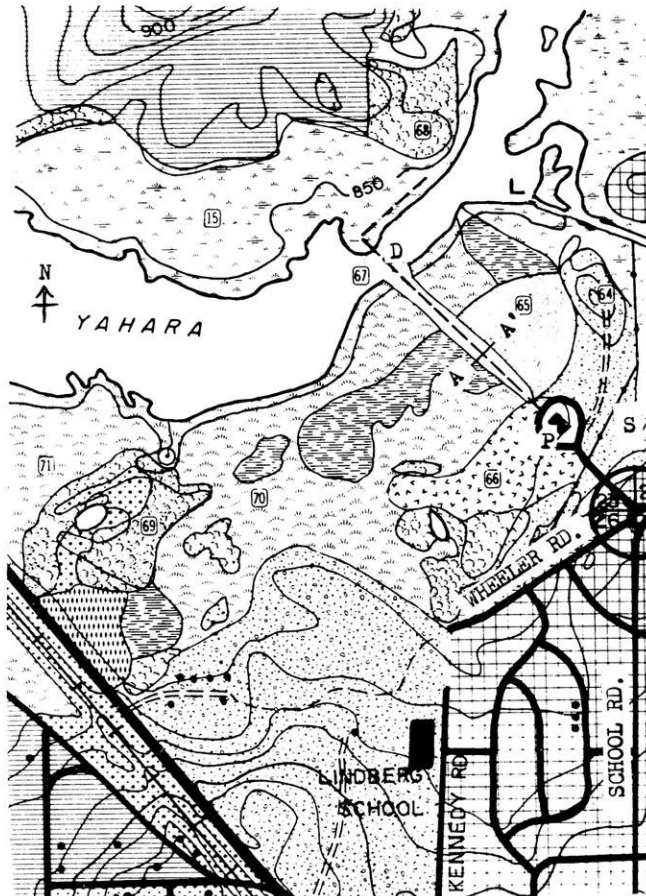


Fig. 2. Location of Wheeler-School Roads Fen (adapted from Bedford et al. 1974) in the SE 1/4 of Sec. 23, T 8 N, R 9 E, Dane County, Wisconsin, in the City of Madison and Town of Westport.

LEGEND:

- 64 Sand hill
- 65 Fen
- 66 Sand and gravel pit
- 67 Yahara River at site of sewer crossing (dashed line)
- 68-69 Oak knolls
- 70-1 and 15 Diverse natural sedge meadows, fens, low prairies and floating peat mats, with occasional islands of shrubs and aspens
- 73 wet carrs of willow, dogwood, and alder adjoining fens
- L = outlet of large drainage ditch into Yahara River
- D = outlet of level ditch over buried sewer pipe
- P = sewer pump lift station
- S = small drainage ditch

SCALE: 1:12,000 (1" = 1000'; 1 cm = 120 m)

mittent, inundation; Moran notes *Carex stricta* tussocks instead of fen species in an Illinois fen located on a river floodplain.

In the prairie and oak grove region, two extremes in a continuum of fen types may be recognized (Moran 1981; Reed 1983): the *calcareous fen* or marl flat, dominated by extreme calcicoles like *Eleocharis rostellata*, *Rhynchospora capillacea*, and *Potentilla fruticosa*, and the *prairie fen*, with typical wet prairie plants like *Andropogon* spp. along with some of the smaller fen calcicoles like *Carex sterilis* and *Lobelia kalmii*. The marl flats are associated with a rapid groundwater discharge and/or very high lime content; their marl deposit is probably the combined result of direct solute precipitation and the growth of diatoms, bluegreen algae, *Chara*, and molluscs. The prairie fens, in contrast, form deep peat layers (often over a layer of marl), to a depth of 1-3 m, largely as a result of root accumulation, although the organic matter is not incorporated into the upper mineral soil as is the case in true wet to dry prairies. Curtis (1959), Van der Valk (1975), and Kohring (1982) have demonstrated the "hybrid" or, rather, spectral or zonal nature of fens, in which floristic composition varies locally with the rate of groundwater flow, such as around a "discharge window," where varying degrees of waterlogging, lime accumulation, and peat formation depend on lateral distance from the window. The habitat permanence of steady flow combined with the high diversity of local conditions helps explain the puzzling richness of fen floras, which have evidently sustained relict and specialized species through climatic changes by excluding competition from widespread species which require more "average" conditions under a given climate. A further part of the explanation lies in the mechanisms of competition and renewal among populations of associated fen species. The temporary disturbance of the natural fen investigated here provided an opportunity to explore these dynamics, which have import for the man-

agement of rare and endangered species, as well as for wetland restoration.

The purpose of this study was to see if a disturbed fen could restore itself, and to determine useful management strategies applicable to this type of disturbance, which was devegetation due to displacement of surface peat. The undisturbed portion of the fen would serve as a "control" or benchmark area.

#### SITE DESCRIPTION AND METHODS

A series of accidents paved the way for this opportunity. Glacial dams impounded Madison's five lakes in the spring-fed Yahara Valley (figure 1). In 1912, the Tenney park lock and dam in Madison raised the upstream water-level of the Yahara River north of Lake Mendota, preventing agricultural and urban drainage ditches (L and S) from lowering the watertable in a 3-ha hillside fen (#65) in Cherokee Marsh near Wheeler and School Roads (figure 2). From comparative observations of recently farmed fens in the area, this one appears to have had little or no human impact at least as far back as 1912; mowing and livestock grazing could have occurred before that if it was not too wet then. The vascular flora of this fen, described in Bedford et al (1974), and presented in Table I (Groups A, B, C), is similar to that of the six fens studied by Curtis (1959) near Madison, Wisconsin, and the ten prairie fens studied by Moran (1981) in northeastern Illinois. Of 37 "modal" species (those having their highest % presence in fens) and of 43 species with 33% or higher presence, in Curtis' fens, 24 and 38 species, respectively, occur in this fen. All of Moran's 36 most prevalent species (rated by presence and frequency in combination) occur in at least some Wisconsin fens, and 26 of them are found in this Cherokee fen.

Although Cherokee is one of the Madison Park System's "Conservation Parks", plans to avoid sensitive areas like the fen when routing the Waunakee-DeForest sanitary



sewer interceptor were not implemented because a map was misdelivered. Following construction of the sewer, the segregated sand and peat were carefully replaced after being piled overwinter in 1971-72; but not quite all the peat could be scraped off the fen (figure 3). An irregular layer of raw fen peat 1-20 cm thick suffocated most of the vegetation on a strip 10 m wide and 200 m long, paralleling the sewer on its north side. That strip is herein referred to as the disturbed zone (DZ). When asked in April, 1972, by a seedsman for advice on what to plant to stabilize exposed peat, I asked to see the site. Field inspection indicated that the water table had not been altered, and that diverse native fen vegetation existed in the adjacent undisturbed zone of the fen (UZ). Since the usual recommended wetland cover, an Eurasian strain of reed canary grass (*Phalaris arundinacea*), can remain as a competitive monotype in both wet and drained fens, I

obtained the cooperation of the Madison Metropolitan Sewerage District in allowing natural revegetation to occur.

Within one season, native fen plants plus a variety of temporary upland weeds attained 30% cover by visual estimate. No surface, wind or water erosion was observed. However, the peat replaced over the sewer pipe was so fluid that it flowed westward out into the river, leaving a level ditch (D in figure 2) containing shallow water connected to the river, allowing entry of fish which attracted angling adults and youth for eight years. By the time the high water of August, 1981, caused a peat mat to float downstream and lodge at the ditch mouth and close it off, a well-worn path had been made in the DZ parallel to the ditch. This path demonstrated the importance of devegetating disturbances to the perpetuation of truly pioneer herbaceous but not woody species. Although the fresh fen peat spoils had dried and become

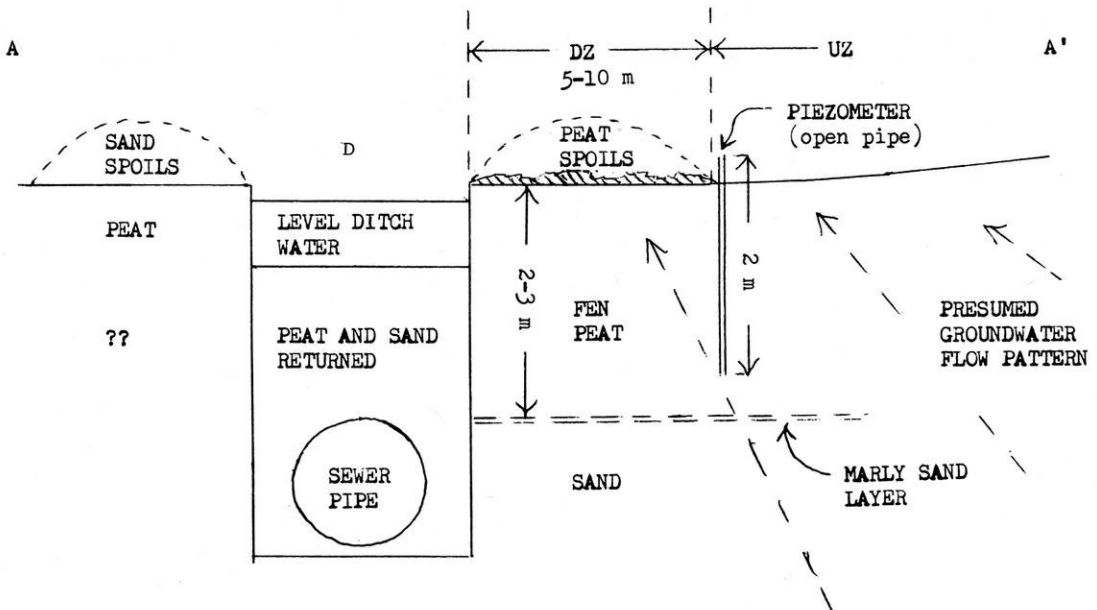


Fig. 3. Sewer Construction Impact: Transect A-A' of Figure 2 in Vertical Section Looking Toward River (vertical scale exaggerated),

DZ = Zone of Peat Spoils incompletely scraped off

UZ = Undisturbed Fen

D = Level Ditch

encrusted with salts during May, 1972, the upwelling artesian water had wetted the surface again by late summer, and pools of surface water remained in the spoils' irregularities through the following ten years. During even the dry summers of 1976-77, the water level in the piezometer (figure 3) remained near the peat surface, in contrast to the level in the impacted Wingra Fen in the University of Wisconsin Arboretum (figure 1) which dropped below the bottom of the pipe and whose peat developed large cracks (personal observation).

Observations were made at least once each summer in 1972 through 1982. The final accident was the fortuitous availability of summer ecology classes for doing vegetation sampling and manual labor. Although some data were lost and some were not reliable enough to use, one set of frequency data from eight 1-m<sup>2</sup> randomly placed quadrats was obtained in the DZ in August, 1972, and sets of five and ten quadrats in the DZ and UZ respectively were obtained in July, 1976. I personally sampled both the DZ and UZ again in September, 1979, using 16 quadrats each (Table I). Identification of immature and vegetative plants was accomplished by comparing mature species in the UZ. The frequency figures should be taken only as indicators of trends, for the uneven terrain and small sample could cause a large sampling error. The line intercept used by Reed (1983) is probably a more reliable as well as quicker procedure.

The shrub cover in the UZ was 50% in 1976, based on 100 m of line intercept; it was mostly red osier. Shrubs were lacking in the DZ, either because of trampling by machinery and burial, or possibly because they were scarce there to start with. The DZ alone suffered a one-time invasion in 1972 of numerous seedling woody species—the arboreal cottonwoods (*Populus deltoides*) and willows (mostly *Salix nigra*), the clonal *Salix interior*, and the cespitose *Salix discolor*, *S. petiolaris*, and *S. bebbiana*. It was assumed that this dense invasion (more than one stem

per m<sup>2</sup>) might have usurped the DZ for decades, since similar invasions have persisted around lagoons dug in 1936 and 1944 in the University of Wisconsin Arboretum (no doubt there aided by peat-drying due to spoils piling, water table lowering, and enhanced evapotranspiration by the woody species). Therefore, it was decided to remove them from the DZ. They were pulled up by hand, while it was still possible, in 1972 and 1973, when they were still small (20-200 cm tall). The widely scattered mature shrubby cespitose *Salix* and *Betula* species were allowed to remain in the UZ where they were not spreading. Several spring fires that swept the fen, including the latest (and only intentional) one in 1982, appeared to have little effect on any shrubs, since they always regained full size in one or two seasons. The seed source for the cottonwoods and tree willows was the ditch berm (L) 300 m to the north (figure 2). This fen was, uniquely, almost entirely free of seed sources of alien *Phalaris*, *Rhamnus*, and *Lonicera* species within a radius of 300 m beyond the fen.

#### RESULTS AND DISCUSSION

Table I lists all the vascular plant species found in the UZ and DZ of the 3-ha Wheeler Road-School Road Sector of the Cherokee Marsh Fens, except for the mostly short-lived native and alien upland crop weeds, which were abundant in 1972 in the DZ. These included *Agrostis alba*, *Aster pilosus*, *Barbarea vulgaris*, *Chenopodium* sp., *Cirsium arvense*, *Erigeron strigosus*, *Fragaria virginiana*, *Juncus tenuis*, *Lactuca* sp., *Lepidium* sp., *Oenothera biennis*, *Panicum* sp., *Phalaris arundinacea*, *Poa pratensis*, *Polygonum* sp., *Solidago altissima*, and *Taraxacum officinale*. Except for occasional small clumps of *Agrostis* and *Phalaris*, these species ceased to dominate the DZ by 1973 and had nearly disappeared by 1979, as had occasional ephemeral seedlings of *Populus tremuloides*, *Carya ovata*, *Ulmus americana*, *Acer saccharinum*, and *A. negundo*. After 1973 the ground was fully covered by

plants as the fen species rapidly spread and displaced the agricultural weeds without human intervention.

Group A of Table I comprises perennial herbaceous species believed to be tolerant of intense plant competition. They appear to be long-lived, persistent, and often slow-growing. The five starred species account for most of the cover, thus qualifying as "climax dominants." The others are "climax associates," likewise consistently well distributed and periodically very conspicuous in the UZ, and in similar undisturbed prairie fens in southern Wisconsin. Hence, they are all here considered to be species of the "climax" phase, defined as stable, given unchanging hydrologic conditions. In the recent dynamic allogenic "Gleasonian" model of wetlands (Van der Valk 1982), there is no "Clementsian" mesic climatic climax. The term climax as used here refers to the presumed most stable and enduring sedge-grass-dominated fen phase among the endless cycling between dry and wet phases characterizing all wetlands (Zimmerman 1982) and between open (disturbed or devegetated) and closed (fully vegetated) habitats (the "internal succession" of Curtis, 1959).

The double-starred species of Group A and the *Cladium* seldom flowered under undisturbed (crowded) conditions in the UZ; sometimes they flowered at the edge of water, or occasionally with fire or local animal or frost disturbances, in other fens. The "tussock sedge", *Carex stricta* (possibly including hybrids with *Carex aquatilis*), does not produce tussocks in the raised calcereous prairie fens of Wisconsin. *Carex sterilis*, however, always produces distinct small, dense, raised tussocks (with over 100 shoots/year) in the Yahara Valley Fens and some others, whereas it is reported by Moran not to do so in the northeastern Illinois prairie fens he studied. *Carex prairea*—locally dominant—forms raised tussocks as large as those of *Carex stricta*. Several species appeared to exhibit striking year-to-

year variation in dominance as measured by vigor and heavy flowering; but unfortunately quantitative data were not obtained. In dry summers like 1976-77, *Andropogon gerardi* grew tall and tended to flower abundantly throughout the UZ. It also did so after fire, such as in 1982, despite waterlogging caused by abundant groundwater recharge and discharge. In the wettest year (1974), *Cladium* dominated several large areas with heavy flowering, whereas it was almost impossible to find in other years. *Carex sterilis* always flowered well and was easy to find through June; but it can be obscured in late summer in high *Andropogon* years. The flowering *Andropogons* were always all *A. gerardi*, whereas Moran found *A. (Schizachyrium) scoparius* to be nearly as important as a co-dominant. The latter was found to be the sole dominant in one small fen-like wet prairie in Jefferson County, Wisconsin (personal observation, 1982). Some of the vegetative shoots seen in the UZ were very flat but they did not form tussocks as is usual in *A. scoparius* in both wet and dry sites.

The colonization pattern of the species of Group A in the DZ is in general accord with expectations for climax vegetation: they require time. Even as late as 1979 (column 3), most of them failed to attain full frequency. The absence of the last five species, and of recognizable *Muhlenbergia glomerata*, in the DZ cannot be explained at present. *Muhlenbergia mexicana* commonly colonizes ant hills, which might qualify it as competition-intolerant (Group B); but it is widely prevalent in dense cover along with *M. glomerata*, although it sometimes is inconspicuous even in autumn. The other species may have needed a coincidence of dispersal and special weather conditions not experienced by 1982 in order to colonize the DZ. Possibly the *Spiranthes*, which has been known to invade open peat or moist sand, requires time for a specific fungal development. A solitary plant of *Valeriana* discovered in the DZ in 1982 might have been

from a buried root rather than a windblown seed. The re-invading species evidently started mostly or wholly from seeds brought into or lying dormant in the peat, and grew soon after the disturbance ended (1972 and possibly 1973), since they were seen as numerous small plants in those summers, although the possibility of a few coming from buried roots cannot be ruled out. It is possible that the abundance of *Viola* in August, 1972, came from new (1972) ant-dispersed seeds finding the habitat still very open and thus highly favorable, in addition to some buried seeds and plants, whereas the slow increase in *Andropogon* suggests a gradual seeding-in (by wind) in combination with a slow maturation rate. The high values in 1979 for *Carex stricta* and *C. aquatilis* in the DZ, along with a conspicuous abundance of *Typha latifolia* and *Scirpus validus*, may indicate "pioneering" advantage. (Possibly, too, these four semi-aquatic species were augmented in the DZ with rhizomes brought in during peat dumping from flooded areas closer to the river.)

The species in Group B, in contrast to Group A, are rapid-growing and probably less competitive herbs, as deduced from the fact that they attained a much larger plant size and/or abundance in the DZ than in the UZ; moreover, many matured more quickly than the "climax dominants" did, and then some declined in abundance by 1979 (compare columns 1, 2 and 3). The starred species of Group B, in particular, exhibited unusual vigor in the DZ where plant cover was uneven and hence plant competition was perhaps reduced. For example, *Bidens coronata* occasionally reached 2 m in height in the DZ, in contrast to about 20 cm in the UZ, while *Gentiana procera* reached 50 cm in height, with 5-20 flowers per plant, in the DZ, in contrast to 10-20 cm, with but 1-3 flowers, in the UZ. This effect was as striking for some perennials, such as *Solidago riddellii*, *Pedicularis lanceolata*, and *Parnassia glauca*, as it was in the biennials and winter annuals.

A further distinction could be made,

within the plants of Group B, between "climax opportunists" (O) which persisted in or reinvaded both zones, with a steady annual frequency but lower in the UZ, and the "true pioneers" (P) which appeared only temporarily after the dredging disturbance, and were not found in the UZ during the ten years of observation. The true pioneers tended to recur in the DZ only in the foot path along the ditch after the first few years. Both groups, probably differing only in the degree of their intolerance of plant competition, include calcicoles (C) and general wetland species (W), and they include both annuals-biennials (A) and perennials. The long-lived clonal perennials (R) like *Aster lucidulus* and *Solidago gigantea* persist as rarely-flowering widely-scattered short stalks in the UZ as do the (presumably short-lived) cespitose perennials (S) like *Eupatorium maculatum* and *E. perfoliatum*. With drainage, these (R & S) species soon explode and dominate the biomass, as noted in the Wingra Fen study (Salli 1965) as well as by Moran. Some perennials suspected of being short-lived in dense cover, such as *Carex hystericina* and *Scirpus atrovirens*, may persist indefinitely in springs, paths, ditches and pastures; but they had died out in the DZ by 1979. In one of the University of Wisconsin Arboretum's lagooned fens (Monroe Street Duckpond), both species persisted on eroding peat banks until 1948, 12 years after the original dredging, and then reappeared on spoils from redredging in 1974 (personal observation); possibly, then, their seeds lay dormant in the bottom peat for 26 years.

The dozen "climax opportunists" which had not appeared in the DZ by 1979 (and 1982) are placed in this category on the basis of personal observation elsewhere. No explanation can be offered for the behavior of *Thalictrum*. It is here, as usual, scarce in the virgin climax condition; but it was expected to invade the DZ in exceptional abundance. It is one of the commonest species in most of our somewhat pastured or drained fens

today, whereas it was apparently a rare species in the early days (Cheney and True 1893).

The woody species (Group C in Table I) seem to fall into the same three classes as did the herbs. "Climax" species, marked T, appear to be stable in the UZ and in similar fens, neither increasing nor decreasing much over the years. Curtis (1943) reported a drastic decline in stem density of bog birch (*Betula pumila*, *glandulosa*, or *sandbergii*; part of a confusing complex needing further study) in Wingra Fen in the University of Wisconsin Arboretum, and a corresponding increase in flowering and stem density of *Cypripedium candidum*, after several years of annual mowing, simulating prairie fires; but whether the shrubs' roots actually disappeared is not clear. Moran reviews several observations suggesting that fires may help control shrubs; but again it is not certain whether these woody shrubs are actually eliminated by fire or merely kept in an inconspicuous subordinate state. As does the birch, red osier dogwood varies from 0 to over 50% cover in various undisturbed burned and unburned Wisconsin prairie fens, yet seemed not to be changing in the UZ in the ten years observed. The dogwood remained at 50% cover with neither seedlings nor rooted stolons observed in the UZ.

Reproduction of the "climax" woody species, however, may require special site conditions so they might really all be "opportunists" or even "pioneers." The birch, of low density in the UZ, was not observed to reproduce in either zone, whereas in the dry year 1976, birch seedlings appeared in spring at very high densities (up to 10/cm<sup>2</sup>) in the drying areas of peat exposed in Wingra Fen, only to die of drouth later in the season (personal observation). The dogwood was virtually absent in the DZ until 1979, when an abundance of seedlings (66% frequency, often occurring in groups of 2-6 individuals, estimated at 1-4 years of age, about 5-20 cm in height) was discovered there. Only six adult bushes were in that zone in 1979; presumably they predated the

construction in 1972. The tardiness of this high rate of invasion by red osier dogwood suggests that a special means of seed dispersal was necessary, since berry production was high in all years (never all burned). Experimental germination was obtained readily in one season with stratification and/or scarification (Kogler, 1979); therefore seeds buried in peat should have grown by 1973. One possibility is that voles and shrews—probable important vectors and cachers of seeds (obtained either from berries or bird excrement)—would not invade the DZ until several years of revegetation had built up sufficient cover and litter to provide suitable habitat and food. Perhaps by 1979 the small mammal population was large enough to consume most of the seeds they brought in, as may be chronically the case in the UZ, where no dogwood seedlings were found. Habitat specificity, including temporarily reduced plant competition, as well as reduced water saturation, may be as important for the ecesis of dogwood as for bog birch. In Waterloo Fen (Jefferson County, Wisconsin) these shrubs are found mostly at the sides of the fen humps which may be subject to slumping and drying (personal observation). Shrub patterns are likewise conspicuous at Waubesa Fen (Kratz and Winkler 1982), and they form a ring around the Waubesa "gentian pocket" (Burr 1980) and the "prairie ring" in one part of Wingra Fen (Lovely 1983). These circles may surround "discharge windows." *Salix candida*, like bog birch, failed to colonize the DZ, perhaps likewise requiring a rare or narrow range of temperature or moisture conditions which did not coincide with the temporary absence of competition in the years 1972-73. A reasonable hypothesis for a scattering of dogwoods, willows and birches in the UZ and in other relatively undisturbed fens is that microtopography caused by anthills and trampling by deer might occasionally provide small dry colonization sites.

In contrast to the "conservative" woody species discussed above, *Salix bebbiana*, *S. petiolaris*, and *S. discolor* (which do occur at

low frequencies in unaltered fens) invaded the DZ very abundantly, but did so only once, in 1972, while not changing in abundance in the UZ. Hence they can be called "true pioneers, like the tree willows and cottonwoods. Unlike the pioneer herbs, however, all these woody species may be able to dominate the vegetation for many years and even alter the environment (by shading ground herbs and drying the peat) to their temporary advantage and that of upland invaders. The sapling willows and cottonwoods reached a height of 0.5-2.0 m in the first or second years and were becoming difficult to pull out by autumn, 1973. It required about 20 people, working 2-3 hours, in both 1972 and 1973 to eradicate all these invaders save a few of the climax opportunist willow shrubs; although not counted, the number removed must have been on the order of 1,000-2,000 in the DZ, in many parts of which the density exceeded one per  $m^2$ . The unmanaged control areas of the DZ were perhaps not fully comparable since they were sandier and drier—at the east end of the ditch on both sides and all along the south side where sand had been piled. In these places an enduring dense thicket of cottonwood, sandbar willow and tree willows now reaches to ten m in height, with stem densities still approaching or exceeding  $1/m^2$ .

#### CONCLUSIONS

1. Given a chance, natural vegetation can restore itself in a prairie fen. In this case, without any planting, given a seed source of diverse native species nearby and possibly also in the peat, given an undisturbed hydrologic regime which soon wetted the additional (but thin) peat spoils cover, and given prompt removal of the one-time invading willows and cottonwoods, native plant species restored full cover by the second season's end. In 1979, after the eighth summer, 49 of the 71 enduring fen species had returned, including ten of the fifteen presumed "climax" fen herbs.

A major difference in aspect of the dis-

turbed zone throughout this study was lack of red osier dogwoods. However, a late heavy invasion of seedlings of this shrub in the DZ (by 1979) portended abnormally dense dogwood cover in the future if these did not die and if they were not removed or thinned while still small. A second conspicuous difference in the restored disturbed zone as compared to the UZ was a greater abundance maintained through 1982 of semi-aquatic species, including *Typha latifolia*, *Scirpus validus*, *Carex stricta* and *C. aquatilis*. It was not clear whether this difference would be permanent or not and to what extent the invasion was due to temporary lack of competition in 1972, or to fortuitous seed availability, or to an artifact of spoils transport.

A distinction must be made between disturbances of the surface (soil or vegetation) and of the hydrologic regime (water levels, pressures, rates of flow, and sources). This fen was unusual in suffering only a surface disturbance; most fens today suffer hydrologic as well as surface impacts due to human activity, with characteristic resulting invasion of lowland and upland carr and forest, or of ragweed (*Ambrosia trifida*) and nettle (*Urtica procera*), or reed canary grass, or at least of general wetland opportunists such as *Impatiens biflora*, *Aster lucidulus* and *A. simplex*, and *Solidago gigantea* and even *S. altissima*.

2. When compared with the vegetation in the undisturbed zone, the response to disturbance revealed individual behavioral characteristics and relationships among the plant species. Several approaches for portraying the nature of plant succession are suggested by the results:

(a) A spectrum of survival strategies. At one end are the "climax dominants and associates" which endure competition, grow slowly, and exhibit a certain amount of year-to-year rotation in dominance. At the other end are the "true pioneers" which can invade only once, at a time of major devegetational disturbance, and then run their life course whether short or long. Among the

woody pioneers, tree species while alive indicate by their age the date of the most recent major disturbance. In between the extremes are the "climax opportunists" which persist in or reinvade the climax phase at low vigor and frequency (in a steady-state pattern) and which indicate by becoming conspicuous the time and location of minor as well as major surface disturbances. Some of these plants may have special survival strategies such as the root parasitism of *Pedicularis* (Piehl 1965), fungal associations (orchids and perhaps others), and special dispersal and seed planting requirements such as being stamped into the soil by deer or livestock (suggested by various authors for *Gentiana* and *Cypripedium*). Reed (pers. comm. 1983) suggests subdividing the "climax opportunist" class into "general opportunists" found in many habitats (*Equisetum arvense*, *Impatiens biflora*, *Scirpus atrovirens*, *Thalictrum dasycarpum*, *Aster simplex*, *Solidago altissima*), "mid-succession" species (most of Group B in Table I), and "late succession" species (perhaps *Galium labradoricum*, *Spartina pectinata*, *Carex prairea*, etc.).

No doubt the individual strategems will prove to be so diverse and complex as to defy simple classification when fully known. For example, it has been suggested (Calvin DeWitt, U W. Env't. Studies Institute, pers. comm.) that *Cypripedium candidum* (absent in this fen but present in fens nearby), whose crowns are known to remain dormant during some growing seasons, might flower best when under environmental stress—the only time that expenditure of energy for reproduction is crucial—and if so would then indicate conditions of environmental change or habitat degradation rather than of stability and "health."

(b) The disturbance requirement for maintenance of even the "climax" vegetation. Some competition-tolerant species may occasionally have a chance to replace their senescent individuals in the local disturbed sites that favor the opportunists as well (the "gap-phase" of forestry and the "internal succession" of Curtis). Other climax

members may require the prior establishment of mid-succession or even pioneer species to flourish (possibly the case for the last 5 species of Group A in Table I). However, it appears from this study that many of the permanent species of Group A reproduced chiefly in the year of major disturbance along with the pioneers. Succession, as measured by successive dominance of species, would then be an artifact of the different maturation rates of pioneer and climax types. Succession in other wetlands, too, has been found to be closer to this "fortuitous allogenic" model than to the traditional "environmental conditioning" model (Van der Valk, 1981, 1982).

(c) "Party-crashing" by species from alien ecosystems. In the Van der Valk model, plants play two games. Disturbances are like the periodic stopping of music in the game of "musical chairs." Once "in," either the climax dominant fen herbs or the pioneering woody species may then play "king of the hill," excluding most competitors and freezing for a long time the pattern of temporary disturbance and fortuitous seed availability. In these games, species from two alien communities—field and forest—may likewise get "in" and participate in the fen's successional cycle. In healthy fens, agricultural crop pests (American and Eurasian) are unlikely to remain except possibly the hydrophytic reed canary grass, which has persisted in a wet fen hump in Waubesa Wetlands for several decades (Burr 1980). A few small clones of reed canary have persisted in the DZ through 1982.

By shading and drying effects, woody invaders pose a serious threat to fen herbs now that so few gene banks of native species remain and now that additional Eurasian species are available. In the past, invading woody species such as alder (*Alnus rugosa*), tamarack (*Larix laricina*) and white cedar (in cool climates) and the cottonwoods and willows of river floodplains, accompanied or followed by other wet forest species, were probably a normal successional expression of dry phases of climatic cycles. Such an

interpretation could explain the woody and charcoal layers in Vogl's sedge peat profiles. Tree-dried peat, in time of drouth, might be especially prone to burn. Today, Eurasian invaders of impacted fens exacerbate the extinction of native fen species by being pre-adapted for fens and relatively resistant to local consumers like deer, rabbits, and insects. Kogler (1979) documents the rapid invasion of Gardner Marsh (a ditched fen) by *Lonicera x Bella* (*morrowi x tatarica*), *Rhamnus cathartica*, floodplain trees (cottonwood, sandbar willow and ash), and especially the European fen buckthorn, *Rhamnus frangula*. The latter has abundantly invaded Wingra Fen (Lovely 1983) and is now appearing even in the minimally altered Cedarburg String Bog at Saukville (personal observation, 1983). It is not known if its recently widely propagated cultivar "tallhedge" will also invade natural communities.

3. Management of natural ecosystems to perpetuate native gene banks requires counteracting the human impacts. For fens, these impacts include alien species as well as hydrologic effects. A number of our rare or endangered plant (and possibly animal) species appear to be true pioneers or at least climax opportunists, dependent on a certain amount of recurrent local disturbance of the soil and the vegetation fabric by weather, animals, and probably by certain types of fire (for example, see Smith 1983). These same disturbances, however, may enable long-lived and often habitat-influencing alien species (from other habitats or continents) to usurp the site. Planting, earth-moving, and alteration of hydrologic regimes in the vicinity provide seed sources for these aliens almost everywhere today, so that the conditions (disturbance patterns) necessary for native species' maintenance in protected habitats risk allowing some aliens repeatedly to get a foothold. For example, lesser fringed gentians seem to benefit from light grazing or trampling by dairy cattle at the fen edge (Walworth County, Wisconsin, near Lake Comus, personal observation,

1981). In such places, these alien threats to lesser fringed gentians and other rare plant and animal fen species include: a) reed canary grass such as in South Waubesa and Wheeler Road fens, b) buckthorns and river nettles and giant ragweed in Wingra Fen and many others, c) purple loosestrife (*Lythrum salicaria*) in the Fox Valley Crane Refuge and at the Horicon Wildlife Refuge, and d) cottonwoods and several willows in all of these Wisconsin wetlands.

Management of natural areas, therefore, involves continual removal of the alien species within and without the protected area. Ironically, this constant cost-intensive spatial segregation of species is precisely what distinguishes the garden and the zoo from a natural area. The high cost of seizing opportunities to study impacted habitats and the high cost of maintaining virgin examples for comparison are justified by the high efficiency with which the interactions and dynamics are revealed, on which to base successful resource management strategies.

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# STORED-PRODUCT INSECT PESTS IN FEED MILLS IN SOUTHERN WISCONSIN

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## *Abstract*

Twenty feed mills located in southern Wisconsin were sampled in an attempt to assess the stored-product insect fauna present during the summers of 1975 and 1976. Over 100 insect species were collected and identified, and 11 species recorded for the first time as occurring in Wisconsin. Various sampling methods, including insect traps and debris collections, were used to determine the degree of infestation within each mill, and to determine the insect fauna present.

## INTRODUCTION

The worldwide movement of stored-product insects through commerce has often caused economic and political problems (Freemen, 1973). Early detection, and a knowledge of the life histories and habits of the insect species involved, are essential for correct control procedures and for the protection of the products involved (Aitken, 1975). Federal inspections and quarantine regulations do much to check the introduction or spread of stored-product pests, but the need to monitor the insect fauna remains. To illustrate this point, *Trogoderma granarium* the Khapra beetle, was first collected and identified in the United States in California in 1953 (Allen and Linsley, 1954), yet this destructive species had been introduced into the United States at least seven years earlier, and spread to four states before being eradicated in the early sixties (Cotton, 1963).

No comprehensive stored product insect survey has been previously conducted in Wisconsin. The plan of the present investigation was two-fold. First, 20 feed mills were sampled over a two-year period in Southern Wisconsin in an attempt to assess the stored product insect fauna present. Secondly, an analysis of interspecific distribution records for the collected species of stored product insects was made. This paper deals with the in-

sect fauna collected and categorized during the two-year study.

## MATERIALS AND METHODS

### *Sampling Sites*

Twenty feed mills located in southern Wisconsin were selected as sampling sites during the Spring of 1975: Sampling was conducted in Dane, Rock, Iowa, and Jefferson counties during the eight-week periods of June 24 through August 12, 1975 and June 25 through August 11, in 1976. Permission to sample each mill was requested yearly, and an agreement was made to keep the affiliations and locations of each establishment unpublished. In 1976, two mills refused to allow further sampling for undisclosed reasons.

Each feed mill was visited biweekly and a) inspects traps were placed, b) previously placed traps were collected, c) a 250 ml. sample of spilled feed and grain was taken, d) and a hand collected sample of insects was made during each visit. Eight collections were obtained from each mill during the two year survey. Conditions of sanitation, infestation problems, and insecticide treatments were recorded, along with pertinent comments obtained in conversations with the mill managers.

Fourteen of the twenty mills were less than 28,000 sq. ft. in area and the remaining six

sampling sites were more than 30,000 sq. ft. Small amounts of corn were stored in various bins and storerooms in each of the sampled mills. Fifty-pound bags of dairy cow, calf, hog and horse feed along with various dog foods were stored throughout the mills. Three of the sampling sites were also manufacturing plants and produced their own feeds for commercial sale.

### Identification of Specimens

The following specimens were identified or confirmed by the following specialists at the University of Wisconsin, Madison: Philip Kingsley (Anthocoridae), Dennis Engel (Diptera), Dr. R. D. Shenefelt (Braconidae), and Dr. Jim Mertins (Pteromalidae). Speci-

mens of *Lariophagus distinguendus* were sent to the Insect Identification and Beneficial Insect Introduction Institute, Beltsville, Maryland, for verification. All Coleoptera and Lepidoptera specimens, and a majority of the Diptera and Hymenoptera were identified by the senior author. Identified specimens have been deposited in both the Department of Entomology, University of Wisconsin-Madison collection, and with the State Agriculture Department, Madison. Wisconsin State Department of Agriculture and University of Wisconsin Insectarium records, along with pertinent literature were used as the criteria for distinguishing state records for the occurrence of an insect species.

TABLE 1. Anthropods collected in southern Wisconsin feed mills during 1975 and 1976.

	1975		1976	
	No. of mills present		(Total No. collected)	
Insecta				
Thysanura				
<i>Lepisma saccharina</i> L.	1	(1)	2	(5)
Collembola	10	(—)	12	(—)
Hemiptera				
Reduviidae				
<i>Reduvius personatus</i> L.	1	(1)	2	(3)
Anthocoridae				
<i>Lyctocoris campestris</i> (Fab.)	3	(4)	—	
<i>Xylocoris</i> sp.	—		1	(1)
<i>Orius insidiosus</i> (Say)	2	(2)	—	
Nabidae	1	(1)	1	(1)
Pentatomatidae	—		1	(1)
Lygaeidae	1	(1)	—	
Homoptera				
Cicadellidae	1	(1)	1	(4)
Fugaloridae	—		1	(1)
Aphidae	—		2	(2)
Psocoptera	12	(1)	10	(—)
Coleoptera				
Anobiidae				
<i>Stegobium paniceum</i> (L.)	2	(5)	5	(15)
<i>Trypopytis sericeus</i> (Say)	1	(1)	—	
Anthicidae				
<i>Anthicus floralis</i> (L.)	2	(2)	1	(2)
<i>Anthicus cervinus</i> LeFerte	1	(1)	6	(10)
Bostrichidae				
<i>Rhizopertha dominica</i> (Fab.)	1	(1)	—	

TABLE 1. Anthropods collected in southern Wisconsin feed mills during 1975 and 1976.—Continued

	1975		1976	
	No. of mills present		(Total No. collected)	
<b>Carabidae</b>				
<i>Clivina impressifrons</i> LeConte	2	(2)	—	
<i>Agonum</i> sp.	1	(1)	—	
<i>Bembidion</i> sp.	—		1	(1)
<i>Agonoderus lecontei</i> Chaudoir	—		1	(1)
<i>Harpalus compar</i> LeConte	1	(1)	—	
<b>Chrysomelidae</b>				
Undetermined spp.	1	(1)	1	(3)
<i>Gastrophysa polygoni</i> (L.)	1	(1)	—	
<i>Disonychia</i> sp.	—		1	(1)
<i>Agalyma vitta</i> F.	—		1	(1)
<b>Coccinellidae</b>				
<i>Adalia bipunctata</i> (L.)	3	(6)	2	(3)
<i>Hippodamia convergens</i> Guerin	—		1	(1)
<i>Coleomegilla fuscilabris</i> Mulsant.	4	(8)	2	(7)
<i>Scymnus</i> sp.	—		1	(1)
<b>Cryptophagidae</b>				
<i>Cryptophilus integer</i> Heer*	5	(22)	2	(5)
<i>Cryptophagus pilosus</i> Reitter	6	(9)	2	(3)
<i>Cryptophagus obsoletus</i> Reitter*	5	(8)	1	(1)
<i>Cryptophagus croceus</i> Zimm.	7	(18)	3	(3)
<i>Cryptophagus</i> sp.	2	(2)	—	
<i>Atomaria</i> spp.	2	(2)	—	
<b>Cucujidae (Silvanidae in part)</b>				
<i>Cryptolestes turcicus</i> Grov.*	11		9	
<i>Cryptolestes ferrugineus</i> Steph.*	12	(2,364)	9	(2,506)
<i>Silvanus bidentatus</i> (F.)	1	(1)	—	
<i>Oryzaephilus surinamensis</i> (L.)	19	(1,698)	17	(793)
<i>Ahasverus advena</i> (Walt.)	20	(755)	17	(185)
<b>Curculionidae</b>				
<i>Sitophilus granarius</i> (L.)	15	(779)	17	(1,455)
<b>Dermestidae</b>				
<i>Attagenus megatoma</i> (Fab.)	20	(455)	18	(342)
<i>Attagenus elongatulus</i> Casey	2	(3)	1	(1)
<i>Attagenus</i> spp. (larvae)	20	(1,014)	18	(579)
<i>Anthrenus fuscus</i> Olivier	2	(2)	—	
<i>Anthrenus castanae</i> Mels.	3	(4)	2	(2)
<i>Anthrenus scrophularae</i> L.	2	(2)	—	
<i>Anthrenus</i> sp. (larvae)	1	(1)	2	(4)
<i>Trogoderma variable</i> Ballion	1	(2)	1	(6)
<i>Trogoderma glabrum</i> (Hbst.)	5	(37)	5	(12)
<i>Dermestes lardarius</i> L.	11	(28)	15	(65)
<b>Dytiscidae</b>				
<i>Ilybius</i> sp.	1	(1)	—	
<b>Endomycidae</b>				
<i>Mycetaea hirta</i> (Marsh.)*	1	(1)	—	
<b>Histeridae</b>				
<i>Dendrophilus xavieri</i> Marsuel	4	(5)	2	(2)
<i>Dendrophilus punctatus</i> (Hbst.)	—		1	(1)
<i>Carcinops pumilio</i> (Erickson)	3	(3)	9	(118)
<i>Acritus</i> sp.	2	(4)	1	(128)
<i>Sparinus</i> sp.	—		1	(1)

TABLE 1. Anthropods collected in southern Wisconsin feed mills during 1975 and 1976.—Continued

	1975		1976	
	No. of mills present		(Total No. collected)	
Hydrophilidae				
<i>Cyphon</i> sp.	1	(1)	—	
Lathridiidae				
<i>Lathridius minutus</i> (L.)	10	(35)	2	(5)
<i>Cartodere</i> sp.	1	(1)	1	(1)
<i>Coninonus constricta</i> (Gyll.)	5	(7)	1	(2)
<i>Corticara</i> sp. (near <i>elongata</i> (Curtis))	3	(4)	1	(1)
Undetermined sp.	1	(1)	—	
Lyctidae				
<i>Lycytus planicollis</i> LeConte	1	(1)	1	(1)
Mycetophagidae				
<i>Typhaea stercorea</i>	16	(163)	11	(66)
<i>Mycetophagus quadriguttatus</i> Mull.	5	(7)	3	(7)
<i>Litargus balteatus</i> LeConte	7	(7)	1	(1)
Nitidulidae				
<i>Carpophilus hemipterus</i> L.	11	(20)	2	(2)
<i>Carpophilus sayi</i> Parson	1	(1)	—	(2)
<i>Carpophilus brachypterus</i> Say	3	(3)	2	(2)
<i>Glishrochilus fasciatus</i> (Ollv.)	2	(2)	—	
<i>Glishrochilus quadrisignatus</i>	9	(25)	4	(6)
<i>Omosita colon</i> (L.)	1	(1)	3	(5)
<i>Eupuraea</i> sp.	1	(1)	—	
Ostomidae				
<i>Tenebriodes mauritanicus</i> (L.)	18	(269)	17	(151)
Orthoperidae				
<i>Molamba</i> sp.	—		1	(1)
Ptinidae				
<i>Ptinus fur</i> (L.)	7	(10)	4	(6)
<i>Ptinus villiger</i> (Reitter)	7	(11)	3	(13)
<i>Ptinus clavipes</i> (Panzer)	6	(14)	2	(3)
<i>Gibbium psylloides</i> (Czenpinski)	1	(4)	1	(2)
<i>Pseudeurostus hilleri</i> (Reitter)	1	(1)	1	(2)
Rhizophagidae				
<i>Monotoma picipes</i> Herbst	—		2	(3)
Scarabeidae				
<i>Aphodius</i> sp.	1	(1)	—	
Staphylinidae				
<i>Philonthus</i> spp.	2	(2)	4	(6)
<i>Atheta</i> spp.	4	(5)	5	(9)
Undetermined specimens	2	(3)	6	(11)
Tenebrionidae				
<i>Alphitophagus bifasicatus</i> (Say)	2	(18)	1	(1)
<i>Alphitobius diaperinus</i> (Panzer)*	3	(3)	1	(1)
<i>Cynaesus angustus</i> (LeConte)	4	(6)	5	(5)
<i>Platydema ruficornis</i> Sturm.	4	(4)	—	
<i>Tenebrio molitor</i> L.	19	(169)	17	(135)
<i>Tenebrio obscurus</i> Fab.	19	(29)	9	(12)
<i>Tenebrio</i> spp. (larvae)	20	(554)	18	(414)
<i>Tribolium castaneum</i> (Hbst.)	7	(258)	5	(234)
<i>Tribolium confusum</i> DuVal.	9	(207)	8	(179)
<i>Palorus ratzeburgi</i> (Wiss.)*	5	(129)	4	(122)

TABLE 1. Anthropods collected in southern Wisconsin feed mills during 1975 and 1976.—Continued

	1975		1976	
	No. of mills present		(Total No. collected)	
<b>Diptera</b>				
Chironomidae	—		1	(1)
Cecidomyiidae	4	(6)	4	(5)
Mycetophilidae	2	(—)	3	(—)
Psycodidae				
<i>Psycoda</i> spp.	2	(2)	2	(2)
Scenopinidae				
<i>Scenopinus fenestralis</i> L.	14	(101)	13	(42)
Muscidae				
<i>Muscina stabulans</i> (Fallen)	4	(11)	3	(4)
<i>Musca domestica</i> L.	2	(3)	1	(1)
Anthomyiidae				
<i>Hylemya</i> sp. (prob. <i>ciljcura</i> (Rondani))	7	(30)	9	(17)
<i>Fannia canicularis</i> (L.) (pupae)	2	(5)	1	(1)
Scatopsidae				
<i>Scatopsis</i> spp.	10	(42)	4	(28)
Tabanidae	—		1	(1)
Syrphidae	1	(1)	—	
Lonchaeidae				
<i>Lonchaea</i> sp.	5	(7)	—	
Caliphoridae	3	(3)	3	(3)
Dolichopodidae	—		1	(1)
Drosophilidae	2	(2)	1	(1)
Helicomyzidae	1	(1)		
Phoridae	1	(1)		
Undetermined Acalypterates	5	(12)	7	(10)
<b>Lepidoptera</b>				
Pyrilidae				
<i>Pyralis farinalis</i> L.	14	(77)	8	(30)
Tineidae				
<i>Tineola biselliella</i> Humm.	4	(7)	4	(18)
<i>Nemapogon granella</i> (L.)*	3	(19)	5	(9)
Phycitidae				
<i>Ephestia kuehniella</i> Zell.	3	(11)	6	(12)
<i>Plodia interpunctella</i> Hubner	8	(89)	3	(17)
<b>Hymenoptera</b>				
Ichneumonidae				
<i>Idechthis canescens</i> (Gravenhorst)	4	(5)	2	(3)
Braconidae				
<i>Metrius</i> sp.	2	(2)	—	
Pteromalidae				
<i>Lariophagus distinguendus</i> Foerst*	9	(22)	5	(15)
Undetermined specimens	4	(6)	3	(3)
Bethylidae				
<i>Cephalonomia</i> sp.*	4	(6)	2	(4)
<i>Plastanoxus</i> sp.*	1	(1)	—	
Formicidae	1	(1)	1	(1)
<b>Arachnida</b>				
Chelontida				
Cheliferidae				
<i>Chelifer cancroides</i> (L.)	10	(42)	12	(102)

\* State record for occurrence of species.

### Sampling

A number of sampling techniques were used in an attempt to fully assess the insect fauna present in each mill. Samples of live and dead insects were hand-collected during each visit.

A 250 ml sample of whole grain corn, oats, grain dust, and spilled feed was collected from each mill. Each sample was passed through two sieves (U.S. standard sieve series #40 and #12), adult insects were separated, and the sample was incubated for 120 days at  $21 \pm 3^\circ\text{C}$  and 60% RH, after which it was again passed through a sieve and all insects were removed and recorded.

A number of trap types were placed in each mill and were collected during the following visit. Pitfall traps using  $100 \times 15$  mm plastic petri plates;  $15 \times 25$  cm rolled sheets of single-backed corrugated cardboard; and cheesecloth-wrapped food traps baited with various combinations of poultry mash, whole grains, and Brewer's yeast were employed. Traps were brought back to the laboratory and stored at  $-10^\circ\text{C}$  until the insects could be separated and identified.

### RESULTS

#### Fauna

A total of 18,410 insects were collected and identified during the two year survey. The faunal list obtained is shown in Table 1. Eight orders, 60 families and over 100 insect species were associated with the 20 southern Wisconsin feed mills sampled. Eleven species have been recorded for the first time as occurring in Wisconsin.

#### Coleoptera

Coleopterans made up 90.6% of the insects collected (Table 2). Of the 83 species of beetles recorded, 62 are associated with stored products (Cotton and Good, 1937, and Aitken, 1975). The flat and rusty grain beetles, *Cryptolestes turcicus* and *C. ferrugineus* were the most abundant insects encountered. Both of these *Cryptolestes* spp. were identified for the first time as occurring in Wisconsin. Specimens identified as *C. pusillus*, which had been previously collected in the State were found in the University of Wisconsin Insectarium and in the collection of the Wisconsin State Department of Agri-

TABLE 2. Percentage of the total number of insects collected for select insects.

		1975	1976
<i>Tenebriodes mauritanicus</i>	adult	1.76%	1.39%
<i>Tenebriodes mauritanicus</i>	larvae	1.00	0.346
<i>Dermestes lardarius</i>	adult	0.29	0.749
<i>Attagenus megatoma</i>	adult	4.67	3.94
<i>Attagenus</i> spp.	larvae	10.41	6.67
<i>Oryzaephilus surinamensis</i>	adult	17.4	9.14
<i>Sitophilus granarius</i>	adult	7.99	16.77
<i>Ahasverus advena</i>	adult	7.75	2.13
<i>Tenebrio</i> spp.	larvae	5.69	4.78
<i>Tenebrio molitor</i>	adult	1.73	1.55
<i>Tenebrio obscurus</i>	adult	0.297	0.138
<i>Tribolium castaneum</i>	adult	2.64	2.69
<i>Tribolium confusum</i>	adult	2.07	2.13
<i>Typhaea stercorea</i>	adult	1.67	0.761
<i>Cryptolestes</i> spp.	adult	24.37	28.89
<i>Palorus ratzeburgi</i>	adult	0.379	0.253
<i>Pyralis farinalis</i>	adult	0.787	0.345
<i>Ephestia kuehniella</i>	adult	0.112	0.138
<i>Plodia interpunctella</i>	adult	0.913	0.196
Total		91.97%	83.16%

culture. Inspection of these specimens revealed that they had been misidentified by a taxonomist at the Smithsonian Institute, Washington, D.C. and were actually a mixture of *C. ferrugineus* and *C. turcicus*. Over 4,000 specimens were identified and 125 genitalia dissections were made, but no specimens of *C. pusillus* were found during this survey or in either collection. Bishop (1959) reported numerous misidentified specimens of *Cryptolestes* spp. as well as confused distribution records, and that *C. turcicus* and *C. ferrugineus* are the most abundant species found in the northern grain growing areas.

*Attagenus megatoma* was the most widely distributed insect, occurring in every mill sampled. Beal (1970) has recognized two subspecies of *Attagenus megatoma*; *A. megatoma megatoma* and the northern form *A. megatoma canadensis*. Movement of the two forms through commerce has somewhat obliterated the line of demarcation. The distinguishing characteristic between the forms is the number of golden brown hairs present on the elytra; no golden setae present in *A. megatoma megatoma*, and *A. megatoma canadensis* having golden brown hairs inserted in some numbers on the base of the elytra back to a distance equal to at least three lengths of the scutellum. Examination of the adult specimens collected during this survey revealed the presence of *A. megatoma megatoma*. No specimens of *A. megatoma canadensis* were collected, but numerous intergrade specimens (having golden hair inserted on the base of the elytra for a length of one half to two lengths of the scutellum) were found. The sample populations from a given mill had a characteristic and more or less constant appearance. *Attagenus megatoma megatoma* was prevalent in eastern Dane and Jefferson counties, while the intergrade specimens appeared in southern Dane and Rock counties. The gradation within mills was so constant that an individual specimen could be placed as to the county, and in some cases the mill, from

which it was collected on the basis of appearance alone.

*Sitophilus granarius*, the granary weevil, was found to be abundant and widely distributed within the sampled feed mills. A number of mill managers reported farmer-delivered oats as the major source of the infestations, yet specimens were collected only in grain samples of whole corn, and weevils were not observed at any time on whole grain oats. The extreme winter temperatures and short storage periods (usually under one year) normally prevent weevil infestations from becoming economically important in Wisconsin, but weevil populations were sufficiently large in two feed mills during the spring of 1975 to require a fumigation. Although it has been recorded in stored grain in Wisconsin, the rice weevil, *Sitophilus oryzae*, was not collected in any of the feed mills sampled.

Other economically important stored product pests recorded include the cadelle beetle, *Tenebriodes mauritanicus*, the drugstore beetle, *Stegobium paniceum*, and the lesser grain borer, *Rhizopertha dominica*. Both *Tribolium castaneum* and *T. confusum* were widely distributed and in some cases abundant. Mixed populations of both species were collected during 1975 and 1976 in five and six of the sampled mills respectively. Laboratory experiments have shown that *Tribolium* spp. cannot coexist in a closed system (Yoshida, 1976), but no evidence of species dominance was observed. *Tribolium* populations were largest in the heated manufacturing mills. The tenebrionids, *Tenebrio molitor* and *T. obscurus*, were found to coexist in a number of sampled mills, but in all cases *T. molitor* was more numerous.

Various species of fungus beetles made up 32.4% of the total number of beetles encountered (Table 2). *Ahasverus advena*, the foreign grain beetle, was the most abundant fungus beetle collected. The hairy fungus beetle, *Typhaea stercorea*, was the most widely distributed mycetophilous beetle;



other members of the family Mycetophilidae, *Mycetophagus quadriguttatus* and *Litargus balteatus* were observed in a number of mills, but were not abundant. Seven species of Nitidulidae were captured, with *Carpophilus hemipterus* and *Glish-rochilus quadrisignatus* being the most widely distributed and most numerous sap beetles encountered respectively. Although members of this family often infest corn in the field (Daugherty and Brett, 1966), *C. hemipterus* was the only economically important storage pest of this family collected. Members of the family Cryptophagidae appeared in better than 25% of the sampled mills. Species collected from this family in order of decreasing abundance include: *Cryptophilus integer*, *Cryptophagus croceus*, *C. pilosus*, *C. obsoletus* and *Atomaria* spp. *Lathridius minutus* was collected in ten of the mills sampled while four other species of Lathridiidae were encountered.

Members of two predaceous beetle families associated with stored product insects, the Staphylinidae and Histeridae, were observed and collected in a number of mills. The numbers of these carnivorous beetles collected in any given mill were normally low, but in two cases in 1976, large numbers of the hister beetles, *Carcinops pumilio*, and *Acritus* sp. were observed. In both instances the areas had remained undisturbed for long periods of time, and large populations of stored product pests had built up in the 8-30 cm of spilled feed and grain present on the floor.

Over 2,000 specimens of the sawtoothed grain beetle were collected, they were present in 95% of the sampled sites (Table 1). Observations on the number of beetles collected during each sampling revealed rather constant populations of *Oryzaephilus surinamensis* present throughout the summer.

Three minor stored product pests, the small-eyed flour beetle *Palorus ratzeburgi*, the lesser mealworm *Alphitobius diaperinus*, and the spider beetle, *Pseudeurostus hilleri*, along with the mycetophilous stored product

beetles *Cryptophilus integer*, *Cryptophagus obsoletus*, and *Mycetaea hirta* were collected and identified in Wisconsin for the first time. Because of the cosmopolitan distribution of most of these species it is unlikely that any were recently introduced. The lesser grain borer, *Rhizopertha dominica*, was recorded for the second time in Wisconsin.

### Diptera

A number of dipterans collected during this survey are not normally associated with stored products. Members of the families Chironomidae, Dolichopodidae, Syrphidae, Tabanidae, Caliphoridae and Helicomyzidae do not normally breed in stored product habitats, or feed on stored product insects. Their presence in the feed mills is therefore considered accidental.

Damp, mold-ridden stored products often support populations of mycetophilous Diptera. Species associated with these conditions collected during this survey include members of the families Cecidomyiidae, Scatopsidae, Psychodidae, Mycetophilidae, Anthomyiidae and Muscidae. Pupae of *Fannia canicularis* were found in four of the sampled mills. Fifteen specimens of *Muscina stabulans*, which normally breeds in decaying organic matter (James and Harwood, 1969), and four specimens of *Musca domestica* were also collected.

Both the adults and larvae of the windowpane fly, *Scenopinus fenestralis*, were collected in over 60% of the feed mills. Adults were observed and collected at windows, and the larvae, which are predaceous on stored grain insects (Hinton and Corbet, 1955) were associated with samples of spilled grain and feed.

### Lepidoptera

Five species of stored product Lepidoptera were recovered during the two years of sampling. The European grain moth, *Nemapogon granella*, was recorded for the first time in Wisconsin. The meal moth, *Pyralis farinalis* was the most abundant and wide-

spread lepidopteran. Rarely economically important, this pyralid breeds in damp products (Anonymous, 1965). *Plodia interpunctella*, the Indian meal moth, and the Mediterranean flour moth, *Ephestia kuehniella*, built up to economically important numbers separately in two Dane county feed mills in 1975. *Plodia interpunctella* was encountered in 40% of the sampled feed mills in 1975. *Tineola biselliella*, the webbing clothes moth, was prevalent in one feed mill during 1976. The important lepidopteran stored grain pest, *Sitotroga cerealella*, has not been collected in Wisconsin.

#### Miscellaneous Orders

Six specimens of the silver fish, *Lepisma saccharina*, were collected during the two-year survey. Because of a starch diet, Linsley (1944) considers these thysanurans to be of little importance and their presence largely incidental in stored products. Psocids (order Psocoptera), were observed in over 55% of the feed mills in 1975 and 1976. Their small size, speed, and cryptic habits prevented an accurate quantitative assessment. Members of the collembolan family Entomobryidae were collected in over half the mills sampled. The Homoptera and Hemiptera collected appear to be of accidental occurrence.

One species of Hymenoptera, *Lariophagus distinguendus* (family Pteromalidae), and two genera, *Cephalonomia* (prob. *C. tarsalis* (Ashm.)) and *Plastanoxus* (family Bethyilidae) were collected in Wisconsin for the first time. *Lariophagus* has been recorded as a parasite of the rice and granary weevils (Cotton and Good, 1947). *Plastanoxus* spp. are parasitoids of various *Cryptolestes* spp., and *Cephalonomia* has numerous known stored-product hosts, (Evans, 1964). Distribution records within the twenty feed mills for these minute parasitoids are probably incomplete, as a majority of the specimens were hand-collected at windows, and the traps were not designed to capture hymenopterans. Other hymenopterans collected include the stored product lepidop-

teran parasitoid, *Idechthis canescens* (family Ichneumonidae), and the braconid, *Metrious* sp.

#### DISCUSSION

Feed mills offered an excellent environment to sample the fauna of stored product insect in Wisconsin. Few regulations deal with insects in animal feed, and little concern is given to insect infestations. Sanitary conditions varied greatly throughout the feed mills sampled, and as business picked up in the spring and fall, mill managers reported that little time was invested in clean up procedures. Insect infestations levels found during this survey were directly proportional to the amount of debris found on the floor of a given mill.

The total number of insect species collected during this survey of twenty southern Wisconsin feed mills is higher than other previous surveys conducted in the United States and Canada. Few records of stored product insect infestations exist for Wisconsin, and because little previous sampling has been done outside of Dane County, over 140 county records for distribution were recorded during this survey. Too often when insect populations develop, chemicals are used to control the infestations, and no attention is given to identification of the species causing the problem. Knowledge of which species are present, and an understanding of their biology, would give clues useful in implementing future sanitary and cultural practices that could prevent infestations.

The most significant finding of the study was the repeated observation of the high percentage of fungus feeding insects associated with stored products. Unlike the southern United States, where stored grains are eaten and destroyed by primary pests such as the granary and rice weevils, Wisconsin's insect problems seem to be associated with moldy feed and grain. Although any insect contamination may lead to dockage when the grain is sold, Wisconsin's problem

stems from moisture and mold problems, which can draw insects in from outdoors. Proper handling and storage could eliminate 90% of our stored grain insect problems in the state without any remedial control needed. This situation is unique to the upper Midwest.

#### ACKNOWLEDGEMENTS

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# FIRST REPORT OF A SAMSON GRAY FOX

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There have been reports of samson red foxes (*Vulpes vulpes*) (Helminen 1961, Allen 1974) and other carnivores (Allen 1974), but none of gray foxes (*Urocyon cinereoargenteus*). The samson form is a genetic variant in which the normal long guard hairs of the coat are absent, showing only the woolly undercoat. Failor (1977) stated that this condition occurred more often among red than gray foxes, but could not document an observation of a samson gray fox. No Wisconsin records of samson gray foxes are known.

In late November 1979 a complete samson gray fox was shot in Richland County, Wisconsin. Gross examination revealed a lack of guard hairs over the entire body, in contrast to a lack of guard hairs restricted to the tail and hind quarters which is characteristic of partial samson foxes (Allen 1974). External measurements were: head, 148 mm; tail, 320 mm; hind foot, 132 mm; total body length, 641 mm. Jackson (1961) gave the following approximate measurements for the gray fox

in Wisconsin: tail, 310-390 mm; hind foot, 130-145 mm; total length, 950-1,040 mm. Gross body weight was not recorded, but the animal appeared to be in good overall condition when shot. Tooth wear patterns (Wood 1958) indicated that this male was <1 year old when killed.

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## “BURBANK WITH A BAEDEKER . . .”

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Travel records can be broadly categorized as impersonal (objective and literal) or personal (subjective and interpretative). The former results when the purpose of the journey is the gathering of information and the intention of the account is the accurate reporting of that information. In the twelfth century, Rabbi Benjamin of Tudela visited Jewish communities from Sargassa to the boundaries of China and his account of conditions he observed is an early example of the impersonal record.<sup>1</sup> Lewis and Clark, instructed by Jefferson to gather information on practically everything from the Mississippi to the Pacific, recorded in their journals a mass of facts on animals, plants, people and geography.<sup>2</sup> However far execution may have fallen from intention, early records of exploration were generally of this type. They were intended as the basis from which further exploration, exploitation or colonization would proceed. Accuracy of reporting was the goal of the writer and assumed by the reader. It was of paramount importance not only to encourage the investment of capital and recruitment of colonists but also to protect both investment and colonists when they were finally committed to exploitation or settlement.

Nevertheless, credulity or inflexible religious, philosophical or geographical theories or errors in translation or transcription could lead to gross inaccuracies in the written record. Often over-zealous and imaginative projections of the desires and biases of the explorer resulted in records which were descriptions of what he wanted to see rather than what he saw. Often his description of what he hoped to find beyond the mountain range he did not cross cannot be distinguished from his account of areas he had

actually traversed. Thus, Verrazano, determined to find Cathay whether it was there or not, saw the “vast Oriental sea” beyond the reefs of North Carolina and blithely compressed the North American continent into an isthmus.<sup>3</sup> (It is altogether appropriate that Verrazano, the first to sight the harbor of New York, has given his name to a bridge of that city. Many of its present inhabitants share his unusual view of continental geography.)

Some of the more speculative early records were based on interrogation of indigenous populations in whose answers the explorer heard only what confirmed his already entrenched beliefs in the Northwest Passage or El Dorado. Often these same *indigenes*, sensing from his questions the answers he wished to hear, happily cooperated by supplying them.<sup>4</sup> One of the consequences of this desire to please (or to get rid of the nosey and intrusive stranger) was that distances were shortened or lengthened depending on the circumstances of the questioning. In addition, the potential for error was increased by differences between the traveler and his informant in their sense of distance. The perception of “short” and “long” might bear little relationship to actual milage. Further errors might appear in the conversion from time to distance when the circumstances of the journey are not the same. A “three day’s journey” may take considerably longer in the rain or when burdened with baggage. Furthermore, in gathering information on land he himself had not traveled through, even the most unbiased and objective explorer faced the problems of translation from one language to another, from one system of measurement to another or from a

lack of system to understandable units. Who knows, for example, what is implied by “across many rivers”?

Errors might proliferate but the intent of this type of travel record was an accurate, factual and literal description of verifiable details of geography, agriculture, meteorology and inhabitants. Ideally, the account was a manual for use by succeeding travelers along the way as well as an advertising brochure and geographical record.

To guide him when he reached Cathay, Columbus took with him on his first voyage *The Travels of Sir John de Mandeville* which, unhappily, was discovered in modern times to have been written in the fourteenth century by a well-read Belgian who had probably never left his home in Liege.<sup>5</sup> For a variety of reasons, it is fortunate that Columbus was never forced to depend on the totally mythical *Travels*. However, the work, though spurious, is an example of another type of impersonal travel record—the guidebook.

Though among the first (and thoroughly fascinating in itself), the *Travels* hardly ranks among the best. It does, however, display many of the characteristics that distinguish the type. Most guidebooks are of less interest intrinsically than they are as historical or sociological indicators. For example, the very existence of a guidebook implies the existence of a “tourist”—someone with leisure and funds to pursue an activity not related to supplying his daily needs. The ostensible purpose of the *Travels* was to guide those on pilgrimage to religious sites in the Holy Land and beyond. Though many in the fourteenth century may have sinned mightily, few had the means or opportunity to atone so thoroughly. However, manuals for pilgrims were some of the earliest guidebooks. The *Travels* was extremely popular and underwent numerous translations,<sup>6</sup> but its fascination lies not in its worth as a guidebook but in its portrayal of the astonishing monsters and marvels to be

met with in foreign lands—the men with heads beneath their shoulders who reappear in Raleigh’s account of Guiana (see note 4), people with heads of dogs (complete with bark), the bountifull land of Prester John, the people with but one huge foot which they hold aloft to shade themselves while resting and more, much more. There are notations of distances between cities and outlines of alternate routes as in any guidebook but the delight of the *Travels* lies in the mythical not the real information that it contains.

There were no Baedekers because few traveled, as did Thomas Coryat in the sixteenth century, for enjoyment.<sup>7</sup> When they did, it was without benefit of marked routes and handy lists of monuments. Celia Fiennes, at the end of the seventeenth century visited extensively with friends and family throughout England and even beyond the pale to Scotland and Wales. Presumably, she relied on them for directions since it was not until 1697 that a law ordaining signposts on roads was passed.<sup>8</sup> The classically trained tutor sent with young noblemen on the Grand Tour probably learned through bitter experience the galleries and monuments to which his charges were to be exposed. But early travel was literally travail, a physically uncomfortable activity accompanied by fear of both the known and the unknown perils of the journey. The earliest travelers—minstrels, missionaries, mendicants or merchants—journeyed as a necessity of their calling and, though they and their tales were objects of interest and curiosity, relatively few of their hearers would willingly risk the vicissitudes of the road.

The guidebook emerged as a response to changes both in attitudes toward travel and in the physical conditions and economics of the journey. These factors were inter-related and development and change in any one influenced the others. Improvement in roads and accommodations and their policing and supervision made getting from one place to another a less uncomfortable and dangerous

undertaking. The growth of a class with money and time to spend on travel encouraged improved conditions. Entrepreneurs, from gondoliers in Venice to merchants in Jerusalem with a large supply of left-over fragments of the True Cross, realized the value of this new source of income.

As early as the end of the sixteenth century, young English noblemen were sent to travel on the Continent at the end of their formal schooling. Destined in the nature of things to govern the country and to shape international policy, it behooved them to know something of the countries with which they would treat. Under the guidance of a mentor, they traveled through France and Italy on the Grand Tour, meeting their French and Italian counterparts, viewing public works, watching ceremonies, looking at shipyards and, regrettably, betraying hospitality by acting as spies for their government. They might, in addition, visit ruins, sketch vistas and copy inscriptions.<sup>9</sup> Perhaps nothing so completely separates the tourist from the native or the traveler by necessity than the veneration of historical sites. To those who for ages had frugally re-used the beautifully chiselled stones of Greek or Roman ruins to shore up their own houses, the interest of the tourist in the preservation of fallen buildings must have seemed more than slightly mad.

As the eighteenth century ended, spying was no longer an adjunct of the Grand Tour but travel had come to be considered an educational activity and, moreover, a serious one. One did not travel to get away from it all but to learn more about it. Many of the newly rich and newly leisured, lacking the traditional education of the upper classes, strove to amend their deficiencies by travel. The guidebook was a necessary tool and reflected the solemn diligence of their methodical approach to the wonders of foreign lands. It told them not only what they could but what they *should* see and experience for

maximum benefit. Baedeker began publishing his series of guides in 1829 and soon his name was a synonym for "guidebook." He introduced a system of rating both attractions and accommodations and himself visited the areas covered by his guides and awarded the ratings. Until the innovation in mid-century of the tours of Thomas Cook the Baedeker was indispensable to the inexperienced but eager traveler.

Ultimately, changed conditions and attitudes contributed to making travel fashionable. Because travelers obviously could afford to spend time and money on pleasure and would return from the journey "broadened" by the experience, travel became a symbol of status. The early travelers by necessity—the government agent, the diplomat, the merchant—were joined by the wealthy for whom travel was a social exercise and by frowning note-takers plodding purposefully around tombs and tumuli. Of more significance, however, to the development of the literature of travel was the emergence of the figure of the permanent wanderer, the professional traveler.

Fashions and status symbols, however, lose their value as they become less exclusive. As more and more people clutching Baedekers thronged the world's cultural, historical and recreational centers, a curious reversal took place "Bright young things" began to separate themselves from the earnest bourgeoisie by *avoiding* those havens of culture found in the pages of Baedeker. In the late eighteenth and much of the nineteenth century, most who wrote of their travels scrupulously reported the number of steps at Lourdes or windows at Versailles. As time passed, however, an increasing number of travel books appeared with introductory disclaimers stating that the author would not dream of insulting the reader's intelligence by offering anything resembling a guidebook stuffed with mere dull facts. By implication, both writer and reader shared the assurance and independence of settled

incomes or secure positions in society and were absolved from the grim necessity of being broadened.<sup>10</sup>

The useful guidebook is, of course, still with us. The classic Baedeker was followed by Murray, Michelin and countless others and by those publications which echo its humble and utilitarian origins by advising the traveler on what can be seen and done for a minimum daily expenditure. These are the most fleeting of an ephemeral form. When economics—changes in prices or rates of exchange—make it impossible to see Europe for a dollar a day, wholesale revisions raising the ante to five, ten or fifteen dollars render the existing publications useless.

Like the explorers' records, guidebooks intend objectivity and factual accuracy. There is, certainly, selection of detail and even an occasional negative judgement but the selections and judgements are more likely to reflect the temper of the time than the impressions of an individual traveler. Though contributing to an understanding of the social and economic aspects of the history of travel and, thus, to social history generally, the guidebook—with few exceptions such as E. M. Forster's *Alexandria*<sup>11</sup>—has never attempted to be and has never been accused of being literature. It is the antithesis of the personal travel record.

The disclaimer, sometimes teetering on the edge of the arch and coy, became a convention of the personal record. The introductory apologia, familiar as a conceit of other genres since the Renaissance, appeared somewhat earlier. If the journey served no obviously useful purpose and the record could not be justified as educational, the apologia served to excuse what might seem a frivolous exercise. Ill-health might be adduced as the reason for the journey and the insistence of friends the reason for publication. In the late nineteenth century, for example, Isabella Bird Bishop journeyed throughout the world. In Indochina, the

Rockies, Afghanistan, she traveled with daunting stamina in or on every mode of conveyance known at the time including horses, camels, donkeys and her own feet. Her doctor had prescribed travel for her delicate health. Having, at age seventy, ridden a thousand miles through Morocco, she died, no doubt delicately, at seventy-three.

It is the diffidence of the apologia (not, incidentally, a characteristic of the numerous works of Bishop) that is significant in the development of the literature of travel. It defines a period of transition from the informational and utilitarian to the personal and subjective records. It signals the tentative entrance of the individual voice—though only at the urging of friends. It is a further step toward the travel record which, in Lawrence Durrell's phrase, evokes a "spirit of place."<sup>12</sup>

In 1844, in his introduction to *Eothen*, Arthur Kinglake defended his approach in a wry disclaimer which indicates the broad conventions of the personal travel record. He writes, ". . . the book is quite superficial in its character. I have endeavored to discard from it all valuable matter derived from the works of others. . . . I believe that I may truly acknowledge, that from all details of geographical discovery or antiquarian research—from all display of 'sound learning and religious knowledge'—from all historical and scientific illustrations—from all useful statistics—from all political disquisitions—and from all good moral reflections, the volume is thoroughly free. . . . but it is true in this larger sense,—it conveys, not those impressions which *ought to have been* produced upon any 'well-constituted mind,' but those which were really and truly received at the time of his rambles by a headstrong and not very amiable traveller, whose prejudices in favor of other people's notions were then exceedingly slight."<sup>13</sup>

The development of the personal record implies an audience receptive to a subjective



and interpretative—in other words, literary rather than informational—record. It implies, further, a knowledgeable audience of readers who respond to the record as well as the event, taking pleasure in the author's communication of a spirit of place though the place is one they have no intention of visiting or, perhaps, one that no longer exists. The personal and subjective nature of these accounts is strikingly apparent, for example, in Arthur Symonds' re-creation of his experience of Arles. Other accounts stress the blinding sun, the intensity of color, the heat or the mistral which drives the unwary insane. Symonds was impressed by a road lined with Roman tombs and describes Arles as a mausoleum covered by the dust of centuries which deadens sound, obscures outlines and mutes color—a description in which there is no hint of the sun drenched riot of Van Gogh's Arlesian canvasses.<sup>14</sup>

It is true that the intense enthusiasms of some of the early explorers result in vivid images. Accounts of discovery in North and South America often communicate an almost poetic sense of a world new-made and awesome in its abundance. In their heightened imagery, these accounts become literary as well as informational but the conveying of facts remains their main objective.<sup>15</sup> The fully developed personal record, however, is the product of a traveler who is as much, if not more, a writer as he is a wanderer and who may journey with the express purpose of then writing of his travels. In establishing a sense of place, the author endeavors to communicate an emotional experience by enumerating and describing those details that have contributed to the impact of the place upon the person. A journey of a hundred miles remains a hundred miles in Baedeker or Michelin. In the personal travel record it may seem to stretch forever or to be over much too soon. Readers are not concerned, in reading the personal account, with the actual mileage but respond, rather, to the writer's description of the boredom of a seemingly unending

road, perhaps, or his perception and re-creation of the poignancy inherent in the fleeting nature of all journeys.

An increase in the personal statement marks the development of this type of travel literature. Where Baedeker may say, "From this spot can be seen . . .," the author of the personal record says, "When I saw this, I reacted thus. . . ." The object of scrutiny—a person, an activity, a flower, a backstreet—may never appear in the pages of a guidebook. (There are, however, numerous titles which begin "Little Known . . ." or "Unnoticed . . ." or "Undiscovered . . ." which are guidebooks in the strictest sense.) The object becomes image—the single *memento mori* of Symonds' description of Arles or the more complex structure of Robert Louis Stevenson's *The Amateur Emigrant*. As Stevenson travels further from Scotland on his way to California, the objects and situations he describes reflect his increasing alienation and the journey becomes a metaphor of the emotional and spiritual trauma of movement into the unknown.<sup>16</sup>

The writer of the personal record may scoff at those attractions which earlier travelers felt compelled to visit and extol or he may find in them a significance quite different than that which is assumed to be their historical or cultural value or he may simply ignore the usual or expected sites. In *Iberia*, James Michener explains that there is no description of the city of Logroño because his energies were spent, so to speak, in gathering information for an impassioned description of the various wines of the region. He tastes one from central Rioja, then one from lower Rioja. Then, "A patriot from upper Rioja now proposed, 'Our wine is the one that travels well, and when you're in a foreign country and want a breath of Spain, order a bottle from our region.'" Michener concludes, "I have only the kindest memories of Logroño, and if I cannot remember a single monument in the city or any public works, in Rioja wine I found a friend whose dark red countenance

and crisp syllables evoke for me the spirit of pilgrimage wherever I encounter him."<sup>17</sup>

In records such as those of Fiennes or Bishop, the object of their scrutiny remains firmly rooted in actuality. They may be highly individual in their judgements and in that sense personal, but they are commentaries rather than evocations. Wales, for example, sent George Borrow<sup>18</sup> (and others) into raptures but elicited the following from Fiennes. ". . . from thence my Relation carry'd me to Holly Well (Holywell) and pass'd thro' Flint town which is the shire town, 5 mile from Harding; its a very ragged place many villages in England are better, the houses all thatched and stone walls but so decay'd that in many places ready to tumble down; there was a Town Hall such a one as it was. . . ." And she continues, ". . . they speake Welsh, the inhabitants go barefoote and bare leg'd a nasty sort of people. . . ."<sup>19</sup>

Though there may also be a wealth of factual information in works such as Michener's, images like Rioja wine and a Romanesque church on a treeless plain communicate the traveler's experience of locale and evoke the spirit of place. If it can be said that in these accounts the object becomes image, in works such as Stevenson's *An Inland Voyage*, the experience becomes metaphor. Stevenson describes the exhilaration he felt canoeing on the Oise in flood and then says, "If this lovely and beautiful river were, indeed, a thing of death's contrivance, the old ashen rogue had famously outwitted himself with us. . . . If a man knows he will sooner or later be robbed upon a journey, he will have a bottle of the best in every inn, and look upon his extravagances as so much gained upon the thieves. And above all, where instead of simply spending, he makes a profitable investment for some of his money, when it will be out of risk of loss. So every bit of brisk living and above all when it is healthful, is just so much gained upon the wholesale filcher, death. We shall have the less in our pockets, the more in our stomach,

when he cries stand and deliver. A swift stream is a favourite artifice of his, and one that brings him in a comfortable thing per annum; but when he and I come to settle our accounts, I shall whistle in his face for these hours upon the upper Oise."<sup>20</sup>

At the furthest remove from the commentaries of Fiennes is William Beckford's *Dreams, Waking Thoughts and Incidents* in which the actualities of the journey are almost completely subordinated to the singular mental experience of the writer. Unfortunately, Beckford's reflections are neither broad nor deep and are muddy enough to obscure almost all sense of place. These are not unusual faults of this type of extremely personal record. His descriptions, though profuse, lack specificity but his imaginative daydreams are lovingly detailed. Nothing, however, in his vague descriptions of town or terrain seems sufficiently unusual to warrant the speculations they engender. The experience does not grow into metaphor; it remains simply an excuse. The relationship of statement to object seems purely fortuitous. His account may be so completely divorced from the actuality of place that it ceases to be description and becomes vision. "It was a mild, genial evening; every mountain cast its broad shadow on the surface of the stream. . . . All were asleep except a female form in white with glow-worms shining in her hair. She kept moving disconsolately about; sometimes I heard her sigh, and, if apparitions sigh, this must have been an apparition. Upon my return, I asked a thousand questions, but could never obtain any information of the figure and its luminaries."<sup>21</sup>

In their handling of details of place, these examples represent four broad types of the personal travel record. In Fiennes, the details remain fact. In Michener, they become image, in Stevenson, metaphor and in Beckford, excuse. An attempt to recognize and define categories such as these (with a constant awareness that they grade one into the other and have no firm boundaries)

is a necessary first step in developing a critical system which will aid in further analysis and understanding.

Because travel literature, like the mystery novel, is defined by subject rather than form, criticism often concentrates on the journey or the locale, on the "what" rather than the "how" of the record. Rather than analyzing the intention of the record or the method by which the writer reconstructs the journey for the reader, this type of criticism at its worst can degenerate into cavail over where the traveler did or did not go or what the critic thinks should have been seen and was not. Superficial criticism of this nature also encourages the undertaking and subsequent recording of specialized and sometimes peculiar journeys. Paul Theroux's train rides and Anthony Smith's ballooning are examples, and good ones, by and large, of this type of specialized journey.<sup>22</sup> One would not be surprised, however, to find among titles of this type something like "I Journeyed from Boise to Butte on Hands and Knees Pushing a Peanut with My Nose" and to discover within its pages much about ant hills and nothing about the Rockies.

Figures of speech based on the traveler and the journey are ubiquitous in fiction and poetry. Life seen as a journey from birth to death or death seen as a journey from which there is no return are examples so ubiquitous, in fact, that they have lost much of their metaphorical character. Dip into allegory or fantasy, for example, from *The Fairie Queen* to *The Lord of the Rings* and there will be the hearty welcome of "mine host" at the inn, the threat of the highwayman, the solace of companions of the road, the loneliness of a stranger in a strange land and the fear of a mis-step that will plunge the pilgrim into the Slough of Despond. Figures of speech such as these, from the sparrow's flight through the warmth of the great hall that converted an English king to Christianity to the "carry me home" and "lonesome road" complaints of popular songs need no

exigesis. They are immediate in their impact and economical in their execution. The development and application of a critical system or rhetoric that focuses attention on the travel record as a literary production will enhance not only the understanding and appreciation of travel literature but also those works of fiction for which it has supplied the raw material of metaphor and image. As the title of this article suggests, even the lowly guidebook may provide material for image-making.<sup>23</sup>

#### NOTES

<sup>1</sup> *The Itinerary of Rabbi Benjamin of Tudela*, ed. Marcus Nathan Adler (New York: Philip Feldheim, 1966).

<sup>2</sup> *The Journals of Lewis and Clark*, ed. Reuben G. Thwaites (New York: Dodd, Mead and Co., 1904).

<sup>3</sup> Lawrence C. Wroth, *The Voyage of Giovanni de Verrazzano* (New Haven: Yale Univ. Press, 1970).

<sup>4</sup> In his first voyage to Guiana, Sir Walter Raleigh was convinced of the potential riches to be plundered from the city of Manoa (the El Dorado of the Spaniards) by the revelations of a native, Topiawari, and the captured Spanish governor of Trinidad, Berreo—neither of whom, for different reasons, was a disinterested informant. More astonishing, however, was his credulous acceptance of the existence of "a nation of people whose heads appear not above their shoulders; which though it may be thought a mere fable, yet for mine own part I am resolved it is true, because every child in the provinces of Arromaia and Canuri affirm the same. . . . Such a nation was written of by Mandeville, whose reports were held for fables for many years, and yet since the East Indies were discovered, we find his relations true of such things as heretofore were held incredible. . . ." Sir Walter Raleigh, "The Discovery of the large, rich and beautiful Empire of Guiana," in Richard Hakluyt, *Voyages and Discoveries*, ed. Jack Beeching (Harmondsworth: Penguin Books, Inc., 1972), p. 402.

<sup>5</sup> *Mandeville's Travels*, ed. M. C. Seymour (Oxford: Oxford Univ. Press, 1967).

<sup>6</sup> On the basis of an English translation, "de Mandeville" was known as "the father of English prose" until it was discovered that the original manuscript was written in French.

<sup>7</sup> *Coryat's Crudities* (Glasgow: J. MacLehose and Sons, 1905).

<sup>8</sup> *The Journeys of Celia Fiennes*, ed. Christopher Morris (London: The Cresset Press, 1949).

<sup>9</sup> Geoffrey Trease, *The Grand Tour* (New York: Holt, Rinehart, Winston, 1967).

<sup>10</sup> This attitude toward the tourist was so prevalent that it needed no explanation when it appeared in popular literature. For example, "She liked travel but dreaded sight-seeing and would retain memories as sharp as pencil drawings of unimportant details—a waiter, a group of sailors, a woman in a bookstall." describes a character in Ngaio Marsh's mystery novel, *A Wreath for Rivera (Photo Finish & Two Other Great Mysteries*, New York: Nelson Doubleday, Inc., n.d.).

<sup>11</sup> *Alexandria: A History and a Guide* (Garden City: Doubleday and Co., 1961).

<sup>12</sup> *Spirit of Place*, ed. Alan G. Thomas (London: Faber, 1969).

<sup>13</sup> *Eothen* (Lincoln: Univ. of Nebraska Press, 1970), intro. p. xvi.

<sup>14</sup> "Arles II," *Wanderings* (London: J. M. Dent and Sons, 1931), pp. 23-27.

<sup>15</sup> Pierre Esprit Radisson, one of the first to travel on Lake Michigan in the mid-seventeenth century, writes, "We embarked on the delightsof lake of the world. . . the country was so pleasant, so beautiful, and fruitful that it grieved me to see that the world could not discover such enticing countries to live in. This I say because the Europeans fight for a rock in the sea against one another, or for a sterile land and horrid country. . . Contrariwise, these kingdoms are so delicious and under so temperate a climate, plentiful of all things, the earth bringing forth its fruit twice a year, the people live

long and lusty and wise in their way." *The Explorations of Pierre Esprit Radisson*, ed. Arthur T. Adams (Minneapolis: Ross and Haines, Inc., 1961), p. 91.

<sup>16</sup> *The Amateur Emigrant in From Scotland to Silverado*, ed. James B. Hart (Cambridge: Harvard University Press, 1966). See also Meredith E. Ackley, "The Creative Artist as Traveler: Robert Louis Stevenson in America," *Transactions of the Wisconsin Academy of Sciences, Arts and Letters*, vol. 69 (1981), 87-92.

<sup>17</sup> *Iberia: Spanish Travels and Reflections* (Greenwich, Conn.: Fawcett Publications, Inc., 1968), p. 861.

<sup>18</sup> *Wild Wales* (New York: W. W. Norton, 1955).

<sup>19</sup> Fiennes, *op. cit.*, pp. 179-181.

<sup>20</sup> *An Inland Voyage* (New York: Charles Scribner's Sons, 1902), pp. 108-109.

<sup>21</sup> *Dreams, Waking Thoughts and Incidents*, ed. Robert J. Gemmett (Cranberry, N.J.: Fairleigh Dickinson Univ. Press, 1971), p. 86.

<sup>22</sup> Paul Therroux, *The Great Railway Bazaar: By Train Through Asia* (New York: Ballantine Books, 1976).

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Anthony Smith, *Jambo: African Balloon Safari* (New York: New American Library, 1963).

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## TWO WISCONSIN LIBRARIES: 1854-1954

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This is the story of two publicly supported libraries: the general library of the University of Wisconsin, and the library in the State Historical Society of Wisconsin. More specifically this is the story of how two libraries sought a *modus operandi* in the building of library collections. For them, an agreement on policy could not be avoided. Being publicly supported, those responsible for acquisitions simply could not ignore each other. Mindless duplication was infeasible, not only on economic grounds, but in order to avoid the charge of squandering public monies.

Where a state-supported society and university are in separate cities, the need for cooperation is lessened. Likewise of significance, even when the two are in the same city, is the scope of the society's acquisition program: the less ambitious the program, the less is the need for cooperation. Working out a coordinated policy is relatively simple when a society is content to make its own state its exclusive area of interest. In Wisconsin, even after extensive retrenchment, the acquisitions program of the society is exceptionally comprehensive. Unlike publicly supported societies that limit themselves to the region of which they are a part, the Wisconsin society took on a greater responsibility.

In explaining these differences among historical societies a leading author has written: "Whether support comes from private citizens or legislatures, State historical societies develop their own different approaches and characteristics. These depend in part upon location, the relative age of the State, the nature of the inhabitants, and the extent of their resources; they depend also to a considerable degree upon the personal interests

and abilities of the individuals who have shaped them in critical periods of their careers."<sup>1</sup>

Wisconsin, especially among state-supported societies, is different. Lyman Draper, its first director, made a difference. Furthermore, among this kind of society, Wisconsin got an early start. A society founded in the 1850's was likely to be more ambitious than a society that got its start in the eighties or nineties. In the nineties, the imperatives of fiscal support and the growth in book production served as a warning to those inclined to be overly ambitious.

For the University in Madison the Society was both a problem and a blessing. Struggling to support its variety of activities, the youthful nineteenth century University was troubled by the failure of its library to keep pace with those in comparable universities. Nearby, was the Society—eager to serve the widest possible constituency, including university students and professors. What was the University to do? Should it, or could it, challenge the propriety of the Society's wide-ranging acquisitions policies? Or should it remain quiet, hoping that its energetic neighbor would successfully carry out its self-appointed responsibilities in a manner suitable to the needs of a university?

### *A Cavalcade of Books (1954-1956)*

In the years 1954-1956 the Historical Society transferred a large number of books and periodicals to the new Memorial library of the University of Wisconsin. Most of the volumes dealt with British and European history; others with Central and South America. Included also were a considerable number of titles by and about Shakespeare,

and a large and unusual collection on history, science and theology that had once been the property of a Dutch minister.

Two widely divergent estimates have been made of the number of volumes transferred. Benton Wilcox, then the Society's librarian, put the number at 50,000 *volumes*. Clifford Lord, sometimes Director (now deceased), set it at 100,000 *titles*.<sup>2</sup> Wilcox, employing an accounting procedure common among librarians, regarded a book of pamphlets as a single volume. Lord, wanting to account for the pamphlets separately, estimated that the total number of pamphlets transferred was equal to the combined total of books, periodicals and bound documents. Unfortunately, the proportion of pamphlets among the British publications was probably smaller than among those relating to the United States. Consequently, because the number of pamphlets cannot be estimated with sufficient accuracy, Wilcox's count of 50,000 volumes (inclusive of pamphlets) must be taken as more reliable.

Two other questions arise in connection with this transfer. How did it come about that an American historical society had acquired a large body of materials on foreign history and literature? And why, after many years of ownership did the Society in the mid-twentieth century relinquish its title to it? Some answers to these questions are to be found in the sections that follow.

*Two Giants in the Pursuit of  
Research Materials: Lyman Draper and  
Reuben Gold Thwaites, 1854—1913*

Two more eager and energetic accumulators of library research materials than Draper and Thwaites would be difficult to imagine. Both held the title of Secretary to the Historical Society, Draper in the years 1854-1886, and Thwaites from 1887 to 1913. Draper's biographer has written that he "wanted all American history—and any other kind of history."<sup>3</sup> To assist him in this task, Draper had Daniel Steele Durrie, who

for about 37 years gave almost undivided attention to augmenting the Society's library. As has been written of the pair, they "worked together with one heart and hand in many an endeavor. . . ."<sup>4</sup> It was Durrie who supervised the printing of the library's catalog that appeared in 1873; one needs only casually to inspect this volume to see that Draper had more in mind than American history. With respect to foreign history he was drawn strongly to Great Britain and her colonies, so much so that he wrote a rationalization of his conduct:

"Whatever relates to English history, her colonies, her primitive manners and customs, and the genealogy of her families, has an intimate relation with American history and habits of thought. In all our American history there is so intimate a blending of our own with the annals of the fatherland, that our growth and progress cannot be properly delineated without constant reference to these blending relations."<sup>5</sup>

Reaching beyond American and British history, and indeed, beyond history itself, was the Society's acceptance of the Tank collection. Consisting of 4,812 volumes and 374 pamphlets, it was rich in works of science and theology as well as in history. Gathered by her father, a minister in Holland, and presented to the Society in 1868 by Mrs. Otto Tank of Howard, Wisconsin, this was the kind of acquisition in which Draper could exult.<sup>6</sup> Nor was he swayed negatively by the foreign languages in which the books appeared. Said Draper, with respect to these languages, the Society must be ready to serve "the wants of our citizens of all nationalities."<sup>7</sup>

In the same year, Draper was able to announce the purchase of 37 volumes of newspapers, published, in part, in Capetown (South Africa), Melbourne, Liberia, China, Smyrna and Constantinople.<sup>8</sup> Then in 1873, the Society acquired an esteemed Halliwell edition of Shakespeare's works in 16 folio volumes.<sup>9</sup>

Thwaites, too, deserves his reputation as a great but sometimes indiscriminate collector of research materials. In quantitative terms alone, his accomplishments were impressive; in 13 years he managed to double the size of the Society's library, and then trebled its size after 26 years in office.<sup>10</sup> Better organized than Draper, Thwaites proceeded to systematize the acquisition process; and then in his methodical way, by purchase, by exchange and by begging, he continuously enriched the Library's resources. One writer claims that in the era of Thwaites, about 75 percent of the accessions came as gifts.<sup>11</sup>

No more than Draper, did Thwaites turn down opportunities to grasp sources that were unrelated to American history. Regretfully, however, he was forced to report that apart from material on English history the Society's library possessed "few sources of information for *original* study." In the absence of the requisite funds, with respect to original sources "we cannot venture far beyond our old-time speciality of Americana."<sup>12</sup> Even so, he made the best of his opportunities. A "monumental" work on animal locomotion by Muybridge is but one example; of the works of Shakespeare, in 1900 the Society possessed 1,000 volumes; a vellum manuscript copy of the *Book of Hours* was the prized accession of 1888;<sup>13</sup> at a price of \$265, paid by a donor in 1890, the Society became the owner of *Monumentos del Arte Mexicano Antiguo*, edited in three large folio volumes by the "famous" Mexican scholar, Antonio Penafiel.<sup>14</sup> In 1912, the year prior to Thwaites' death, the Society acquired funds for the purpose of establishing a Hollister Pharmaceutical Library—despite the existence of a well-established library in the University's School of Pharmacy.<sup>15</sup>

No matter how far afield, gifts were difficult to refuse; as for purchases, Thwaites recognized that in order to maintain its reputation as a library of history, the Society would need to arrange with the University for a division of interests. Logically, he

argued that such an arrangement would be facilitated if the two libraries were to come together in a single building.<sup>16</sup> So long as the Historical Library continued in the State Capitol building, and the University Library in Assembly Hall (later Music Hall), the process of rationalization would be delayed. Even before the two libraries were united in 1900 in the first unit of a magnificent structure at the foot of Bascom Hill, Thwaites conceived of a division of responsibility in which the University would acquire materials in literature and the general sciences, while the Society would develop a "department of History."<sup>17</sup> But as will be seen, his definition of history was worthy of Draper.

In retrospect, several alternatives were available to those responsible for the development of the Society's library. One choice, the narrow one, was to limit the materials to the history of Wisconsin; most readers of this article will no doubt be amazed to learn that this narrow alternative seemed to be in the minds of those who wrote the Society's constitution of 1854.<sup>18</sup> An alternative was to embrace the history of the Middle West, or the whole of the United States. Yet, as already seen, to Draper and Thwaites these alternatives were too confining, and this no doubt explains the greater latitude permitted in the constitution of 1897. To fit his style, that constitution made legitimate what Thwaites desired, namely, to cover the whole of history, with special attention to Wisconsin and to the "Middle West."<sup>19</sup>

#### *The University's Reaction to Draper and Thwaites*

In 1900 when the two libraries jointly occupied the new building on the lower campus, the University library claimed 75,000 volumes and 25,000 pamphlets. The Society at this time estimated its holdings at 114,572 volumes and 112,374 pamphlets.<sup>20</sup> How is this difference in resources to be explained? To begin with, the Society was far ahead of the University in the persons of Draper and

Thwaites, whereas those responsible for the University library prior to 1890 were professors (with clerical assistants) who attended to library business on a part-time basis. Furthermore, the University had other problems to which it assigned a higher priority. Though there was no intention to ignore the library, the Regents and the administration could not fail to recognize that the Society's library in the State Capitol building was ably serving both students and professors. In 1891, the Society's Executive Committee was told that "students and professors now form a large proportion of our readers. . . ." <sup>21</sup>

This is not to imply that the University had no interest in its library. Certainly President Adams made no secret of his desire to improve the standing of the library in academic circles. As evidence, there are the remarks he made before the Regents in 1897 in which he spoke of the relative affluence of Michigan and Cornell in library holdings. "I fear," said Adams, "the members of the board are tired of hearing me on this subject . . ." <sup>22</sup> Nor was the University's first full-time librarian (appointed in 1890) quiescent. Said he to the Regents: "While progress has been made, the library is still greatly inferior as a working library to those of many American universities with which the university of Wisconsin is proud to compare herself in equipment and work." <sup>23</sup> All to little avail. Despite the complaints of Adams, the protests of the faculty and students, and the pleas of the University Librarian, the library in Wisconsin continued to lag behind those found at comparable universities. <sup>24</sup>

*The Delineation of Acquisitions Policies, 1895-1950*

Even before the new building was jointly occupied in 1900, the two libraries undertook informal agreements. As Thwaites revealed in 1897, for the past "two or three years" the libraries had been guided by informal stipulations by which the University undertook responsibility for science, tech-

nology, philosophy, philology, education, the fine arts, and belles lettres (except for Shakespeare and old English drama). For its part, the Society continued purchases in its established specialties of history, genealogy, travel and description, economics, sociology, Shakespeare, old English drama, and newspapers. Admittedly, according to Thwaites, there were aspects of the agreement that left open "many complicated exceptions" which in the future would need to be addressed. <sup>25</sup>

Further clarification was achieved by 1907, in a document in which the Society declared its areas of interest to be North, Central and South America, the United Kingdom, and the British colonial possessions in the western hemisphere. In recognition that all aspects of history in these areas would be too ambitious a program, the Society agreed that on the subject of education it would concentrate on materials relating to the United States; on immigration, the Society would not go beyond the United States and Great Britain; American labor materials were to be restricted to specific labor unions, the general topic of labor to be left to the University. Priority of interest in agriculture was conceded to the University's school of agriculture. With respect to anthropology, the University was to be responsible for white Americans, while the Society would concentrate on works relating to American Negroes and Indians. All municipal public utilities, except those in American and Canadian cities, were declared to be within the University's purview. In church history, the Society limited itself to the United States and to the Church of England.

Despite these retreats, the Society's library was left with a considerable mandate. Except for subjects regarded as having only minor interest, it was still responsible for the history, broadly interpreted, of the United States and Great Britain. Of materials on Central and South America it still had much to acquire, as for example, in politics, biography, genealogy, travel accounts, and



general descriptive geography.<sup>26</sup> In fact, looking ahead some thirty years, it was to become clear that the Society had staked out a claim too great for its financial resources.

With the arrival in 1941 of Edward Alexander, the new Director of the Society, a fresh look at the library's problems was guaranteed. Affable, yet energetic, among his many problems Alexander recognized that there was one that he might in a relatively short period of time move in the right direction. Quickly, he saw that his library's book budget was hopelessly incapable of meeting its wide-spreading acquisitions program. Surprisingly, that budget for 1941-1942 was less supportive than it had been ten years earlier.<sup>27</sup> Acting in concert with the University Librarian, two consultants—the historian, Dean Blegen of Minnesota, and the librarian, Metcalf of Harvard—were brought to Madison in 1943 to offer advice pertaining to acquisition policies and to the problems of space.

On acquisitions, the consultants recommended that the Society limit itself to American history, “broadly” defined. They found that in American history the Society's library was losing ground, and that the situation with respect to Great Britain and Latin America was even worse. As for the University Library, in order to take on new responsibilities, it would require a doubling of its book budget.<sup>28</sup>

Determined to accept the advice of the consultants, Alexander made a straightforward recommendation to the Executive Committee of the Society's Curators. Clearly, he pointed out, the Society's library was attempting much more than it could manage. The obvious solution was for the library to cut loose those of its responsibilities that could with propriety be turned over to the University. Given the inadequacy of funding, how could the Society justify the ambitious course set by Draper and Thwaites? The book fund, which stood at \$10,700 in 1928-1929, had now shrunk to \$6,000. Moreover, Alexander had more than

the library on his mind; it worried him to have no funds for the museum.<sup>29</sup>

Responding to the suggestions of the two consultants, and to the importunities of Alexander, the Curators agreed to the change in acquisitions policy, and when the Regents of the University added their approval, the librarians of the two organizations began to hammer out the details of a written program.

*The Memorial Library and the American Historical Research Center, 1950-1954*

From the viewpoint of dividing the responsibility for collection building the year 1950 was marked by two related events. One was the passage by the State legislature of an appropriation for the University for an independent library building. The other was the announcement by the Society of the creation of an American Historical Research Center.

When the two consultants (Blegen and Metcalf) arrived in 1943, storage space had been a critical problem for both libraries for about twenty years. After the original building had been extended in 1913, each library had its own bookstack in a U-shaped structure. Without success the University had, in 1925, sought funds for an independent library building. In their report of 1944 the consultants made suggestions designed to enable the two libraries to remain in the same building: for newspapers, they advised that a separate structure should be constructed; and to provide supplementary shelving for books they recommended a T-shaped addition to the existing building.<sup>30</sup> These recommendations met with little favor. The Society feared that their library would soon be regarded as merely another agency of the University.<sup>31</sup> Within the University there was strong support for an independent structure.

From that moment the University moved with determination towards legislative approval of a new library building. Within a legislative appropriation for the University

passed in 1945, the Regents set aside a portion for a library, but this money had to be diverted elsewhere within the University because the State Architect failed to move expeditiously with the preparation of the necessary drawings.<sup>32</sup> Finally, a special library appropriation was approved in 1950 to honor those Wisconsin citizens who had seen military service.

Professors in the American section of the History Department were troubled by the promise of a separate University library. To some of these professors it was unpalatable, for example, to divorce books on American history from those on American literature. Having these books in the same library building, as they had been since 1900, was a convenience that they preferred not to lose. Of interest, therefore, to these professors was the announcement in 1950 by the Historical Society of the formation of an American Historical Research Center.<sup>33</sup> If acceptable to the University—and this is what led to considerable debate—those books in the University library relating to American culture would not be transferred to the soon-to-be constructed Memorial Library, but would remain behind in the library of the Historical Society. More explicitly, this meant that the University's books in American literature, economics and political theory (among others) would be affected. Though requiring a considerable outlay in funds, both for books and additional study facilities, the Director of the Society was confident that he could win the support of the legislature in favor of the new Center.<sup>34</sup>

Opposition to the Society's proposal was immediately expressed by the Department of English,<sup>35</sup> and soon after when the University Library Committee made a canvass of other departments it became clear that except for the History department, disapproval was overwhelming. Therefore, in the autumn of 1950, the Director of the Society was informed that "with a new University Library in the offing it is impossible to per-

suade the faculty of the wisdom of transferring to the Society new fields for purchase."<sup>36</sup>

This is a story with a sequel. When the Joint Committee of the two library committees met on the 16th of January, 1953, it was told that a majority of the History department now wanted the books of the Society to be transferred to the Memorial Library in accordance with their previously expressed desire to keep all books on American culture together. As those in attendance knew, the Curators were unlikely to accept this suggestion, and the chairman of the History Department himself said that the main purpose was to have his department's wish made part of the record.<sup>37</sup>

In his *Clio's Servant*, Clifford Lord wrote that the University had missed an outstanding opportunity in not accepting the Society's plan for the American History Research Center. As he expressed it, "the great vision" thus offered the University community was not to be realized.<sup>38</sup> Whether the opportunity would in practice have proven successful must remain a matter for conjecture. Realistically, in-so-far as it concerned the University, the proposal was doomed from the start. Not realized by Lord and by certain members of the History department was that within the University a transformation in attitude towards its library had come about. One element in the change in outlook was the prospect of the new library building. Additionally, three hundred thousand dollars had been raised in 1945-46 to acquire the heralded Thordarson collection. Consisting of about 11,000 titles representative of various aspects of Anglo-Saxon civilization, the purchase of this private library containing editions prized by connoisseurs served to convince the faculty that better days were surely ahead for its library.

Thus, with its new confidence in the future of the University library, the faculty in 1950 was sending an unprecedented message to the Society: no longer would it willingly surrender acquisitions that were normally the

province of a major research library. On the other hand, there was no disposition within the University to challenge the Society in those fields for which its library had become famous.

Once the University made known its opposition to surrendering its responsibility for the whole of American culture, there arose the need to end the delineation of fields of collecting that had been tinkered with since 1945. This task was completed in 1954, producing a document not significantly different from earlier versions.<sup>39</sup> Of the various stipulations made the most important was the Society's agreement to confine its area of interest to the region north of the Rio Grande, inclusive of Canada.<sup>40</sup> Cut loose were Great Britain and South and Central America. While including a number of details that do not require enumeration, some of the provisions found in the 1954 document are essential to an understanding of the degree to which the Society was reshaping its program to fit its pocket-book. Among the variety of concessions made by the Society some of the most important are as follows:

Literature—except fiction and essays by Wisconsin writers.

Economics—except materials on Wisconsin finance and production.

Banking, industry, railroads—as with Economics.

Anthropology—only as it relates to the area north of the Rio Grande.

Recreation—except in Wisconsin.

General periodicals.

Foreign newspapers.

Manuscripts—only those pertaining to American history.

#### *A Retrospective View*

For almost a century the University library danced to the tune played by the Wisconsin Historical Society. When Draper made the Society responsible for the whole of the United States, the University raised no protest. Likewise, with respect to Canada, Great

Britain, and Latin America. In other universities the need to forego foreign history did not arise. In other historical libraries, such as those in Minnesota and Ohio, because these did not claim more than state and region as areas for acquisitions, their neighboring university libraries were not required to ignore the whole of the United States.

Understandable, and even fortunate from the viewpoint of his successes, was the University's decision not to challenge Draper's program as it related to the history of the United States. Actually, the University could hardly have mounted a competing campaign, considering that during the whole of Draper's tenure the University had not appointed a full-time librarian. Less excusable, as the University moved into the 20th century, was its acquiescence with respect to historical materials on Great Britain and Latin America. On these subjects, because the Society's holdings were not exceptional, the University could with justice have offered to take over. Had the University library in the twenties or thirties been in possession of an adequate budget, would the Society have been willing to accept the offer?

Not until 1950, in connection with the proposal by the Society to inaugurate a comprehensive library of American civilization, was the University able to call its own tune. Now it was the Society that was in the weaker position by virtue of asking the University to surrender that which it already held. Unlike 1941, when the Society was anxious to absolve itself of responsibilities, the University in 1950 was determined not to give way as it had in the past.

Though it is true that scholars profited from the policies set by Draper and Thwaites, in the end both the Society and the University were forced to face the consequences. The Society, for its part, inherited a program it could not support. As the consulting team of Blegen and Metcalf reported, the Society's ability to collect research materials on the United States was impaired by the requirements of its extended acquisi-

tions policies. Years before Alexander called for a halt, the Society might have insisted that the University assume responsibility for areas outside the United States and Canada.

Nor did the University library escape unscathed. For this the Society could not be blamed; yet it is true that the strength of the Society's library made it possible for some University officials to argue that it was necessary to include the Society's collections when counting volumes on the University campus. That university libraries in other states could follow the same procedure seems not to have been taken into account. Actually, the situation was worse than they knew. For example, the library of the University of Minnesota, not the largest in the mid-West, had almost as many volumes in 1927 as did the two libraries in Madison combined, and by 1945 it had forged ahead.<sup>41</sup> Not until the fifties did the University of Wisconsin finally bestir itself in response to the need for more rapid growth.

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<sup>16</sup> On the campaign which led to the appropriation for the building occupied in 1900 see Vernon E. Carstensen, "Adventure in Cooperation," *Wisc. Mag. Hist.*, 34:95-99 (Winter, 1950).

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<sup>22</sup> Minutes of the Board of Regents of the University of Wisconsin, Record E, August 24, 1897, p. 39 (in University Archives).

<sup>23</sup> Biennial Report of the Board of Regents of the University of Wisconsin, 1910-11 and 1911-12, p. 275 (in University Archives).

<sup>24</sup> Merle Curti and Vernon Carstensen, *The University of Wisconsin, A History, 1848-1925* (2 vols., Madison, 1949) 1:652-655.

<sup>25</sup> *Proceedings*, 1898, p. 22-23.

<sup>26</sup> The document referred to is found in the Society's Archives, Series 678, Box 26, File 5.

<sup>27</sup> *Proceedings*, 1941, p. 29.

<sup>28</sup> The report of the consultants was reprinted in the *Wisc. Mag. Hist.*, 27:498-502 (June, 1944).

<sup>29</sup> *Ibid.*, p. 495-497.

<sup>30</sup> For the text of their report see the *Wisc. Mag. Hist.*, 27:498-502 (June, 1944). See also *Proceedings*, 1944, p. 493.

<sup>31</sup> Lord, *Clio's Servant*, p. 373-374.

<sup>32</sup> Minutes of the Board of Regents, December 1, 1954, in University Archives.

<sup>33</sup> Lord gives credit for the idea of the Center to the History department. See *Proceedings*, 1952, p. 48 and Lord, *Clio's Servant*, p. 435.

<sup>34</sup> See the minutes of the Library Committee of the Society, dated June 24, 1950 in Minutes of Proceedings, 6:32.

<sup>35</sup> Minutes of the Joint Library Subcommittee dated July 18, 1950 in Minutes of Proceedings, 6:33.

<sup>36</sup> Louis Kaplan to Clifford Lord, October 12, 1950 in the Society's Archives, Series 678, Box 26, File 5.

<sup>37</sup> Minutes of Proceedings, 7:10-11.

<sup>38</sup> Lord, *Clio's Servant*, p. 435-436.

<sup>39</sup> Minutes of Proceedings, 7:218-222.

<sup>40</sup> The relevant agreements are to be seen in the Society's Archives, Series 678, Box 26, File 5. See especially the material dated April 1 and September 15, 1945.

<sup>41</sup> Curti and Carstensen, *The University of Wisconsin*, 2:308-309. See also [Louis Kaplan], *Some Data Relating to the Library at the University of Wisconsin*, in University Archives, file 22/1/4.

# THEME AND SPEAKERS IN SHUMWAY'S "SONG OF THE ARCHER"

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With the publication of the fourth book of poetry, *Practicing Vivaldi* (La Crosse, Wisconsin: Juniper Press, 1981), by the Wisconsin poet, Mary Shumway,<sup>1</sup> a critical appreciation of some of her early work is in order. An examination of Shumway's early narrative poem, "Song of the Archer,"<sup>2</sup> can provide insights into her methods and themes.

The theme of the poem, suggested by frequent quotations from Yeats's "Sailing to Byzantium," is that life (or love) gives way to death, out of which something permanent (art) is reborn; this theme is articulated or evoked by the three principal speakers in the poem—the chorus, which acts as a kind of framing narrator; the archer-centaur Chiron, who narrates the main line of action; and the adult poet Chris, who, as a child, is the main character in Chiron's narration.

The first speaker is the chorus, represented in the text with roman type, the other two speakers being represented with italicized type. Though the chorus's is not the first voice we hear—Chiron's is that—it may be thought of as structurally the first voice since the chorus, providing a more general overview than the other two speakers, sometimes quotes Chiron and sometimes evokes rather generally the theme of the poem.

In the form of somewhat general commentary, the chorus refers to twin aspects of the theme, death and rebirth. Lines of the chorus towards the end of the poem, just after Chris has noticed that something has happened to her grandmother (she may have fallen under the weight of something she was carrying), bespeak the inevitability of death:

We have seen August reach  
Into autumn without holding back thieving winds

Nor catching leaves from swift brooks plying  
A chrisomed shore; we have seen sun come and go  
Without the seven trumpets . . . ah, we worry the  
Very daylight with how to become what we anyhow  
Must become . . .

A few lines later, the chorus suggests another aspect of the theme, namely, that out of pain (or death) shall come a rebirth in the form of art, in this case "The Song of the Archer":

Once the wash of the wind lay open the quick  
Heart shall the heavens tell and shall we hear  
The song of the archer roaming the early hill[.]

The rather dense metaphorical language concentrates the meaning of the lines, which may be explained as follows: A wash in the West is similar to an arroyo, or dry gully, so one has the impression of the wind's channel or path lying open, suggesting exposure and perhaps dessication. The exposure implies vulnerability, perhaps the vulnerability one feels after being reduced, diminished, or hurt by death. But the "quick/Heart"—a heart cut to the quick or a vital heart or even a quickened heart—speaks (maybe cries out), calling forth "The song of the archer."

Though the first speaker, the chorus, refers generally to the theme of the poem, the second speaker, Chiron, evokes the theme in more specific terms. The opening lines of the poem, for example, which are spoken by Chiron, combine the suggestions of mortality inherent in a dying day with the vitality of sexuality: Chiron likens the setting sun to "a slaughtered bull" that "Spewed blood . . . over a/brewing storm. . . ." The scene includes "two cats" that "Coupled deep by the shed" and "A young chit" presumably sitting "In the rust wood where centuries rutted and/spilled Novembers," the young chit being Chris. The sexual con-

notations of the lines are deepened by the pun on "rutted," which suggests that the centuries were not only in a rut in producing Novembers year after year but that they copulated like animals and had as their offspring a succession of Novembers; and there are sexual overtones in the word "chit," too, which may mean not only a pert girl but, obsolescently, the offspring of a beast, for example, a cub (see *Webster's New International Dictionary*, Second Edition).

Not only does Chiron evoke death and life in the opening description of the setting, but he does so in a description of the sunset that comes a bit later:

*The earth*

*Turned slow from the dying sun and blood seeped  
from the veined dust into a million tiny  
Serpents shimmering in the turning, the tiresome  
turning.*

The lines obviously describe a form of death—the sunset—and the weariness evoked by them suggests that the earth itself is approaching death. But the vividness of the imagery, with streaks of sunlight being likened to "*a million tiny/Serpents shimmering*," indicates also the presence of life, albeit a somewhat repulsive life.

In addition to Chiron's presenting the simultaneous presence of life and death in some of the early descriptions, the archer-centaur later conveys the theme of the poem, that human existence is made up of a cycle—from life to death to, in the form of art, rebirth. This theme is shown in Chiron's dramatization of the vitality of Chris's grandmother (Gran), moving evocation (through Chris's reaction) of Gran's death, and symbolization of the death with the suggestion of rebirth.

Concerning Gran's vitality, before the grandmother dies Chiron vividly and affectionately evokes her liveliness. He shows it in her colorful, if somewhat corny, way of speaking (ironically, everything she says has the feeling of death about it, though not the

way she says it): "*Don't like the looks of that sky,*' her grandmother/said, '*Something rotten in Denmark, if you ask me./I wish it'd storm if it's goin' to.*'" Later, in warning Chris about being burned in the woods, she says, "*Fine grease spot/You'll make in the devil's kitchen.*" And still later, after some nearby Indians have finished a ceremony for someone who has died, she says, "*Well, I guess that's that. It's sure none of us/gets outa this world alive. . . .*"

Not only does Chiron show us the vitality of the grandmother, but he movingly evokes her death through Chris's reaction to it. Chris offers to carry something that Gran is carrying, but Gran stubbornly refuses any help and then apparently stumbles under the load and dies. Gran's dying is frozen in slow motion, the effect being to deepen Chris's anguish. Twice Chris calls out to her grandmother, "What's the matter," and eight times she calls to her mother to come. One has the impression of Gran's slowly slumping to the floor—like the slaughtered bull, perhaps, mentioned in the second line of the poem—and of Chris's mother's responding in a painfully slow fashion. There is some reproach against the mother—Chris may blame her for her grandmother's death. After the eighth time that Chris calls her mother, the mother says, "*I suppose we should at least see . . .*," recalling an earlier incident in the poem. In that incident, after Chris had asked her mother whether she could hunt turtles in the slough and got her mother's response, Chris had said, "*All you ever say is 'we'll see' . . . well, when will/we?*"

In addition to showing in a moving way Gran's death through Chris's reaction to it, Chiron also symbolizes it in his description of the physical setting at the time of the grandmother's death; and he hints at a rebirth. The physical setting is a latent and then breaking storm during a dying day of a dying year (the time is November, "*the month of the hunter*"). Using heightened

diction, Chiron describes the storm's breaking as Gran dies, with a possible pun on "dam":

*The*

*Old earth shuddered beneath her knees, the dam  
crumbled and dissolved in the boiling flood, and  
Thunder rode dusk from the river to the hill where  
the storm lay broken.*

But if the storm symbolizes death, it also offers hope of renewed life. In the last lines of the poem, which complete the passage just quoted, Chris reacts to Gran's death in such a way as to suggest a rebirth of sorts:

*She saw the shallows flood,  
And the old house fell in the thundering wind  
darkly to the dark sun. She crawled toward them,  
Into them, and with a single vision they were one,  
and sang ("... of what is past, or passing,  
Or to come.")*

The "single vision" that Chris has achieved indicates that she has integrated the parts of her experience, especially the experience of her grandmother's death, and that, while she sorrows over that death, she nonetheless has put it into perspective. The achievement of the "single vision," moreover, answers the question, already referred to, that Chris had put to her mother earlier in the poem: "All you ever say is 'we'll see' . . . well, when will/we?" Finally, the song that Chris sings (presumably the lines from "Sailing to Byzantium") is the rebirth that follows death; and it has the permanence of "such a form as Grecian goldsmiths make/Of hammered gold and gold enamelling," referred to in the same stanza of Yeats's poem as the lines which Chris sings.

Chris not only appears as a character in Chiron's narration, but, as an adult poet, she emerges as one of the three principal speakers in the poem. She speaks in a sort of inner monologue, which may be narrated by Chiron—the passages, like those Chiron speaks, are italicized—though the reader feels, partly because of the indentation of the lines, that Chris is speaking more directly

than in the parts of Chiron's speech proper in which Chiron quotes her. The parts or fragments of the inner monologue—one is reminded of the "fragments" that the Fisher King in *The Waste Land* has "shored against [his]ruins"—moreover, are not chronologically organized as are the events of Chiron's narration (indeed, some events must have occurred after Gran's death). Rather, they are thematically organized, as Jacob Korg has suggested the "unas-similated quotations" of *The Waste Land* are organized.<sup>3</sup> And the theme that unifies the parts of Chris's monologue is a recapitulation of the three aspects of the main idea of the poem as a whole: life (often associated with or replaced by love in Chris's monologue), death, and rebirth (often identified with art).

The three aspects of the theme are symbolized in an early fragment that occurs as part of Chris's inner monologue:

*Her grandmother came running with a rake  
and killed a springing snake she was  
Playing with on the road, but she got to keep  
the injured dove and built a cage until  
He died of oatmeal.*

The running grandmother, the "springing snake," and the playing girl all represent life. The "injured dove," which finally dies, represents death. And the cage that Chris built represents rebirth; it is an art form born out of suffering and dying and, like the "form as Grecian goldsmiths make," outlives the mortal animal.

Though the fragment from Chris's monologue just discussed symbolizes all three aspects of the poem's theme, most of the fragments seem to focus on only one or two aspects. One section, for example, seems primarily to evoke the idea of death though it contains overtones of life:

*Down the hill she saw her grandfather  
Carry old Peach to the river with a shovel:  
"Where you going with Peach, Gramp? Hey, Gramp,*



*What's the matter with him? Put him down,  
Gramp; don't take him"  
But he had something else on his mind.  
She ran but the wind was thick and it pushed  
her head back hard on her shoulders.*

Peach has presumably died—this is one of the fragments the action of which occurs after the events of Chiron's narration, in which Peach is alive—so that the focus of the lines is on death. There is, however, undeniably a sense of vitality in Chris's running against the wind.

It is the sense of vitality, often in the form of sexuality or love, that informs most of the fragments represented as parts of Chris's monologue. In one place, for example, Chris recalls the sexuality of her mother and father: "*'how'rt/tha both Mary and Thais, ma cunt and/Mother, and I thy love and lover?'"* (These lines are almost exactly repeated in another fragment and alluded to in another.) It is not sexuality itself, however, that so much informs a number of Chris's fragments as it is sexuality shading into romantic love; for the reader becomes aware that Chris's inner monologue is also a love song, as indicated in the following fragment:

*I want to wear it proudly, I want to wear it  
on my face proud as autumn flames, stark as  
Winter frames her black branches in a Christwhite  
purity; this is no Gethsemane for solitary  
Prayer. . . .*

Very likely the reference of "it" is love—in the next fragment Chris says she is "*all innocence and Adam, huge and/unabashed having found you in the world/to love*"—and generally the overtones of the passage are positive or life-affirming though the diction is slightly ambiguous. In moving from the inflected adverb, "proudly," to the uninflected adverbs "proud" and "stark"—or are "proud" and "stark" adjectives?—the poet is concentrating her effect; she is also moving from a rather more conventional statement to a rather less conventional state-

ment about love or life. The reader may wonder whether Chris wears love or life starkly because she has been ravished or exhausted by it.

The fragment just discussed ends with a reference to Gethsemane, which is picked up in another fragment of Chris's monologue. It is one of a group of fragments that emphasize eye imagery (one is reminded of Chris's achievement of a "single vision," which resolved the conflict of the principal narrative line of the poem):

*And the sky hung like a full skin of ripe  
wine. ' . . . in thine eyes the Gethsemane  
Gift and the envious sun scuttles thy  
Kidron in fluted riffs of light . . . '*

The lines give further evidence for the claim that Chris's inner monologue is a love song, for here Chris, quoting herself, addresses a lover. (The Keatsian diction of the lines, moreover, especially of those within quotation marks, testifies to the claim that Chris has grown up and become a poet.) The lines indicate that Chris sees in her lover's eyes "*the Gethsemane/Gift,*" which must be, judging from evidence in the first fragment alluding to Gethsemane, a reference to the privacy of the lovers' love. The meaning of the independent clause beginning with "*and the envious sun*" is rather complex, but Shumway-Chris must be using the intransitive sense of "scuttle"—to scurry—transitively to mean to chase something, not the usual, transitive sense of "scuttle," which means to sink a ship or boat. Kidron, usually Kedron, according to *Webster's New World Dictionary of the American Language*, College Edition, was once a stream flowing into the Dead Sea. So Chris means that the softness in her lover's eyes is like a river, the ripples of which are touched by the sun—perhaps are light itself.

The rather complex association of eyes, sexuality, and love is suggested in another of Chris's fragments (already partly quoted from). Chiron's lines, "*She turned and saw*

*the deep wet sky/in her mother's eyes,"*  
blend into lines of Chris's:

*... like two preachers at a spring revival  
Intoning a weariness of sin, 'but she lay  
her hand on my repentance and my blood  
Sang salvation deep in my proverbs . . . how'rt  
tha both Mary and Thais, ma cunt and  
Mother, and I thy love and lover?'*

The reference to Thais—presumably the grandmother's name—calls to mind Massenet's opera, alluded to elsewhere in the poem, and it specifically suggests the fusion of the sexual and religious, which the passage as a whole generally suggests. (In Massenet's opera, Thais is transformed from a life of sensuality to one of spirituality.)<sup>4</sup> This fusion, moreover, reminds the reader of the "single vision," which Chris has achieved at the end of the poem and to which the eye imagery may be symbolically related.

Eye imagery occurs in another fragment spoken by Chris, which recapitulates the idea of vitality and sexuality that one has come to associate with the fragments:

*Weren't we always, Mother, or did we begin  
somewhere? Her hair caught light like  
Chestnuts do in falling suns, and the deep  
cabala of the marvelous eyes[.]*

Two fragments at the end of the poem, separated by a narrative passage but clearly continuous with each other, gather together the motifs and phrases that have been running through the poem and re-emphasize the sexuality and love that have been at the heart of Chris's monologue, here moving from (in the first fragment) Chris's parents' sexuality and love to (in the second fragment) Chris's own:

*"How'rt tha both Mary and Thais, ma cunt  
and mother, and I thy love and lover—  
and in the falling suns, Oh Lord, how plentiful,  
how plentiful thy. . . ."*

*. . . and I'll sleep in the wind, lie in the  
belly of the sun for thy wisdom, thy wish,  
thy gift. . . .*

The use of the affectionate possessive pronoun in the second fragment echoes its use in an earlier fragment, already discussed, in which Chris seemed to be looking into the eyes of her lover. One may conclude, therefore, that Chris here, too, is addressing her lover.

In conclusion, Mary Shumway's "Song of the Archer" is structured according to three speakers—the chorus, which functions as a framing narrator; Chiron, who narrates the main action of the poem; and the poet Chris, who comments, in an inner monologue, on the main action of the poem and recapitulates its theme in her love song. That theme, we have seen, paralleling the theme of Yeats's "Sailing to Byzantium," which is quoted throughout "Song of the Archer," is that life gives way to death but that out of death something permanent (art) is reborn.

#### ACKNOWLEDGMENT

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#### NOTES

<sup>1</sup> According to the dust jacket of *Song of the Archer and Other Poems*, Mary Shumway is a "native of Wisconsin's 'Winnebago Country,'" and she has taught at the University of Wisconsin, Stevens Point, since 1965.

<sup>2</sup> It is the title poem of *Song of the Archer and Other Poems* (Chicago: Henry Regnery Company, 1964). I am indebted to Mary Shumway for pointing out to me that "Song of the Archer" originally appeared as a short story in  *motive*, 24 (January-February 1964), 45-50.

<sup>3</sup> "Modern Art Techniques in *The Waste Land*," *The Journal of Aesthetics and Art Criticism*, 18 (June 1960), 456-463.

<sup>4</sup> See *Milton Cross' Complete Stories of the Great Operas* (Garden City, New York: Doubleday and Company, 1952), pp. 530-538.

# FISHES OF NAVIGATION POOL NUMBER 7, UPPER MISSISSIPPI RIVER, I: LAKE ONALASKA

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## *Abstract*

Lake Onalaska, a backwater of Navigation Pool No. 7 of the Upper Mississippi River, has experienced considerable habitat alteration since its creation in 1937. Management objectives for this multipurpose resource are currently being reevaluated by fish and wildlife resource planners. The objective of this paper is to provide needed information on the fish community in Lake Onalaska. Sixty-seven fish species were captured with several gear types used in the summer months of 1976 and 1977. The catch was dominated numerically by centrarchids (bluegill, 50.1%; black crappie, 2.5%; largemouth bass, 2.5%), cyprinids (spotfin shiner, 7.5%; spottail shiner, 3.2%; bullhead minnow, 2.6%), and atherinids (brook silverside, 9.1%). The majority of the total catch biomass was comprised of common carp (30.9%), northern pike (11.4%), shorthead redhorse (8.6%), spotted sucker (6.9%), and bluegill (5.0%). Of the 67 species, approximately equal numbers were represented by sport, rough, and forage species. This great ichthyofaunal diversity reflects the habitat heterogeneity of Lake Onalaska.

## INTRODUCTION

Navigation pools and their associated backwaters were created on the Upper Mississippi River by construction of locks and dams during the 1930's. The backwaters have subsequently been reduced in area due to sedimentation. The Upper Mississippi River Wildlife and Fish Refuge includes considerable backwater habitat, and the resultant habitat changes have prompted renewed interest in developing sound resource management objectives for critical portions of this system.

Lake Onalaska is a shallow (mean depth  $\approx$  1.5 m) backwater lake that comprises the lower third of Navigation Pool No. 7. Some areas of the lake have experienced a 50% decrease in depth since its creation in 1937, and Claflin (1977) predicted further severe loss of habitat diversity in the lake during the next 30 to 40 years because of continued sedimentation and eutrophication.

Historical information on the fishes of this region is generally inadequate. Existing data is limited either by its age, or by the short sampling time and insufficient gear types used in past surveys. Rasmussen (1979) listed 80 fish species for Pool 7, including those that occurred by accidental introduction and those that had not been collected in more than 10 years. Rasmussen's tabulations included fish taken from all habitats of Pool 7; no distinction was made between species of the riverine portion of the pool and those of Lake Onalaska. His species list was compiled primarily from annual reports of the Upper Mississippi River Conservation Committee, much of what had previously been summarized by Smith *et al.* (1971). A more recent lake inventory by the Wisconsin Department of Natural Resources documented the presence of 41 species in Lake Onalaska (Holzer and Ironside 1977).

The intent of this investigation was to

determine the current species composition of the fish community in Lake Onalaska. Results will help provide guidelines for the development of management plans for this multipurpose resource.

#### METHODS AND MATERIALS

Fish sampling was conducted in Lake Onalaska at 13 sites selected as being representative of major extant habitat types (Fig. 1). The sites ranged in substrate composition from finely divided organic material to large rocks, in depth from 0.5 to 2.6 m, and in current velocity from undetectable to 28.2 cm/sec.

The size of Lake Onalaska (2185 ha) and the diversity of its habitats and ichthyofauna dictated the extensive use of several gear types and collection methods. Both active and passive methods were used for approximately seven days in the middle of each summer month (May through August) during 1976 and 1977.

More than 4900 hours of netting were conducted during the two years with experimental multifilament nylon gill nets (50 × 1.8 m, with 10-m sections of 3.8, 5.0, 6.4, 7.6, and 10.0-cm<sup>2</sup> mesh). Large frame nets (1.8 × 0.9 m with 0.6-cm<sup>2</sup> mesh and 15 × 0.9 m leads) were fished in 1976 and 1977 for 4618 hr. Small frame nets (0.9 × 0.6 m with 0.6-cm<sup>2</sup> mesh and 5.6 × 0.6 m leads) were added in 1977 and accounted for 1481 hr of effort. All nets were fished for 20 to 25 hr, and duplicate net sets of the above gear types were made at each site.

All sites were sampled with electrofishing gear (250 V, 3-phase AC). More than 1250 minutes of electrofishing were conducted during nighttime hours. Eight sites were sampled with a 10-m bag seine (0.3-cm<sup>2</sup> mesh) during 1977. One to three seine hauls were made at separate locations at each site, and up to three locations were established in each of the eight accessible sites.

Quantification of fish catch was based on effort. Catch per unit of effort (CPUE) for gill and frame nets was expressed for 24 hr

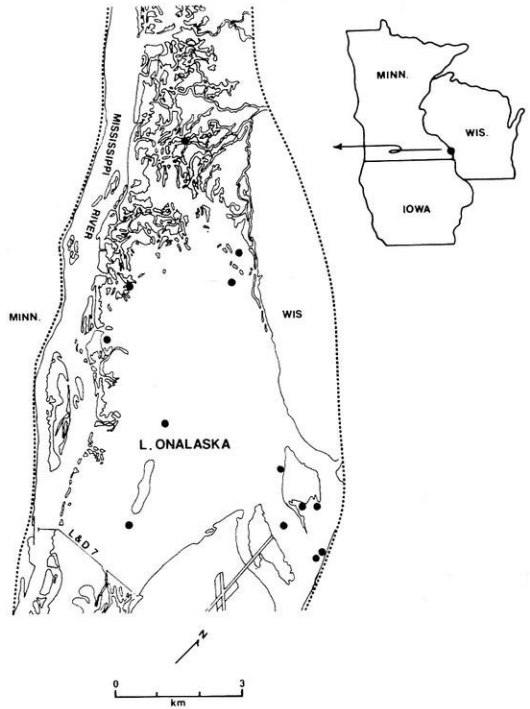


Fig. 1: Thirteen sites in Lake Onalaska (Navigation Pool Number 7, Upper Mississippi River) sampled for fishes during 1976 and 1977. Sampling locations = ●.

and for 0.25 hr with electrofishing gear. All data for each gear type were combined. Wet weights were empirically determined.

#### RESULTS AND DISCUSSION

Sixty-seven species of fish were captured in Lake Onalaska during the two-year study (Table 1). Nineteen species could be classified as rough fish, 21 species as sport fish, and 27 species as forage fish.

The Family Cyprinidae was represented by 17 species, numbering nearly 20% of all fish collected. Five minnow species (golden shiner, spottail shiner, spotfin shiner, weed shiner, and bullhead minnow) were the most numerous cyprinids. Cyprinidae species constituted 31.2% of the total collection biomass, due primarily to the presence of common carp (30.9% of total weight; Table 1).

Ten catostomid species were caught during the study. Shorthead redhorse and

Table 1: Fish species collected from Lake Onalaska (Pool 7, Upper Mississippi River) during 1976 and 1977 with experimental gill nets, large and small frame nets, electrofishing, and seining. The numbers in parentheses indicate the rank of the most important species captured by each gear type. Designation: R = rough; S = sport; F = forage.

Species	Design	Catch Per Unit of Effort					Seine	Total Number	Total Weight(kg)
		Gill (No./24 hr)	L. Frame (No./24 hr)	S. Frame (No./24 hr)	Electrofish. (No./15 min)				
<i>Ichthyomyzon castaneus</i>									
Chestnut Lamprey	R	0.02	0.01	0.03	0.01	0	10	0.1	
<i>Ichthyomyzon unicuspis</i>									
Silver Lamprey	R	0.02	0.01	—	0.01	0	6	<0.1	
<i>Lepisosteus osseus</i>									
Longnose Gar	R	0.51	0.05	—	0.10	1	122	114.2	
<i>Lepisosteus platostomus</i>									
Shortnose Gar	R	0.05	0.08	0.13	0.05	3	40	27.0	
<i>Amia calva</i>									
Bowfin	R	0.33	0.07	0.07	0.14	186	283	207.0(6)	
<i>Anguilla rostrata</i>									
American Eel	R	—	—	—	0.04	0	3	3.7	
<i>Dorosoma cepedianum</i>									
Gizzard Shad	F	0.54(10)	0.28	—	3.43(5)	0	451	62.0	
<i>Hiodon alosoides</i>									
Goldeye	R	0.03	0.01	—	—	0	9	2.6	
<i>Hiodon tergisus</i>									
Mooneye	R	1.53(3)	0.01	—	0.12	2	328	150.2(9)	
<i>Esox lucius</i>									
Northern Pike	S	1.32(4)	0.09	—	0.29	4	316	537.0(2)	
<i>Cyprinus carpio</i>									
Common Carp	R	3.46(1)	0.38(7)	0.23	0.16	18	909(10)	1,452.0(1)	
<i>Hybopsis storeriana</i>									
Silver Chub	F	—	—	0.02	0.01	0	2	<0.1	
<i>Notemigonus crysoleucas</i>									
Golden Shiner	F	—	0.52(6)	2.37(4)	2.36(6)	327(8)	770	3.7	
<i>Notropis atherinoides</i>									
Emerald Shiner	F	—	0.02	0.02	0.08	28	39	0.1	
<i>Notropis blennioides</i>									
River Shiner	F	—	—	—	—	113	113	<0.1	
<i>Notropis cornutus</i>									
Common Shiner	F	—	—	0.02	—	0	1	<0.1	

Table 1 (Continued)

Species	Design	Catch Per Unit of Effort				Seine	Total Number	Total Weight(kg)
		Gill (No./24 hr)	L. Frame (No./24 hr)	S. Frame (No./24 hr)	Electrofish. (No./15 min)			
<i>Notropis emiliae</i> Pugnose Minnow	F	—	—	0.71(7)	0.08	146	197	0.1
<i>Notropis heterolepis</i> Blacknose Shiner	F	—	0.01	0.15	0.06	36	51	0.1
<i>Notropis hudsonius</i> Spottail Shiner	F	—	4.87(2)	1.43(5)	1.14	363(7)	1,483(4)	6.6
<i>Notropis spilopterus</i> Spotfin Shiner	F	—	0.04	0.60(8)	0.07	3,420(3)	3,470(3)	1.8
<i>Notropis stramineus</i> Sand Shiner	F	—	—	—	—	114	114	0.1
<i>Notropis texanus</i> Weed Shiner	F	—	—	2.45(3)	0.05	376(6)	531	0.6
<i>Notropis volucellus</i> Mimic Shiner	F	—	—	—	—	1	1	<0.1
<i>Pimephales notatus</i> Bluntnose Minnow	F	—	—	—	—	200(10)	200	0.3
<i>Pimephales promelas</i> Fathead Minnow	F	—	—	—	—	1	1	<0.1
<i>Pimephales vigilax</i> Bullhead Minnow	F	—	0.03	0.57(10)	0.46	1,134(4)	1,213(5)	1.1
<i>Rhinichthys cataractae</i> Longnose Dace	F	—	—	—	—	1	1	<0.1
<i>Carpiodes carpio</i> River Carpsucker	R	0.02	—	—	0.02	19	24	3.3
<i>Carpiodes cyprinus</i> Quillback	R	0.08	0.18	—	0.88	1,039(5)	1,162(8)	24.9
<i>Carpiodes velifer</i> Highfin Carpsucker	R	0.01	—	—	—	0	2	2.1
<i>Catostomus commersoni</i> White Sucker	R	0.02	0.01	—	0.01	0	6	9.3
<i>Ictiobus bubalus</i> Smallmouth Buffalo	R	0.11	0.01	—	0.05	0	27	9.1
<i>Ictiobus cyprinellus</i> Bigmouth Buffalo	R	0.47	0.01	—	0.16	0	110	114.1

Table 1 (Continued)

Species	Design	Catch Per Unit of Effort				Seine	Total Number	Total Weight(kg)
		Gill (No./24 hr)	L. Frame (No./24 hr)	S. Frame (No./24 hr)	Electrofish. (No./15 min)			
<i>Minytrema melanops</i>								
Spotted Sucker	R	1.13(5)	0.13	0.10	1.86(7)	44	460	322.6(4)
<i>Moxostoma anisurum</i>								
Silver Redhorse	R	0.20	0.01	—	0.84	5	117	80.9
<i>Moxostoma erythrurum</i>								
Golden Redhorse	R	0.03	0.01	—	0.14	0	20	9.9
<i>Moxostoma macrolepidotum</i>								
Shorthead Redhorse	R	2.11(2)	0.15	0.03	1.49(10)	5	590	402.5(3)
<i>Ictalurus melas</i>								
Black Bullhead	S	0.13	0.07	0.02	0.10	0	45	19.9
<i>Ictalurus natalis</i>								
Yellow Bullhead	S	0.78(6)	0.29(10)	0.60(9)	0.38	8	292	99.9
<i>Ictalurus nebulosus</i>								
Brown Bullhead	S	0.02	0.02	0.30	0.02	34	62	3.8
<i>Ictalurus punctatus</i>								
Channel Catfish	S	0.77(8)	0.01	0.02	0.08	0	166	170.7(7)
<i>Noturus gyrinus</i>								
Tadpole Madtom	F	—	0.31(9)	0.26	0.01	33	109	0.4
<i>Pylodictis olivaris</i>								
Flathead Catfish	S	0.10	—	—	—	0	20	29.2
<i>Aphredoderus sayanus</i>								
Pirate Perch	F	—	0.01	0.02	0.04	17	22	<0.1
<i>Percopsis omiscomaycus</i>								
Trout-Perch	F	—	0.01	0.02	0.01	0	4	<0.1
<i>Labidesthes sicculus</i>								
Brook Silversides	F	—	0.02	0.08	1.25	4,081(2)	4,194(2)	2.1
<i>Morone chrysops</i>								
White Bass	S	0.32	0.15	—	1.80(9)	18	262	47.6
<i>Morone mississippiensis</i>								
Yellow Bass	S	0.20	—	—	0.22	0	23	3.0
<i>Ambloplites rupestris</i>								
Rock Bass	S	0.34	0.36(8)	0.29	1.82(8)	11	319	29.7
<i>Lepomis cyanellus</i>								
Green Sunfish	S	—	0.01	—	0.01	1	3	0.1

Table 1 (Continued)

Species	Design	Catch Per Unit of Effort				Seine	Total Number	Total Weight(kg)
		Gill (No./24 hr)	L. Frame (No./24 hr)	S. Frame (No./24 hr)	Electrofisch. (No./15 min)			
<i>Lepomis gibbosus</i> Pumpkinseed	S	0.58(9)	1.41(4)	2.56(2)	4.02(3)	132	1,016(9)	49.8
<i>Lepomis gulosus</i> Warmouth	S	0.01	0.03	0.05	0.02	0	12	0.9
<i>Lepomis macrochirus</i> Bluegill	S	0.39	5.78(1)	14.99(1)	54.83(1)	16,510(1)	23,197(1)	233.6(5)
<i>Micropterus dolomieu</i> Smallmouth Bass	S	0.01	—	—	0.04	0	4	1.2
<i>Micropterus salmoides</i> Largemouth Bass	S	0.31	0.08	0.21	9.53(2)	277(9)	1,163(7)	134.0(10)
<i>Pomoxis annularis</i> White Crappie	S	0.08	1.25(5)	0.21	0.58	2	319	32.2
<i>Pomoxis nigromaculatus</i> Black Crappie	S	0.21	3.26(3)	0.78(6)	3.74(4)	137	1,167(6)	78.7
<i>Ammocrypta clara</i> Western Sand Darter	F	—	—	—	—	8	8	<0.1
<i>Etheostoma asprigene</i> Mud Darter	F	—	—	—	0.01	1	2	<0.1
<i>Etheostoma exile</i> Iowa Darter	F	—	—	—	—	3	3	<0.1
<i>Etheostoma nigrum</i> Johnny Darter	F	—	—	0.11	0.16	31	51	0.1
<i>Perca flavescens</i> Yellow Perch	S	0.37	0.21	0.11	0.97	29	232	28.8
<i>Percina caprodes</i> Logperch	F	—	0.01	0.02	0.19	5	24	0.2
<i>Percina shumardi</i> River Darter	F	—	—	—	—	1	1	<0.1
<i>Stizostedion canadense</i> Sauger	S	0.03	0.03	—	0.48	0	51	7.4
<i>Stizostedion vitreum vitreum</i> Walleye	S	0.06	0.01	0.02	1.00	1	99	23.7
<i>Aplodinotus grunniens</i> Freshwater Drum	S	0.78(7)	0.17	—	0.64	0	245	159.5(8)
						<u>28,926</u>	<u>46,297</u>	<u>4,705.6</u>



spotted suckers were important in terms of biomass and comprised 8.6% and 6.9% of the total collection weight, respectively (Table 1). The apparent importance of quillback (2.5% of the total number) was due primarily to the collection of 984 young of the year in one seine haul.

Lake Onalaska supports nine species of centrarchids. The most abundant species was bluegill which accounted for 50.1% of all fishes collected. Other centrarchids that contributed significantly to total catch numbers were black crappie (2.5%), largemouth bass (2.5%), pumpkinseed (2.2%), rockbass (0.7%), and white crappie (0.7%) (Table 1).

Ictaluridae accounted for 1.5% of the number and 6.9% of the collection biomass. Yellow bullhead and channel catfish were the most abundant of the six ictalurids.

Although nine species of Percidae were collected, their importance in the lake in terms of numbers (1.0%) and biomass (1.3%) was small. The most abundant percids were yellow perch and walleye.

The combined catch from all collection methods indicated that bluegill was the most numerous species (50.1% of total numbers caught), followed by brook silversides (9.1%) and spotfin shiner (7.5%) (Table 1). These three species accounted for two-thirds of the total numbers of fishes collected. Other numerous species were spottail shiner (3.2%), bullhead minnow (2.6%), black crappie (2.5%), and largemouth bass (2.5%). The dominant species in terms of biomass was common carp (30.9%), followed by northern pike (11.4%) and short-head redhorse (8.6%). These three species accounted for over half of the total collection biomass.

Gill net CPUE indicated that common carp was the most abundant species (Table 1). Shorthead redhorse, mooneye, northern pike, and spotted sucker were also frequently captured in gill nets.

Data from large and small frame nets emphasized the importance of centrarchids and

cyprinids in Lake Onalaska. In terms of large frame net CPUE, the most abundant species, in descending order, were bluegill, spottail shiner, black crappie, pumpkinseed, and white crappie (Table 1). Although bluegill, pumpkinseed, and spottail shiner were also frequently taken by small frame nets, this latter gear type more effectively sampled other cyprinids; weed shiner, golden shiner, and spottail shiner followed by bluegill and pumpkinseed in order of importance (Table 1).

Electrofishing CPUE again emphasized the importance of centrarchids in Lake Onalaska. Bluegill, largemouth bass, pumpkinseed, and black crappie were taken most frequently by this method (Table 1).

No attempt was made to standardize seine hauls. The variable efficiency of seining in the different littoral habitats made these results incomparable. It is interesting to note, however, that bluegill also dominated the catch by this method (Table 1). Several forage species, taken infrequently by other methods, were important in seine catches; namely, brook silversides, spotfin shiner, and bullhead minnow.

#### SUMMARY

Intensive sampling during 1976 and 1977 indicated that Lake Onalaska supported a diverse fish community of 67 species, indicative of a heterogenous environment. The rough, sport, and forage species were approximately equal in number.

The lake is apparently well suited for centrarchids (especially bluegill, pumpkinseed, and crappies), as well as predator game fish species (northern pike and largemouth bass). In addition to young of the year centrarchids, several forage species provide a diverse food base for piscivores. Common carp and a significant catostomid fauna also play a major role in the fish community.

These results suggest that management objectives should include the maintenance of habitat diversity in Lake Onalaska.

## ACKNOWLEDGMENTS

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# FISHES OF NAVIGATION POOL NUMBER 7, UPPER MISSISSIPPI RIVER, II: THE RIVERINE PORTION

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## *Abstract*

Adequate fisheries information does not exist for the riverine portion of Navigation Pool No. 7 of the Upper Mississippi River because of the overriding interest in its backwater lake (Lake Onalaska) and because of the difficulties in sampling the riverine portion of the pool. The objective of this paper is to report total catch data from sampling sites associated with the main channel of Pool 7. Seventy-one fish species were captured with several gear types used in the summer months of 1978 and 1979. The most abundant fishes were cyprinids (emerald shiner, 25.9% of total numbers; spotfin shiner, 8.2%; spottail shiner, 7.2%; bullhead minnow, 6.3%) and centrarchids (bluegill, 8.0%, and black crappie, 5.7%). Major contributors to the total catch biomass were common carp (18.1%), shorthhead redhorse (9.2%), northern pike (8.9%), and silver redhorse (7.4%). Of the 71 species, 23 could be classified as rough fish, 19 as sport fish, and 29 as forage fish. This variety of ichthyofauna is an indicator of the habitat diversity in the riverine portion of Pool 7.

## INTRODUCTION

Navigation Pool No. 7 of the Upper Mississippi River was formed in 1937 by the closure of Lock and Dam 7 at Dresbach, Minnesota. The pool extends from river mile 702.5 (miles above the mouth of the Ohio River) to river mile 714.3, a distance of 19 km. The pool has an area of 5443 ha, a perimeter of 60 km, and is up to 7.8 km wide.

Little fisheries information exists on the riverine portion of Pool 7. Investigators have either concentrated their efforts on Lake Onalaska (Held 1983; Holzer and Ironside 1977) or they have combined the fisheries data from all areas of Pool 7 (Rasmussen 1979). Also, comprehensive fish surveys have likely been discouraged because of sampling difficulties associated with the riverine portion of the pool, i.e., problems caused by significant current velocities, fluctuating water levels, and heavy commercial and recreational use of the main channel.

The intent of this study was to sample sev-

eral lotic sites in the riverine portion of Pool 7. This report provides baseline information on the fish community found in this part of the river.

## METHODS AND MATERIALS

Twelve sampling sites were chosen in the tailwater, middle, and lower reaches of Pool 7 (Fig. 1). The sites were sampled midmonth from May through August, 1978, and June through August, 1979.

Multifilament nylon experimental gill nets (50 × 1.8 m, with 10-m sections of 3.8, 5.0, 6.4, 7.6, and 10.0-cm<sup>2</sup> mesh) were fished in all areas for a total of 3726 hr. Large frame nets (1.8 × 0.9 m with 0.6-cm<sup>2</sup> mesh and 15 × 0.9 m leads) and small frame nets (0.9 × 0.6 m with 0.6-cm<sup>2</sup> mesh and 5.6 × 0.6-m leads) were set in littoral habitats for 2488 hr and 2324 hr, respectively. Hoop nets (0.75-m diameter with 2.5-cm<sup>2</sup> mesh) were used in open water areas for a total of 2317 hr. Duplicate sets of the above gear types were made at each site, and each net was fished for 20 to 25 hr.

All areas were sampled at night on most dates with electrofishing gear (250 V, 3-phase AC) for a total of 752 min. Seven to 10 of the areas were sampled with a 10-m bag seine (0.3-cm<sup>2</sup> mesh) when water level conditions permitted.

Quantification of catch was based on effort. Catch per unit of effort (CPUE) for gill, frame, and hoop nets was expressed for 24 hr. CPUE for electrofishing was number per 0.25 hr. Seine hauls were not standardized. All data for each gear type was combined. Wet weights were empirically determined.

### RESULTS AND DISCUSSION

Over 28,000 fish of 71 species were sampled by all methods from the riverine portion of Pool 7 during the summers of 1978 and 1979 (Table 1). The total catch biomass was nearly two metric tons. Of the 71 species, 29 could be classified as forage fish, 23 species as rough fish, and 19 as sport fish.

Seventeen cyprinid species accounted for 59.7% of total catch numbers. Emerald shiner (7342), spotfin shiner (2327), spottail shiner (2045), bullhead minnow (1798), and golden shiner (1560) together comprised 53.1% of the total catch (Table 1). Common carp contributed the majority of the biomass (360.1 kg, or 18.1% of total catch biomass).

Catostomidae were represented by 12 species in the riverine portion of Pool 7. Their numbers (1313) accounted for only 4.6% of the total catch, but their combined biomass (584 kg) represented 29.4% of the total. The most numerous catostomids were shorthead redhorses (1.6% of the total), and spotted sucker (1.1%) (Table 1). Several catostomids contributed significantly to the total biomass, including shorthead redhorse (9.2%), silver redhorse (7.4%), spotted sucker (4.9%), and quillback (3.1%). The collection and first documentation of two river redhorse (*Moxostoma carinatum*) from Pool 7 was of special note.

Nine species of Centrarchidae contributed 18.2% of total catch numbers and 13.6% of

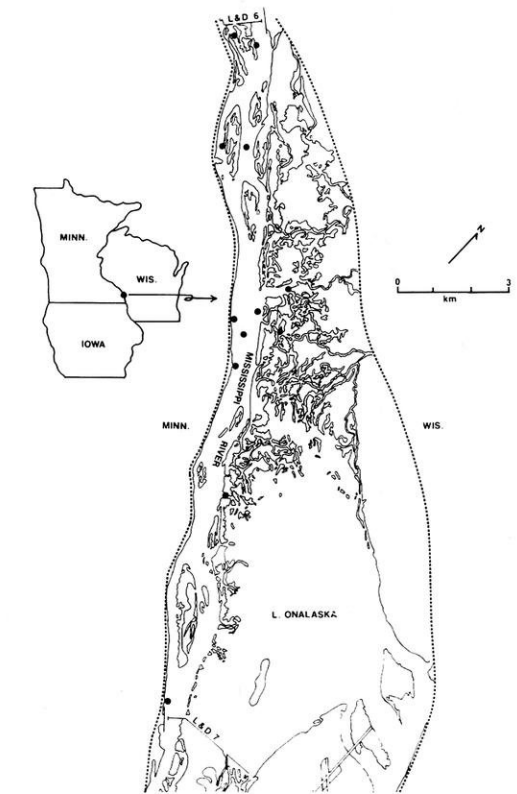


Fig. 1: Twelve sites in the riverine portion of Navigation Pool No. 7 (Upper Mississippi River) sampled for fishes during 1978 and 1979. Sample sites = ●.

the biomass. Bluegill was the predominant component of the sunfish catch and accounted for 8% of the total numbers and 2.7% of the biomass (Table 1). Other important centrarchids were black crappie (5.7% by number and 5.2% by weight) and white crappie (1.9% by number and 3.1% by weight).

Ictaluridae were not very important numerically (1.1% of the total), but their combined biomass comprised 9.6% of the total. Prominent among the five ictalurid species were flathead catfish (128.9 kg, or 6.5%) and channel catfish (55.1 kg, or 2.8%) (Table 1).

The Family Percidae was represented by 10 species, but their combined number (1808) and weight (47.3 kg) were not great (6.4% and 2.4% of the totals, respectively).

Table 1: Fish species collected from the riverine portion of Navigation Pool No. 7 (Upper Mississippi River) during 1978 and 1979 with experimental gill nets, large and small frame nets, electrofishing and seining. The numbers in parentheses indicate the rank of the most important species captured by each gear type. Designation: R = rough; S = sport; F = forage.

Species	Design	Catch Per Unit of Effort					Seine	Total Number	Total Weight (kg)
		Gill (No./24 hr)	L. Frame (No./24 hr)	S. Frame (No./24 hr)	Electrofishing (No./15 min)	Hoop (No./24 hr)			
<i>Ichthyomyzon unicuspis</i>									
Silver Lamprey	R	—	—	—	0.04	0.01	—	3	<1
<i>Scaphirhynchus platyrhynchus</i>									
Shovelnose Sturgeon	R	0.39(2)	—	—	—	—	—	60	72.7(9)
<i>Polyodon spathula</i>									
Paddlefish	R	0.01	—	—	—	—	—	1	1.9
<i>Lepisosteus osseus</i>									
Longnose Gar	R	0.15(8)	0.22(10)	0.03	0.70	—	13	97	62.0
<i>Lepisosteus platostomus</i>									
Shortnose Gar	R	0.08	0.03	0.02	0.10	—	2	24	19.1
<i>Amia calva</i>									
Bowfin	R	0.04	0.06	0.08	0.16	—	1	29	61.7
<i>Anguilla rostrata</i>									
American Eel	R	—	0.01	0.02	—	—	—	3	4.0
<i>Dorosoma cepedianum</i>									
Gizzard Shad	F	0.03	0.07	0.03	1.24	—	872(7)	948(8)	6.9
<i>Hiodon alosoides</i>									
Goldeye	R	0.01	—	—	—	—	—	2	1.1
<i>Hiodon tergisus</i>									
Mooneye	R	0.12	0.03	—	0.80	—	4	65	13.0
<i>Umbra limi</i>									
Central Mudminnow	F	—	0.02	—	—	—	8	10	<0.1
<i>Esox lucius</i>									
Northern Pike	S	0.39	0.09	0.14(10)	0.34	—	245	345	176.9(3)
<i>Cyprinus carpio</i>									
Common Carp	R	0.42(1)	0.18	0.02	1.77(10)	0.01	2	177	360.1(1)
<i>Hybognathus hankinsoni</i>									
Brassy Minnow	F	—	0.01	—	—	—	—	1	<0.1
<i>Hybognathus nuchalis</i>									
Mississippi Silvery Minnow	F	—	—	—	—	—	61	61	<0.1
<i>Hybopsis storeriana</i>									
Silver Chub	F	—	—	—	0.18	.03(9)	4	16	0.3
<i>Notemigonus crysoleucas</i>									
Golden Shiner	F	—	0.35(7)	0.36(7)	0.26	—	1,476(6)	1,560(7)	2.3

Table 1 (Continued)

Species	Design	Catch Per Unit of Effort					Seine	Total Number	Total Weight (kg)
		Gill (No./24 hr)	L. Frame (No./24 hr)	S. Frame (No./24 hr)	Electrofish. (No./15 min)	Hoop (No./24 hr)			
<i>Notropis atherinoides</i>									
Emerald Shiner	F	—	—	0.33(8)	1.04	—	7,258(1)	7,342(1)	3.5
<i>Notropis blennioides</i>									
River Shiner	F	—	—	—	0.08	—	416	420	0.8
<i>Notropis cornutus</i>									
Common Shiner	F	—	0.01	—	—	—	—	1	<0.1
<i>Notropis emiliae</i>									
Pugnose Minnow	F	—	—	0.04	—	—	520(10)	524	0.2
<i>Notropis hudsonius</i>									
Spottail Shiner	F	—	0.02	0.46(3)	0.32	—	1,982(3)	2,045(4)	1.4
<i>Notropis spilopterus</i>									
Spotfin Shiner	F	—	0.15	0.44(4)	0.02	—	2,267(2)	2,327(2)	2.1
<i>Notropis stramineus</i>									
Sand Shiner	F	—	—	0.08	—	—	176	184	0.1
<i>Notropis texanus</i>									
Weed Shiner	F	—	0.03	0.10	—	—	353	366	0.2
<i>Pimephales notatus</i>									
Bluntnose Minnow	F	—	—	—	—	—	123	123	0.1
<i>Pimephales promelas</i>									
Fathead Minnow	F	—	—	—	—	—	8	8	<0.1
<i>Pimephales vigilax</i>									
Bullhead Minnow	F	—	0.02	0.06	0.08	—	1,786(4)	1,798(5)	0.7
<i>Rhinichthys atratulus</i>									
Blacknose Dace	F	—	—	—	—	—	1	1	<0.1
<i>Carpiodes carpio</i>									
River Carpsucker	R	0.15(7)	0.01	—	0.10	—	—	30	27.4
<i>Carpiodes cyprinus</i>									
Quillback	R	0.03	0.01	—	3.31(5)	—	12	184	62.2(10)
<i>Carpiodes velifer</i>									
Highfin Carpsucker	R	0.01	—	—	0.66	—	3	38	8.0
<i>Catostomus commersoni</i>									
White Sucker	R	0.04	—	—	0.02	—	—	7	6.6
<i>Cycleptus elongatus</i>									
Blue Sucker	R	0.01	—	—	—	—	1	2	2.0
<i>Ictiobus bubalus</i>									
Smallmouth Buffalo	R	0.08	—	—	0.22	—	—	24	21.8

Table 1 (Continued)

Species	Design	Catch Per Unit of Effort					Seine	Total Number	Total Weight (kg)
		Gill (No./24 hr)	L. Frame (No./24 hr)	S. Frame (No./24 hr)	Electrofsh. (No./15 min)	Hoop (No./24 hr)			
<i>Ictiobus cyprinellus</i> Bigmouth Buffalo	R	—	—	—	0.14	—	1	8	11.4
<i>Minytrema melanops</i> Spotted Sucker	R	0.14(10)	0.16	0.10	3.53(4)	—	97	323	97.9(7)
<i>Moxostoma anisurum</i> Silver Redhorse	R	0.30(5)	0.04	0.01	2.63(6)	—	15	199	147.0(4)
<i>Moxostoma carinatum</i> River Redhorse	R	—	—	—	0.04	—	—	2	1.4
<i>Moxostoma erythrurum</i> Golden Redhorse	R	0.05	0.03	—	0.34	—	3	30	15.8
<i>Moxostoma macrolepidotum</i> Shorthead Redhorse	R	0.26(6)	0.11	0.08	7.49(2)	0.15(5)	17	466	182.5(2)
<i>Ictalurus melas</i> Black Bullhead	S	0.01	—	0.03	—	—	1	5	2.3
<i>Ictalurus natalis</i> Yellow Bullhead	S	0.01	0.09	0.12	0.04	—	18	43	3.8
<i>Ictalurus punctatus</i> Channel Catfish	S	0.14(10)	0.04	0.02	0.54	0.06(7)	—	61	55.1
<i>Noturus gyrinus</i> Tadpole Madtom	F	—	0.25(9)	0.42(6)	—	—	58	125	0.4
<i>Pylodictis olivaris</i> Flathead Catfish	S	0.08	0.05	0.01	0.20	0.38(1)	—	66	128.9(5)
<i>Aphredoderus sayanus</i> Pirate Perch	F	—	0.16	0.05	0.02	—	72	95	0.1
<i>Percopsis omiscomaycus</i> Trout-Perch	F	—	—	—	0.06	—	4	7	<0.1
<i>Lota lota</i> Burbot	R	—	—	0.08	—	—	1	9	<0.1
<i>Labidesthes sicculus</i> Brook Silversides	F	—	—	—	0.02	—	493	494	0.4
<i>Morone chrysops</i> White Bass	S	0.06	1.44(3)	0.14(10)	2.36(8)	—	107	398	20.0
<i>Ambloplites rupestris</i> Rock Bass	S	0.10	0.66(5)	0.32(9)	1.18	0.08(6)	100	282	23.4
<i>Lepomis cyanellus</i> Green Sunfish	S	—	—	0.01	—	—	—	1	<0.1

Table 1 (Continued)

Species	Design	Catch Per Unit of Effort					Seine	Total Number	Total Weight (kg)
		Gill (No./24 hr)	L. Frame (No./24 hr)	S. Frame (No./24 hr)	Electrofish. (No./15 min)	Hoop (No./24 hr)			
<i>Lepomis gibbosus</i> Pumpkinseed	S	0.02	0.33(8)	0.13	0.20	0.01	56	117	4.4
<i>Lepomis humilis</i> Orangespotted Sunfish	S	—	0.01	—	—	—	12	13	0.1
<i>Lepomis machrochirus</i> Bluegill	S	0.02	0.77(4)	0.99(2)	8.66(1)	0.05(8)	1,640(5)	2,258(3)	53.8
<i>Micropterus dolomieu</i> Smallmouth Bass	S	—	—	0.01	0.92	—	15	62	14.3
<i>Micropterus salmoides</i> Largemouth Bass	S	0.01	0.02	0.09	0.68	—	235	282	10.6
<i>Pomoxis annularis</i> White Crappie	S	0.15(8)	3.25(2)	0.43(5)	1.30	0.25(2)	51	542(10)	61.4
<i>Pomoxis nigromaculatus</i> Black Crappie	S	0.14	4.29(1)	1.17(1)	4.49(3)	0.23(3)	779(9)	1,605(6)	102.8(6)
<i>Ammocrypta clara</i> Western Sand Darter	F	—	—	—	—	—	230	230	0.1
<i>Etheostoma asprigene</i> Mud Darter	F	—	0.01	—	—	—	33	34	<0.1
<i>Etheostoma exile</i> Iowa Darter	F	—	—	—	—	—	1	1	<0.1
<i>Etheostoma nigrum</i> Johnny Darter	F	—	—	0.02	—	—	866(8)	868(9)	0.3
<i>Perca flavescens</i> Yellow Perch	S	0.01	0.12	0.03	1.42	0.01	285	373	5.7
<i>Percina caprodes</i> Logperch	F	—	—	0.02	—	—	46	48	0.1
<i>Percina maculata</i> Blackside Darter	F	—	—	—	—	—	—	1	<0.1
<i>Percina shumardi</i> River Darter	F	—	—	—	—	—	10	10	<0.1
<i>Stizostedion canadense</i> Sauger	S	0.03	0.05	0.04	2.18(9)	—	5	128	17.4
<i>Stizostedion vitreum vitreum</i> Walleye	S	0.03(2)	0.01	—	1.77(10)	—	21	115	23.5
<i>Aplodinotus grunniens</i> Freshwater Drum	S	0.34(4)	0.41(6)	0.03	2.59(7)	0.20(4)	4	252	83.7(8)
							<u>22,870</u>	<u>28,379</u>	<u>1,988.4</u>



The most numerous percids were johnny darter (3.1% of the total catch) and yellow perch (1.3%) (Table 1). Walleye comprised 1.2% of the total catch biomass and sauger, 0.9%.

Some other species that contributed significantly to the total catch biomass were northern pike (176.9 kg, 8.9%), freshwater drum (83.7 kg, or 4.2%), and shovelnose sturgeon (72.7 kg, or 3.7%) (Table 1). Another numerous forage species was gizzard shad (3.3% of the total catch).

In summary, the most numerous species, according to the total catch number of all gear types combined, were emerald and spotfin shiners, bluegill, spottail shiner, bullhead minnow, and black crappie (Table 1). Those species that contributed most to the total catch biomass (all gear combined) were common carp, shorthead redhorse, northern pike, silver redhorse, flathead catfish, and black crappie.

Gill net CPUE indicated that common carp, northern pike, shovelnose sturgeon, freshwater drum, and silver redhorse were the important species in the riverine portion of Pool 7 (Table 1). Large frame nets sampled the centrarchids more effectively and these data suggested the most abundant species were black and white crappies, white bass, bluegill, and rockbass. Small frame net CPUE also indicated that centrarchids were dominant (black crappie and bluegill) but also emphasized the importance of forage species, including spottail and spotfin shiner (Table 1). Electrofishing CPUE again signified the major role of bluegill and black crappie, but electrofishing was also effective in capturing some catostomids, namely shorthead redhorse, spotted sucker, quillback, and silver redhorse. Hoop nets appeared to be the most selective gear type. Hoop net CPUE, generally low, indicated that flathead catfish was an important riverine species.

CPUE was not calculated for seining because it was not possible to uniformly sample the different habitats. Ranking the

combined seine catch, however, emphasized the major role filled by the forage species in the riverine portion of Pool 7 (Table 1). Emerald shiner, spotfin shiner, spottail shiner, bullhead minnow, golden shiner, and gizzard shad owe their high total catch ranking to seine haul results.

#### SUMMARY

Sampling during 1978 and 1979 in 12 areas associated with the riverine portion of Pool 7 documented the presence of a complex fish community. Seventy-one fish species were taken by a variety of gear types. The numerical dominance of some minnow species and other young of the year signified a strong forage base for piscivores, although few large predators (other than northern pike) were prominent in the catch. The riverine portion of Pool 7 seems to be favorable habitat for several species of centrarchids and catostomids. These results reflect the habitat diversity of the river channel and its border. If habitat heterogeneity begets fish community complexity, then attempts to further alter the Upper Mississippi River should be restrained.

#### ACKNOWLEDGMENTS

I express my appreciation to the many students who have contributed to this study, and to the University of Wisconsin-La Crosse Faculty Research Committee and Dairyland Power Cooperative (La Crosse) for financial support.

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# MAMMALS OF FORT McCOY, MONROE COUNTY, WISCONSIN

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## INTRODUCTION

This study was initiated by the author during the summers of 1976 and 1977 to inventory the species of mammals present in Fort McCoy. Information on fur bearers and some of the larger game mammals was provided by Kim Mello, biologist at Fort McCoy, from data collected during the winters of 1979 and 1980.

## MATERIAL AND METHODS

The fort grounds were sampled randomly with snap traps, live box traps and mist nets. Records from trappers were used when available. Trapping was conducted both diurnally and nocturnally. Allocations of specimens to subspecies followed Hall (1981). Specimens were verified by Dr. Herschel Garner. All specimens are on deposit in the mammal collection of Tarleton State University, Stephenville, Texas.

## STUDY AREA

Fort McCoy is located on 59,778 acres in Monroe County, in the unglaciated area of southwest Wisconsin (Martin 1916). The undeveloped habitat suitable for wild mammals consists of 261 acres in streams, ponds, and flowages, 51.1 miles of trout streams and 57,767 acres of varied terrestrial habitats. The altitude ranges from 850 to about 1,450 feet above sea level. The topography is nearly level to very steep with intermittent areas of rolling terrain. The La Crosse River and its tributaries drain most of the fort. Silver Creek drains the extreme south part and merges with the La Crosse River outside the fort boundary at Angelo, Wisconsin. Sparta, Stillwell and Tarr Creeks drain the south central part. All three merge southwest of the troop billeting area then

join the La Crosse River. Squaw Creek and the La Crosse River proper drain the central and north-central area. The north end is drained by Clear Creek (Crispin, *et al.* 1976).

The soils of Fort McCoy are predominantly sands or rough stony land of little agricultural value. Only a few scattered areas of loam or silt loam exist. There are at least five different major soil types.

The average length of the growth season varies from 125 days on low-land to 140 on the uplands. The average killing frost date in the spring is April 25, and for the fall is October 16 (Whitson and Baker 1912). Records from the weather recording station indicate the mean annual precipitation for the fort is 31.16 inches; mean annual temperature is 46.29°F.

This region of Wisconsin consists principally of forest cover with some grassy openings. The native climax grasses are mainly big bluestem (*Andropogon gerardi*) and little bluestem (*Andropogon scoparius*). The principal species of native trees are jack pine (*Pinus banksiana*), white pine (*Pinus strobus*), paper birch (*Betula papyrifera*), red oak (*Quercus rubra*), black oak (*Quercus velutina*), white oak (*Quercus alba*), red maple (*Acer rubrum*), box elder (*Acer negundo*), northern pin oak (*Quercus ellipsoidalis*), and quaking aspen (*Populus tremuloides*).

## SYNOPSIS OF SPECIES

*Didelphis virginiana virginiana* (Kerr)  
Common Opossum. Uncommon throughout the fort limits. Occasionally observed meandering around the buildings after dark, but primarily inhabitants of the deciduous woods. After the harsh winter of 1978, the number of opossums on post declined.

*Sorex cinereus cinereus* (Kerr) Masked Shrew. Uncommon. These shrews were found among the leaf litter of the deciduous or coniferous woods on post. Their greatest period of activity was during the crepuscular hours and at night. This shrew was difficult to catch using snap traps; it might prove to be more common if "pit fall" traps are used.

*Blarina brevicauda brevicauda* (Say) Shorttailed Shrew. Uncommon. Several were caught under log piles near the deciduous woods and in dense grass on the sides of the creeks. They are active primarily after sunset.

*Scalopus aquaticus machrinus* (Rafinesque) Eastern Mole. Very common. Mole workings occurred alongside the fort roads and in the grassy areas near the buildings. They were also common along the edges of the woods. Captures occurred during all hours of the day and night.

*Myotis lucifugus lucifugus* (Le Conte) Little Brown Bat. Very common. They are early flyers which were often seen coming from the attics of some of the buildings on post at twilight.

*Eptesicus fuscus fuscus* (Beauvois) Big Brown Bat. Very commonly seen flying around street lights at night. Many were found in the seldom-used halls of the old hospital. They were swift flyers, usually staying higher than 20 feet.

*Lasiurus borealis borealis* (Müller) Red Bat. Common. Red bats were seen flying up and down the creeks and around street lights shortly after dark. They are swift flyers and usually fly at a height of about twenty feet first, then at a height of about eight feet.

*Marmota monax monax* (Linnaeus) Woodchuck. Abundant. Woodchucks were found in the grassy areas between the buildings, in culverts under the roads, and along edges of the woods. They were especially active in early morning and late afternoon.

*Spermophilus tridecemlineatus tridecemlineatus* (Mitchell) Thirteen-Lined Ground Squirrel. Abundant in the short dry grassy meadow and along the sides of the roads in

the cantonment area. They seem to prefer the sandy soils. All specimens were trapped diurnally.

*Tamias striatus griseus* (Mearns) Eastern Chipmunk. Common in the woods and at the post recreation area by the lake during the day.

*Eutamias minimus neglectus* (J. A. Allen) Least Chipmunk. Rare. Several were observed at the post recreation area. They prefer the coniferous woods. They were active throughout the day, but their greatest activity was in early morning and later afternoon.

*Sciurus carolinensis hypophaeus* (Merriam) Eastern Gray Squirrel. Abundant in the deciduous woods.

*Sciurus niger rufiventer* (Geoffroy-Saint-Hilare) Fox Squirrel. Abundant in the deciduous woods.

*Tamiasciurus hudsonicus minnesota* (Allen) Red Squirrel. Abundant in the deciduous woods. A nest with four baby squirrels was found inside a rotten stump four feet above ground.

*Glaucomys volans volans* (Linnaeus) Southern Flying Squirrel. Flying squirrels were common in the deciduous woods, but due to their nocturnal habits, they were seldom encountered.

*Geomys bursarius wisconsinensis* (Jackson) Plains Pocket Gopher. Gophers were common in open areas with loam or sandy soils. Some mounds were observed along the edges of woods.

*Castor canadensis michiganensis* (Bailey) Beaver. Common. Colonies of beavers use the lakes on post and their dams have impounded water in several places. The beaver population has been estimated to be 130 using data from a biological survey. Sixty-three were trapped in 1981 by trappers.

*Peromyscus leucopus noveboracensis* (Fisher) Northern Whitefooted Mouse. These mice were very abundant in the wooded areas. Most were caught near tree stumps and fallen logs. Several were caught beside piles of limbs that had been stacked. All were trapped after dark.

*Clethrionomys gapperi gapperi* (Vigors) boreal Red-Backed Vole. Red-backed voles were very abundant among the fallen logs and tree stumps. This record is a range extension of 13 miles south from Millston, Jackson County and 22 miles southwest from Mather, Juneau County (Jackson, 1961). Six adults were caught in the same runway beneath a decaying stump, indicating that the red-backed vole could live in colonies and be gregarious. Manville (1949) concluded that the red-backed vole does not form colonies and is not gregarious. Two specimens were caught during the day, the others were caught at night.

*Microtus pennsylvanicus pennsylvanicus* (Ord) Meadow vole. Meadow voles were very abundant between buildings and tall grassy fields. Some were trapped inside buildings. The meadow vole was the most common microtine trapped on the post. These voles were active all day, but most were trapped at night.

*Ondatra zibethicus zibethicus* (Linnaeus) Muskrat. Common. Several colonies have become established on the lakes within the fort boundaries. In 1981, 94 muskrats were trapped by fur hunters. The estimated population is 1,000.

*Rattus norvegicus* (Berkenhout) Norway Rat. Uncommon. They are found under the barracks and also near the messhalls. None were trapped very far from areas frequently used by humans.

*Mus musculus domesticus* (Rutty) House Mouse. Common. They are found around buildings and under piles of decaying logs where timber had been cleared.

*Zapus hudsonius intermedius* (Zimmerman) Meadow Jumping Mouse. Common. Many jumping mice were trapped along the creeks with tall grass along their banks. All specimens were trapped between midnight and dawn.

*Erethizon dorsatum dorsatum* (Linnaeus) Canada Porcupine. Rare. Only a few have been seen in the wooded areas on the northern part of the post limits.

*Lepus americanus phaeonotus* (J. A.

Allen) Snowshoe hare. Rare. Only one has been taken by a hunter in 1979 in the brushy woodlands area of the northern post limits.

*Sylvilagus floridanus mearnsii* (J. A. Allen) Eastern Cottontail. Cottontails were abundant throughout the post. They are very common around the buildings. The cottontails prefer thickets or dense brush. Most were sighted in the early morning hours and shortly before sunset. The biological survey estimated the cottontail population to be over 1,000.

*Canis latrans thamnos* (Jackson) Coyote. Uncommon. However, coyotes were found roaming brushy habitats of the impact area and outlying training areas. Only two were trapped by trappers in 1980.

*Vulpes fulva fulva* (Desmarest) Red Fox. Common around the creek bottoms with good concealment. Thirty-six were trapped in 1981 by fur hunters.

*Urocyon cinereoargenteus ocythous* (Bangs) Gray Fox. Gray foxes are common in the brushy areas, usually along streams. They were found in the woods more often than the Red Fox. Eighteen were trapped in 1981 by fur hunters.

*Procyon lotor hirtus* (Nelson and Goldman) Raccoon. Raccoons were very common in the deciduous woods, usually along streams. They frequently came into the cantonment area at night in search of food. Seventy were trapped by hunters in 1981.

*Mustela rixosa allegheniensis* (Rhoads) Least Weasel. Rare. They were sighted near streams in grassy fields. They were seldom found in the woods. Only one was captured on the post limits.

*Mustela frenata noveboracensis* (Emmons) Longtailed Weasel. Rare. The one Longtailed Weasel observed was in woodlands near streams.

*Mustela vison letifera* (Hollister) Mink. Common. Mink were found in wooded areas along streams and lakes. The biological surveys estimate a population of 200. Fur hunters trapped 2 minks in 1981.

*Taxidea taxus jacksoni* (Schantz) Badger. Common in the impact and training areas.

*Mephitis mephitis hudsonica* (Richardson) Striped Skunk. Skunks were commonly seen roaming at night throughout the post. More common in open wooded areas. Sixty-two were trapped by fur hunters in 1980.

*Lutra canadensis canadensis* (Schreber) Otter. Uncommon. Only a few sightings of otters on post have been documented. These sightings were along streams that were away from the normal areas used for training. A biological survey estimated a population of only 10 otters on the post.

*Lynx rufus superiorensis* (Peterson and Downing) Bobcat. Rare. Very few observations have been reported to biologists on post. These were in the heavily wooded area at higher elevation.

*Odocoileus virginianus borealis* (Miller) Whitetailed Deer. Deer were very common in the woods on post. They were seen roaming throughout the post limits in mornings and evenings. The 1981 deer census conducted on the post has estimated the deer population to be between 1800-2100. The number killed by hunters in 1981 was 839.

#### CONCLUSION

Although Fort McCoy is used as a training area for several thousand military personnel the environment is still inhabited by a total of thirty-nine mammal species, which were recorded on the post reservation; eleven of these species had not previously been offi-

cially recorded in Monroe County (Table 1). Most of these are fairly common to this part of Wisconsin but six represent species that are either at or approaching their distributional limits. (Jackson, H. T., 1961)

No records were obtained for four species which are believed to be present. *Spermophilus franklini*, *Peromyscus maniculatus*, *Synaptomys cooperi*, and *Microtus ochrogaster*. They are within the known ranges (Jackson 1961); with more intensive collecting, these species should be obtained.

#### ACKNOWLEDGEMENTS

I am grateful to Dr. Herschel Garner, Tarleton State University, for verifying the mammals captured and also for his critical reviewing of this manuscript and his advice and helpful suggestions. To Kim Mello, who compiled field data on some of the game and fur bearing mammals of Fort McCoy, Wisconsin, and also for reviewing this manuscript, I am also grateful. Finally, to Dr. Ruth Hine, for her helpful advice and review of this manuscript.

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TABLE 1. New Records of Mammals from Monroe County, Wisconsin.

<i>Myotis l. lucifugus</i>	
<i>Eptesicus f. fuscus</i>	Northeastern limit
<i>Lasiurus b. borealis</i>	
<i>Tamias striatus griseus</i>	Southern limit
<i>Eutamias minimus neglectus</i>	Southern limit
<i>Glaucomys v. volans</i>	
<i>Geomys bursarius wisconsinensis</i>	Eastern limit
<i>Clethrionomys g. gapperi*</i>	Southwestern limit
<i>Zapus hudsonius intermedius</i>	Southwestern limit
<i>Mustela frenata noveboracensis</i>	
<i>Lutra c. canadensis</i>	

\* Species representing small range extension.

# A VASCULAR FLORA OF WINNEBAGO COUNTY, WISCONSIN

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## *Abstract*

The major part of this study is a catalogue of vascular plants that were growing or now grow without cultivation in Winnebago County, Wisconsin. Catalogues of an area's vegetation are an important scientific record. They also serve a critical function in geographical areas where land is continually being converted for urban development and agricultural use. Winnebago County, which in presettlement days was largely covered by hardwood forests, scattered prairies with oak openings, and abundant wetlands, now is over 80 percent developed. Today only seven percent of the land area is wooded, remnant prairies are rare, and wetland acreage has been greatly reduced. While a large number of native species have been identified in the county, the quantity of many of these species has diminished over the years. One dramatic loss has been the disappearance of bogs and almost all bog vegetation. Steps have been taken by the state, the county, and other interested groups to protect several sites of botanical value, but the spread of non-native species, development pressures, and poor land use practices continue to threaten natural habitats.

## SIGNIFICANCE OF A COUNTY FLORA

A county flora is part of an old botanical tradition. As a record of the vegetation of a limited geographical area, it is a valuable reference for comparison with the flora of other areas and the same region at a future date. It documents both the disappearance of species and the introduction of new ones. Awareness of these changes in floristic makeup can initiate action to protect rare species, preserve native plant communities, and inhibit aggressive species which may pose a threat.

Concentrated efforts in a limited geographical area result in a more complete listing of species present than work done in a larger region. In the course of this study, many new county records were added. This does not so much reflect the rarity of these taxa as it does the bias of collectors for favorite places and the tendency to travel

within easy distance from centers of botanical activity.

Since a flora of any region is in a constant state of change, a study of this type is never complete. It is anticipated that this beginning will be an incentive for others to add to this record.

## LOCATION AND LAND USE

Winnebago County, located in east central Wisconsin, is one of the smallest counties in the state, with a land area of 454 miles, or 285,920 acres. An additional 84,000 acres is water. One half of Lake Winnebago is included in the county and makes up most of its eastern border (Fig. 1). The parallel 44°05' North Latitude and the meridian 88°40' West Longitude intersect in the county.

About 10 percent of the land area is wetlands and about seven percent forested. Agriculture is a major land use, with over 70 percent of the land committed to farming. Most development is concentrated along the eastern edge of the county in the Fox River

<sup>1</sup> Publication of this paper has been supported by the Norman C. Fassett Memorial Fund.

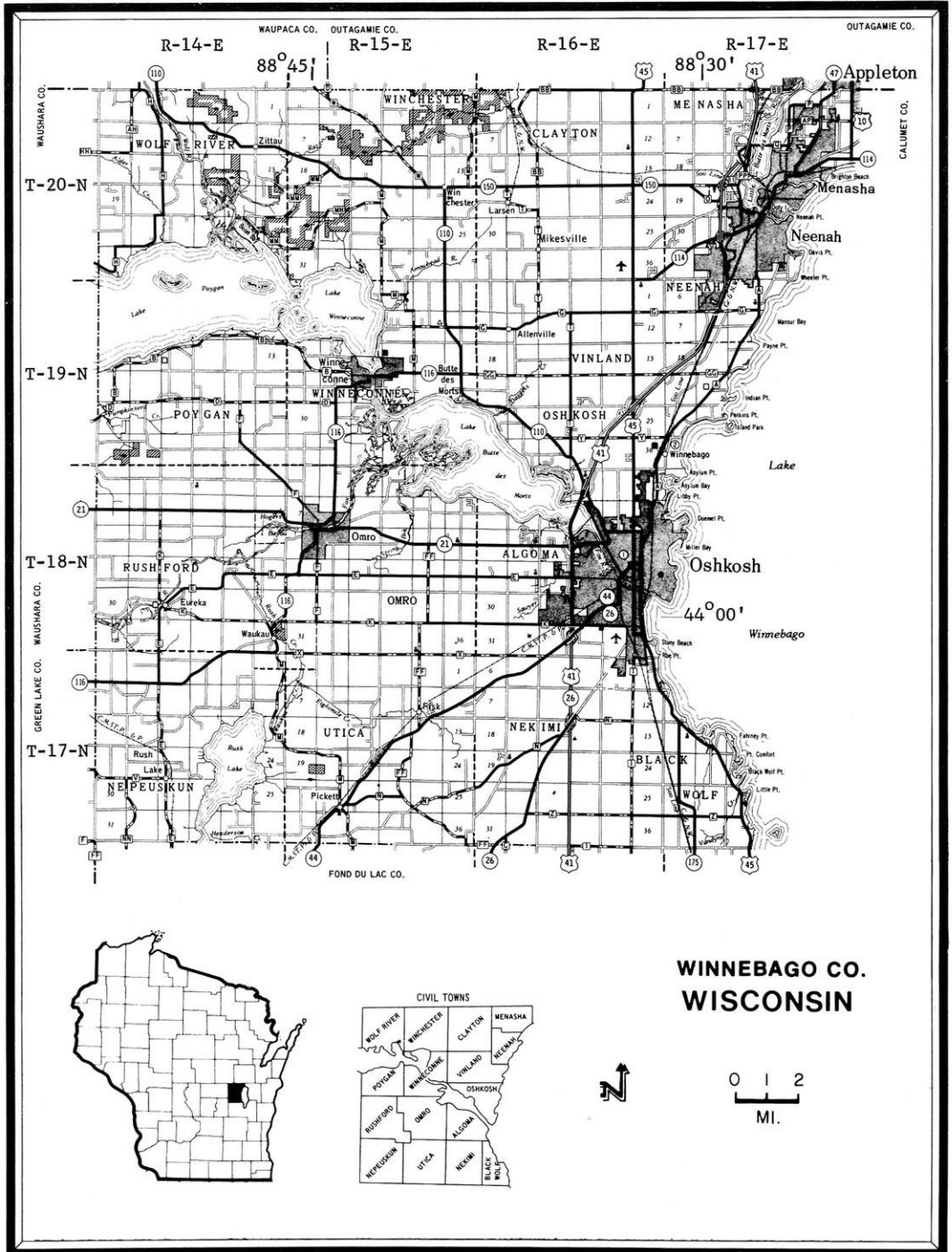


Fig. 1

Valley, an urbanized area extending from Green Bay to Fond du Lac. Population in 1980 was 131,732.

#### SURFACE WATER AND DRAINAGE

The county lies entirely within the Fox-Wolf River drainage basin. The Fox River enters the county from the southwest, emptying into Lake Winnebago at Oshkosh, and after being split into two channels by Doty's Island at Neenah and Menasha, flows through Little Lake Butte des Morts and out of the county at Menasha. The Wolf River, a tributary of the Fox, enters the county from the north, flowing into Lake Poygan and through Lake Winneconne to join the Fox River in Lake Butte des Morts. Lakes Butte des Morts, Poygan, Winneconne, and Little Lake Butte des Morts cover a total area of about 20 square miles. One other lake, Rush Lake, is located in the southwestern part of the county. This lake, with a maximum depth of approximately five feet, is drained by Waukau Creek which flows into the Fox River between Eureka and Omro.

#### PHYSIOGRAPHICAL AND GEOLOGICAL FEATURES

Granitic rocks of Precambrian age underlie the county. These do not outcrop, but are the upper rock unit in one small area north of Lake Poygan (Olcott, 1966).

Above the Precambrian age rocks are four approximately parallel units of sedimentary rocks of Cambrian and Ordovician age. From west to east, the eroded edges of these rock units are exposed in this order: Cambrian age sandstones, Prairie du Chien dolomite, St. Peter sandstone, and Platteville-Galena dolomite. Because of differential weathering, the harder dolomitic layers form two cuestas with backslopes to the east. The west facing escarpments are relatively low, with the Prairie du Chien unit higher than the Platteville-Galena.

The land, fairly flat near the lake, tends to become gently rolling toward the west. The

relief of the county is low with a range of altitudes between 750 and 950 feet above sea level.

The topography of the bedrock controls in part the topography of the county. Pre-glacial valleys cut into bedrock have been filled with glacial deposits so the landscape is relatively level. Glacial deposits in the county were laid down during the Cary and Valders stages of Wisconsin glaciation.

#### SOILS

Soils in the county are classified predominantly as heavy clayey type soils. Sandy soils are limited to an area in the northwest part of the county. About 54% of the land area is classed as "wet" soils, i.e. saturated with water for long periods at a depth of three feet.

The county's soils fall into seven general soil associations. The major soil associations in parts of the county covered by the most recent glacier, the Valders ice sheet, are Kewaunee-Manawa-Hortonville, Zittau-Poy, Houghton-Willette and Oakville-Brem-Morocco. Valders drift, which covers about 86% of the county is a fine textured red clay material with a subdued relief. In the southwestern part of the county, which was primarily influenced by the Cary ice sheet, major soil associations are Kidder-McHenry, LeRoy-Ossian-Lomira, and Plano. Cary drift is characterized by yellowish brown, loamy till with more hills and ridges than Valders drift (Mitchell, 1977).

#### CLIMATE

The climate of the county is continental, with long cold winters and warm humid summers. Mean yearly temperature is 45.9°F (7.7°C). The monthly averages range from 18.6°F (-7.4°C) in January to 72.4°F (22.4°C) in July. About five months of the year are usually free from freezing temperatures. May 9 is the average date of the last 32° temperature in spring and October 4, the



PRESETTLEMENT VEGETATION  
OF  
WINNEBAGO COUNTY, WISCONSIN



After R.W. Finley, 1976. From U.S. General Land Office Notes










- |   |                                 |   |   |
|---|---------------------------------|---|---|
|  | WHITE PINE,<br>RED PINE         |  | LOWLAND<br>HARDWOODS                            |
|  | BEECH, SUGAR<br>MAPLE, BASSWOOD |  | PRAIRIE   |
|  | OAK FOREST                      |  | SWAMP CONIFERS-WHITE<br>CEDAR, TAMARACK         |
|  | OAK OPENINGS                    |  | SEDGE MEADOW, WET<br>PRAIRIE, LOWLAND<br>SHRUBS |
|  | SUGAR MAPLE<br>BASSWOOD         |   |   |

Fig. 2

first in fall. The growing season averages 148 days. Mean annual precipitation, including snowfall, is 28 inches.

#### THOMAS NUTTALL, FIRST BOTANIST

Thomas Nuttall was the first botanist to travel through the Winnebago County area. On a trip in 1810, he included three species as having been collected somewhere between Green Bay and the Wisconsin River portage. These were *Smilacina trifolia* (L.) Desf., *Artemisia gnaphaloides* Nutt., which is now generally considered to be a variety of *A. ludoviciana* Nutt., and *Amorpha canescens* Pursh. [*A. pumila* of Nuttall's Diary (Stuckey, 1967), a new species (Graustein, 1967, p. 53).] As these plants are now considered "lost" it is impossible to know exactly where they were collected. Nuttall also recorded his interest in the making of maple sugar and the harvesting of wild rice by the Indians (Graustein, 1967).

#### PRESETTLEMENT VEGETATION

The presettlement vegetation of Winnebago County was primarily oak savanna interspersed with prairie, southern hardwoods, and in the northern part of the county, pine forests. Wetland plant communities were abundant along the water courses (Fig. 2).

While the field notes of government surveyors dating back to 1834 are the most accurate source of information about presettlement and early settlement vegetation of the county, earlier reports by explorers, traders, and missionaries give an indication of the nature of the county and the plants growing in the region.

Among the most revealing indicators were notes on the food habits of the Indians. Almost all written accounts mention wild rice (*Zizania aquatica* L.). This plant grew in great abundance along the Fox-Wolf and Rat River waterways. The Jesuit Allouez,

wrote of his journey on the Fox River: "The banks of this river, which flows gently through the midst of these prairies are covered throughout with a certain plant bearing what is called here wild oats of which the birds are wonderfully fond." (Jesuit Relations, 1670-1671, 55:193). Jerusalem artichoke (*Helianthus tuberosa* L.) was also gathered by the Indians. In addition, wild plums, crab apples, and berries were reported as Indian food (Campbell, 1906, 2:55). All of these plants grow wild in the county today.

Foraging and gathering had little impact on the flora. Some activities of the Indians, however, brought about deliberate change from the natural condition. Early records describe Indian agriculture. "The Indians raised large quantities of Indian corn, beans and pumpkins, squashes, watermelons and some tobacco. . . ." (Carver, 1796).

In his field notes of the early survey of Poygan Township, in 1852, James Marsh records Indian cornfields and Indian planting grounds. Harney (1880, p. 279) also mentions Indian fields in Black Wolf Township.

Fires set deliberately by the Indians may have been an important factor in maintaining the prairies and oak openings in the county (Curtis, 1959, p. 361). Fuel gathering activities, which included felling trees as well as gathering downed wood, also had an effect on the nature of the woodland.

Curtis (1959, p. 463) claims that there is circumstantial evidence that Indians may have been responsible for the introduction of certain plants into Wisconsin. Among these are *Prunus americana* Marsh. (Canada plum), *Acorus calamus* L. (sweet flag), *Allium tricoccum* Ait. (wild leek), and *Apios americana* Medic. (ground nut). A tree with spotty distribution, associated with Indian village sites, is *Gymnocladus dioica* (L.) Koch (Kentucky coffee tree). The spread of this tree may have resulted from the use of its seeds in a kind of dice game played by the

Indians (Curtis, 1959, p. 463). The Kentucky coffee tree is present in the county today in a few scattered locations.

### Government Survey Records

The government survey records indicate that some townships in the county were prairie and oak opening, with oak-hickory forests on the drier sites and maple-basswood forests on the mesic sites. *Pinus strobus* L. (white pine) was common in the northern part of the county as well as *Larix laricina* (Du Roi) K. Koch (tamarack) and *Thuja occidentalis* L. (white cedar) in the swamps. Survey records also identified marshes along rivers and lake shores.

The prairies are now mostly farm fields, but prairie plants still grow in some undisturbed roadsides and fields as well as along railroad rights-of-way. *Quercus macrocarpa* Michx. (bur oak), a common tree of the oak openings, is still an important tree in the county, but most of the surviving large trees are in yards or parks and in a few uncut oak woods. Oak-hickory and maple-basswood forests are still present but in greatly reduced acreage and mostly second growth. *Fagus grandifolia* Ehrh. (American beech), sometimes a member of the maple-basswood forest, was recorded as a witness tree in the early survey of Menasha Township. Costello (1931) showed American beech for Winnebago County on his distribution map. Except for a few beech trees on undeveloped city lots in Menasha and east of Little Lake Butte des Morts, native beech trees seem to have disappeared from the county.

When wetlands were recorded, surveyors listed numerous marshes containing marsh hay or grass and, as might be expected, wild rice. In the swamps, surveyors noted "alder swamp" and "tamarack swamp" in Wolf River Township, "willow swamp" and "black ash swamp" in Poygan Township, and "cedar and tamarack swamp" in Winchester Township. White cedar and tamarack

still grow in the county, much of it on land which is in public ownership.

The surveyors were not botanists and the reliability of their identifications might be questioned. They used common names exclusively, but in only a few cases is there some doubt about what species is meant.

A tree often mentioned in the survey notes was "sugar." This was generally used to denote *Acer saccharum* Marsh. (sugar maple). Sometimes "maple" was used making it difficult to know what species of maple was intended. "Elm" was probably *Ulmus americana* L. (American elm) but in one instance "slippery elm" was mentioned (*Ulmus rubra* Muhl.). It is probably reasonable to assume that where "pine" was used, it referred to *Pinus strobus* L. (white pine) but in Wolf River Township, James Marsh, in 1852, recorded "yellow pine." He probably was referring to *Pinus resinosa* Ait. (red pine) which grows in the county along with white pine in some of the northern townships.

John Brink, in his surveys of the townships of Utica, Nepeuskun, and Nekimi, mentioned an undergrowth of "red root" and "rosen weed." "Red root" is probably *Ceanothus americanus* L. and "rosen weed." *Silphium laciniatum* L. (Parry, 1848). He also mentions "a growth of red top, cane" in the marshes. "Red top" probably was *Calamagrostis canadensis* (Michx.) Beauv. (blue joint). The European *Agrostis stolonifera* L., also called "red top," was not well established at the early date of 1834 when the townships were surveyed. The "cane" was probably *Phragmites australis* (Cav.) Trin. ex Steud. which is an obvious grass in low meadows.

### EARLY SETTLEMENT

After the land was surveyed and became available for purchase, it was not long before the many advantages of the area attracted immigrants in increasing numbers. At the time the county was organized in

1842, the population was 143 (McLeod, 1846); in just eighteen years, by 1860, it had grown to 23,770 (Titus, 1930).

With settlement came accelerated changes in the vegetation. Trees were cut for cabins and fuel and the land was cleared for agriculture. As the towns grew into cities, much of the original vegetation of the town sites was destroyed. Harney (1880, p. 230) describes the Township of Menasha in the early days of settlement.

Its surface, originally covered with a dense growth of timber, principally sugar-maple, white and swamp oak, beach [beech], hickory, ash and basswood, interspersed in the north-west portion of the town with groves of pine, has been to a large extent, cleared of timber and converted into excellent farming lands.

The coming of the settlers greatly reduced the amount of forested land in the more heavily timbered townships. Extensive logging depleted most of the virgin pines in the northern tier of townships, which lie at the southern edge of the famous "Wolf River Pinery." Settlement, however, was also responsible for an increase in the acreage of woodland in certain of the more open parts of the county.

In the early days, the prairie and openings portion of the county was more open than at present. The annual fires kept down the young growth. Since they have stopped, a native growth has sprung up on the uncultivated ground, and especially in the towns of Utica and Nepeuskun that used to be considered prairie towns, large groves of good sized trees have grown up within the past twenty-five years (Harney, 1880, p. 130).

The luxuriant growth of marsh hay in the county's abundant lowlands was considered an asset when farm land was selected. Harney (1880, p. 261 and p. 275) describes land in the Township of Winneconne, ". . . where extensive marshes abound, of little value, save some which are sufficiently firm to produce good crops of grass and hay."

and in Wolf River Township, ". . . good wild hay is cut on some of the marshes. . . ."

The abundant marshes in the county not only served the farmer as a source of marsh hay, but also stimulated the founding of a grass twine and grass rug industry. The "wire grass" was bound together with cotton thread to make binder twine. This enterprise proved unsuccessful because crickets ate the cotton thread and the twine fell apart. In 1902, the Oshkosh Grass Rug Company began weaving marsh grass into rugs which were sold in many places all over the country as "art squares." The last grass used for this purpose was harvested in 1929 but until 1935 rugs were made from supplies on hand. The waste grass, about 60 percent of the total, was sold for packing material. Although no record of the scientific names of the grass used for these purposes could be found, it was probably a sedge, *Carex stricta*.

Cranberries were harvested and raised with some success for a short time. Harney (1880, p. 275 and 248) writes, ". . . small tracts of marsh have been purchased for raising cranberries; although at the present time with indifferent success." and also in Rushford Township, "In the northwestern portion of the town are some very productive cranberry marshes." In 1907, Lawson (1908, 1:255), lists 512 bushels of cranberries for the county, produced on 110 acres. Today there is little if any evidence of the existence of these cranberry bogs. Tamarack still grows in some locations but without the bog species that might be associated with it.

#### INTRODUCTION OF EXOTICS

Exotics were imported for landscaping at an early date. The survey records from about 1850 show English poplar (*Populus alba* L. ?) and Lombardy poplar (*Populus nigra* L.) as witness trees. Probably the immigrants felt more at home surrounded by familiar plants from the "old country." Norway spruce (*Picea abies* Karst.) was a very popular tree for landscaping and wind breaks.

Norway spruce trees are still growing near rural and urban homes. Also imported were cultivated plants that have since spread beyond the garden. The common dandelion (*Taraxacum officinale* Weber) and chicory (*Cichorium Intybus* L.) were imported as food plants and are now ubiquitous weeds. Water cress (*Nasturtium officinale* R. Br.) was planted in springs and now appears native. Loosestrife (*Lythrum salicaria* L.) and forget-me-not (*Myosotis scorpiodes* L.) were imported for the garden. Loosestrife now appears to be a threat to wetlands, spreading and replacing native wetland species. Of interest may be the early record of forget-me-not in the county. It was collected growing wild in 1894, one of the earliest dates for the State of Wisconsin (Johnson, 1972).

In more recent times, floristic additions to the county have included plants that have extended their ranges. Two of these are *Lycopus asper* Greene and *Aster furcatus* Burgess (Tans & Read, 1975). A very recent addition to the flora of the county is *Butomus umbellatus* L. found in the Wolf River south of Orihula.

Two other aquatics have recently become part of the flora of Winnebago County: *Potamogeton crispus* L. and *Najas marina* L. More recently a halophyte, *Juncus compressus* Jacq. has become established and is spreading along a roadside. This colony is located along a heavily traveled stretch of road that has undoubtedly been repeatedly salted. Possibly this salt tolerant species is better able to compete with other plants in this location.

Two recent intentional introductions are *Coronilla varia* L. (crown vetch) and *Lotus corniculatus* L. (bird's foot trefoil), both planted for erosion control, forage, and soil enrichment. *Lotus* appears to be spreading onto lawns from roadsides where it had been planted for erosion control.

#### PROTECTED AREAS

Poor land use practices, residential development pressures and conversion of

wetlands to agricultural use continue to be responsible for loss of native plant communities. To offset these losses, steps have been taken by the State and other interested groups to protect several sites of botanical interest. These include High Trestle Scientific Area (Sec 12, T17N, R17E), Allen Marsh (Sec 4, T18N, R16E) on Lake Butte des Morts, Waukau Creek Nature Preserve (Sec 25, T18N, R14E), and prairie preserves along the county recreation trail (Sec 31, 32, T20N, R16E and Sec 5, 6, 17, T19N, R16E). In addition, the Department of Natural Resources has acquired natural lands as hunting areas and owns marshes adjacent to critical fish spawning beds. Some high quality natural areas in the county are still unprotected. Unless action is taken in the near future to preserve these areas, their unique scientific, historical, esthetic, and educational values will be lost.

#### CATALOGUE SOURCES

The major part of this report is a catalogue of vascular plants which have grown or now grow without cultivation in Winnebago County, Wisconsin. Included also are those cultivars that have escaped and are reproducing spontaneously.

The catalogue list is based principally upon specimens in the Herbarium of the University of Wisconsin-Oshkosh (OSH), the Buckstaff Collection, formerly housed at the Oshkosh Public Museum but now at the University of Wisconsin-Oshkosh, and my private herbarium, which for purposes of this report will be designated (RILL). All Winnebago County specimens in these herbaria have been examined and verified. Where specimens from other herbaria are cited, credit is given.

In addition to specimens from these herbaria, records from the literature have been included.

A search for species expected in the county, but not found in the above herbaria or during the course of field work, was made at the University of Wisconsin-Madison

(WIS), the Milwaukee Public Museum (MIL), and Ripon College herbaria.

#### CATALOGUE DESIGN

Families are listed according to the Engler-Prantl System. The genera and species are listed alphabetically within each family.

Nomenclature follows Gleason and Cronquist (1963) except where names do not conform to the International Code of Botanical Nomenclature or where new scientific investigations have presented a convincing argument that different names are appropriate. Exceptions to this are *Viola* which follows Russell (1965) except for *Viola papilionacea* Pursh, which Russell does not recognize as a species; and *Salix* which follows Argus (1964).

Each species is recorded with its scientific name and authority. For many, familiar common names, habitat, and statements about frequency of occurrence are included.

The terms "rare," "uncommon," "occasional," and "common" are used to describe frequency of occurrence. "Rare" plants are those found at one or two locations, "uncommon," those seen infrequently, "occasional" refers to those found more often but at scattered locations, and "common," those seen almost everywhere within the county. Although these terms are subjective and inexact, they indicate the relative abundance of species.

Specimens collected in the course of this study are deposited in the Herbarium of the University of Wisconsin-Oshkosh (OSH) and my private herbarium (RILL).

#### DEFINITIONS OF TERMS

The definitions of terms used in this report are as follows: *native flora*, *native vegetation*, and *native plant* refer to groups of plants or plants that were part of the pre-settlement flora. They have developed here since the last period of glaciation and have special value because they represent a gene pool with proven adaptability. An *exotic* is a plant native to another country or continent.

Although some native species may be aggressive, the term *weed* is used to indicate an aggressive exotic that is able to colonize disturbed soil.

#### STATISTICAL SYNOPSIS

The catalogue lists a total of 1024 species. Of these *Aethusa cynapium*, *Festuca myuros*, *Juncus compressus*, *Kickxia elatine*, and *K. spuria* are new for the state. The Compositae is the largest family with 125 species, the Gramineae next with 109, followed by the Cyperaceae with 80. Of the eight known orchids for the county, two are apparently extirpated. Broken down by major groups, there are 30 Pteridophytes, 7 Gymnosperms, 281 Monocots and 706 Dicots.

#### Catalogue of Species

##### LYCOPODIACEAE (Clubmoss Family)

- Lycopodium dendroideum* Michx. Ground cedar. Woods. Uncommon.  
*L. flabelliforme* (Fern.) Blanch. Running pine. Uncommon.

##### EQUISETACEAE (Horsetail Family)

- Equisetum arvense* L. Common horsetail. Roadsides, railroad cinders, and gravel. Common.  
*E. ferrissii* Clute. (*E. hyemale* x *laevigatum*.)  
*E. fluviatile* L. Water horsetail. Marshes, wet ditches.  
*E. hyemale* L. Railroad tracks.  
*E. laevigatum* A. Br. Smooth scouring rush. Roadsides, railroads, damp woods in substrates as diverse as cinders and clay.  
*E. x litorale* Kuhlw. (*E. arvense* x *fluviatile*.) Springy shore of Fox River, Eureka, 14 Sept. 1931, Fassett 13243 (WIS) (Hauke, 1965).  
*E. x nelsonii* (A.A.Eat.) Schaffner. (*E. laevigatum* x *variegatum*.) Railroad tracks.  
*E. scirpoides* Michx. Mapped for Winnebago County, Wisconsin (Tryon et al., 1953) and (Hauke, 1965) probably based on the same specimen (WIS), s.n., undated from the collection of J. J. Davis, collected by Dr. Lewis Sherman, labeled only Lake Poygan, Wisconsin. Lake Poygan is partly in Wau-shara County. Sight record, James Peck in cedar swamp. Northern part of County. Personal correspondence, 1981.

##### OPHIOGLOSSACEAE (Grapefern Family)

- Botrychium dissectum* Spreng. f. *obliquum* (Muhl.) Fern. Leather grape fern. One record.  
*B. lanceolatum* Angstr. Low forest. Northern part of County.

*B. matricariaefolium* A.Br. Low Forest. Northern part of County.

*B. virginianum* (L.) Sw. Rattlesnake fern. In woods. Uncommon.

OSMUNDACEAE (Royalfern Family)

*Osmunda cinnamomea* L. Cinnamon fern. Woods. Uncommon.

*O. claytoniana* L. Interrupted fern. Occasional, in woods.

*O. regalis* L., var. *spectabilis* (Willd.) A. Gray. Royal-fern. Damp meadows, wet woods, and ditches. Uncommon.

POLYPODIACEAE (Polypody Family)

*Adiantum pedatum* L. Maiden hair fern. Occasional. Woods.

*Athyrium angustum* (Willd.) Presl. Lady fern. Deciduous woods.

*Cystopteris bulbifera* (L.) Bernh. Bulbet fern. Wet woods with yellow birch and white cedar. One record.

*C. fragilis* (L.) Bernh. var. *fragilis*. Fragile fern. Woods and limestone outcroppings.

*C. fragilis* (L.) Bernh. var. *mackayi* Lawson.

*C. protrusa* (Weath.) Blasdell. Woods. One record.

*Dryopteris cristata* (L.) A. Gray. Crested fern. Swamps.

*D. intermedia* (Muhl.) Gray. Florist fern. Woods.

*D. spinulosa* (O. F. Muell.) Watt. Low woods.

*Matteuccia struthiopteris* (L.) Todaro, var. *pensylvanica* (Willd.) Morton. Ostrich fern. Wet woods.

*Onoclea sensibilis* L. Sensitive fern. Wet woods.

*Pteridium aquilinum* (L.) Kuhn. Bracken. Light soil.

*Thelypteris palustris* Schott., var. *pubescens* (Lawson) Fern. Marsh fern. Damp meadows, wet woods.

PINACEAE (Pine Family)

*Abies balsamea* (L.) Mill. Balsam fir. Shown for the county near the northern shore of Lake Winnebago (Fassett, 1930). Dots based on Cheney's unpublished manuscript show this species near the north shore of Lake Winnebago.

*Larix laricina* (Du Roi) K. Koch. Tamarack. Wet woods in the northern part of the county and west near the Waushara County line south of Lake Poygan. Old survey records show it much more abundant in the past.

*Pinus resinosa* Ait. Red pine. Large trees present in the northern part of county.

*Pinus strobus* L. White Pine. There are still some remnant forests of pine and hardwoods on the southern edge of the "Wolf River Pinery" in the northern part of the county.

*Tsuga canadensis* (L.) Carr. Hemlock. One tree only in a woods.

CUPRESSACEAE (Cypress Family)

*Juniperus virginiana* L. Red cedar. Occasional in dry woods and pastures.

*Thuja occidentalis* L. White cedar. Only in the extreme northern part of the county.

TYPHACEAE (Cattail Family)

*Typha angustifolia* L. Narrow cat-tail. Less common than the following. Wet marshes, lake shores and sloughs.

*T. latifolia* L. Cattail. Common. Wet marshes, lake shores, and sloughs.

*T. angustifolia* x *latifolia*.

SPARGANIACEAE (Bur-reed Family)

*Sparganium chlorocarpum* Rydb. Bur-reed. Partially dry drainage ditch. One record.

*S. eurycarpum* Engelm. Bur-reed. Marshes, wet shores. Common.

NAJADACEAE (Pondweed Family)

*Najas flexilis* (Willd.) Rostk. & Schmidt. Naiad. A common plant in lakes.

*N. marina* L. Rush Lake. Examined for Wisconsin rare species list 1977. One record.

*Potamogeton crispus* L. Forming large beds. Becoming more common in rivers and lakes.

*P. foliosus* Raf. One location only near the mouth of drain tile at outlet of farm pond.

*P. friesii* Rupr. (?) Lake Butte des Morts. Probably this, although specimen is vegetative.

*P. natans* L. In lakes. Common.

*P. nodosus* Poir. In lakes and rivers. Common.

*P. pectinatus* L. Sago pondweed. In lakes and rivers. Common.

*P. richardsonii* (Benn.) Rydb. In lakes and rivers. Common.

*P. zosteriformis* Fern. In lakes. Fairly common.

*Zannichellia palustris* L. Lake Poygan. Rill 4223 (RILL). Not collected often. Probably more common than collections seem to indicate.

ALISMATACEAE (Water Plantain Family)

*Alisma plantago-aquatica* L., var. *americanum* Schult. & Schult. Water plantain. Shallow water and wet marshy shores.

*A. plantago-aquatica* L., var. *parviflorum* (Pursh) Torrey. Shallow water, wet marshy shores.

*Sagittaria cuneata* Sheldon. Arrow head. Marshes, shallow water, shores of lakes and rivers.

*S. latifolia* Willd. Marshes, shallow water, shores of lakes and rivers.

*S. rigida* Pursh. Shallow water.

BUTOMACEAE (Flowering Rush Family)

*Butomus umbellatus* L. Flowering rush. Wolf River. In shallow water with *Sagittaria*, *Spartina*, *Typha*, and *Scirpus*. Apparently spreading. First collection from Winnebago County, 1976.

HYDROCHARITACEAE (Frog's-bit Family)

*Elodea canadensis* Michx. Waterweed. Quiet water.

*Vallisneria americana* Michx. Tape grass. Shallow water. Submersed.

GRAMINEAE (Grass Family)

*Agropyron repens* (L.) Beauv. Quack grass. A common weedy grass in old fields, pastures, gardens.

- A. smithii* Rydb. Occasional along railroad tracks.  
*A. trachycaulum* (Link.) Malte. Prairies and fields.  
*Agrostis hyemalis* (Walt.) BSP. Weed in rock garden. One record.  
*A. stolonifera* L. including *A. gigantea* Roth. Red top.  
*Alopecurus aequalis* Sobol. Dry drainage ditch. One location.  
*A. pratensis* L. Disturbed fields and lake shores.  
*Andropogon gerardii* Vitm. Big bluestem, turkey foot. Prairies and undisturbed roadsides.  
*A. scoparius* Michx. Little bluestem. Along RR tracks, prairies, undisturbed roadsides. Less common than the preceding.  
*Anthoxanthum odoratum* L. Sweet vernal grass. Spontaneous in my garden.  
*Aristida basiramea* Vasey. Along railroad tracks. Dry locations.  
*A. necopina* Shinnars = *A. intermedia* Scribner & Ball, auct. mult. Along railroad tracks. One record.  
*A. oligantha* Michx. Railroad tracks.  
*Avena fatua* L. Wild Oats. Railroad tracks in cinder and gravel.  
*A. sativa* L. Oats. Railroad tracks in cinder and gravel.  
*Beckmannia syzigachne* (Steud.) Fern. Slough grass. Marsh. One location.  
*Bouteloua curtipendula* (Michx.) Torr. Grama grass. Dry gravelly hillside in the open. Collected twice only.  
*Brachyelytrum erectum* (Schreb.) Beauv. *Pinus* and *Acer rubrum* woods in northern part of county.  
*Bromus ciliatus* L. Brome grass. In woods. Occasional.  
*B. inermis* Leyss. Smooth brome. Fields, roadsides and vacant lots. A common cultivated grass often escaped.  
*B. kalmii* A. Gray. One collection.  
*B. latiglumis* (Shear) Hitchc. = *B. altissimus* Pursh.  
*B. pubescens* Willd. Canada brome.  
*B. tectorum* L. Downy chess. Roadsides, railroads. A common grass of disturbed sites.  
*Calamagrostis canadensis* (Michx.) Beauv. Bluejoint. Marshes, lake shores, wet places. Common.  
*C. stricta* (Timm) Koeler. Undisturbed sedge meadow.  
*Cenchrus longispinus* (Hack.) Fern. Sandbur. Sand along roadsides, railroads, and disturbed sites. Uncommon because of the lack of suitable habitat.  
*Cinna latifolia* (Trev. ex Gopp) Griseb. Wood reed.  
*Dactylis glomerata* L. Orchard grass. Fields and clearings.  
*Danthonia spicata* (L.) Beauv. Oat grass.  
*Digitaria ischaemum* (Schreb.) Muhl. Weed in gardens, lawns, and waste places.  
*D. sanguinalis* (L.) Scop. Crab grass. Weedy grass of lawns, gardens, and disturbed sites.  
*Echinochloa muricata* (Beauv.) Fern. var. *microstachya* Wiegand.  
*E. occidentalis* (Wieg.) Rydb. = *E. crusgalli* (L.) Beauv. Barnyard grass. In damp soil. Common.  
*E. walteri* (Pursh) Heller. A striking and attractive grass of wet muddy shores and marshes of the Fox River and in large lakes.  
*Eleusine indica* (L.) Gaertner. In two separate parking lots on the Fox River at Eureka. Only known locations for county.  
*Elymus canadensis* L. Wild rye. Railroad prairies, roadsides.  
*E. canadensis* L. x *Hystrix patula* Moench.  
*E. villosus* Muhl. in Willd. Weedy area between marsh and woods. One record.  
*E. virginicus* L. Wet woods and lake shores.  
*Eragrostis cilianensis* (All.) Link. Stink grass. Waste places. Weed.  
*E. frankii* C. A. Meyer. Fields, gardens, along paths.  
*E. hypnoides* (Lam.) BSP. Mud flats. Occasional.  
*E. pectinacea* (Michx.) Nees. Fields, gardens. Weed.  
*E. poaeoides* Beauv. ex R&S. Weed in landscape planting.  
*Festuca arundinacea* Schreb. Roadsides.  
*F. myuros* L. Gravel driveway. May have been introduced with fill. One location.  
*F. obtusa* Biehler. Moist woods.  
*F. ovina* L. Weedy in disturbed places.  
*F. rubra* L. Red fescue. Roadside ditch. Garden weed.  
*Glyceria borealis* (Nash) Batch. Moist soil.  
*G. grandis* S. Wats. Marshes, damp places.  
*G. septentrionalis* Hitchc. Wet grassy meadow.  
*G. striata* (Lam.) Hitchc. Fowl meadow grass. Wet woods, marshes, shores. Common.  
*Hierochloa odorata* (L.) Beauv. Sweet grass. Fields, prairies, roadsides. Not found often.  
*Hordeum jubatum* L. Squirrel tail grass. Roadsides, vacant lots, waste areas. Common.  
*Hystrix patula* Moench. Bottlebrush grass. Wet and mesic woods. Occasional.  
*Leersia oryzoides* (L.) Sw. Cut grass. Marshes, wet shores.  
*L. virginica* Willd. Wet woods.  
*Lolium perenne* L. Roadsides. Probably introduced with grass seed.  
*L. perenne* L., var. *aristatum* Willd. = *L. multiflorum* Lam.  
*Milium effusum* L. Woods.  
*Muhlenbergia asperifolia* (Nees & Mey.) Parodi. Mapped (Fassett, 1951).  
*M. frondosa* (Poir) Fern., f. *commutata* (Scribn.) Fern. Shore of Fox River near Eureka locks.  
*M. glomerata* (Willd.) Trin. Wet meadows.  
*M. mexicana* (L.) Trin. Railroad prairies.  
*M. racemosa* (Michx.) BSP. Railroad tracks.  
*Oryzopsis asperifolia* Michx. Rice grass. Woods, Uncommon.



- Panicum boreale* Nash. Marshy woods. One record.  
*P. capillare* L. Weedy grass common along railroads, in fields and gardens.  
*P. depauperatum* Muhl. Railroad prairie.  
*P. dichotomiflorum* Michx. Parking lots, waste places, roadsides. Weedy.  
*P. implicatum* Scribn. Mapped (Fassett, 1951).  
*P. latifolium* L. Woods, with oak, basswood and elm.  
*P. leibergii* (Vasey) Scribn. Railroad prairie.  
*P. miliaceum* L., var. *miliaceum*. Possibly from bird seed.  
*P. miliaceum* L., var. *ruderales* (Kitagawa) Tzevelev. Proso millet. A new agricultural weed.  
*P. oligoanthos* Schult. Edge of quarry. Railroad tracks.  
*P. philadelphicum* Trin. In marsh.  
*P. praecocius* Hitchc. & Chase. Dry hillside.  
*P. virgatum* L. Switch grass. Marshy roadside, prairies.  
*Phalaris arundinacea* L. Reed canary grass. Marshes, low fields, pastures. Covering extensive areas and becoming almost a monoculture in low meadows. Introduced from Europe as a forage grass.  
*P. canariensis* L. Canary grass. Apparently spontaneous near foundation of abandoned house. Probably introduced in bird seed.  
*Phleum pratense* L. Timothy. Fields, roadsides, waste areas. Common.  
*Phragmites australis* (Cav.) Trin. ex Steud. A grass of lakeshore marshes and wet ditches.  
*Poa annua* L. Lawns, disturbed soil.  
*P. compressa* L. Canada bluegrass. Roadsides, railroads, fields.  
*P. paludigena* Fern. & Wieg. Around base of trees. Swamp with *Thuja*, *Larix*. Rill 4267 (RILL).  
*P. palustris* L. Fowl meadow grass. Peaty wet meadow.  
*P. pratensis* L. Kentucky bluegrass. Lawns, pastures.  
*Puccinellia distans* (L.) Parl. Edge of pond.  
*Schizachne purpurascens* (Torr.) Swallen.  
*Secale cereale* L. Rye. Railroads.  
*Setaria faberi* Herrm. Roadsides, fields, railroads, waste places. Especially abundant, edge of cultivated fields. A troublesome agricultural weed.  
*S. glauca* (L.) Beauv. Foxtail grass. Roadsides, fields, railroads, waste places.  
*S. verticillata* (L.) Beauv. Roadsides, fields, waste areas, railroads.  
*S. viridis* (L.) Beauv.  
*Sorghastrum nutans* (L.) Nash. Indian grass. Prairies, roadsides.  
*Sorghum halepense* (L.) Pers. Johnson grass. Field.  
*S. bicolor* (L.) Moench. Weed, soy bean field. Probably persistent from cultivation or accidentally planted.  
*Spartina pectinata* Link. Cord grass. Marshes, wet prairies, shores.  
*Sphenopholis intermedia* (Rydb.) Rydb. Wedgegrass. Mossy woods. One record.  
*Sporobolus asper* (Michx.) Knuth. Dropseed. Railroads.  
*S. neglectus* Nash. Garden weed. Roadsides, disturbed areas of dry, hardpacked, infertile soil.  
*S. vaginiflorus* (Torr.) Wood. Prairies, railroads.  
*S. heterolepis* (Gray) Gray. Railroad prairies. A native prairie grass.  
*Stipa spartea* Trin. Needle grass. Prairies. Uncommon.  
*Triticum aestivum* L. Wheat. Escape.  
*Zizania aquatica* L. Wild rice. Rivers, lakes in shallow water.
- CYPERACEAE (Sedge Family)  
*Bulbostylis capillaris* (L.) Clarke. Adventive on fill.  
*Carex alopecoidea* Tucker. Wet woods, damp ditches, marshes.  
*C. amphibola* Steud., var. *turgida* Fern. Damp deciduous woods.  
*C. aquatilis* Wahl. Marshes and wet meadows.  
*C. arctata* Boott. Sandy woods.  
*C. atherodes* Spreng. Floating bogs, marshes.  
*C. aurea* Nutt. Wet "floor" of limestone quarry.  
*C. bebbii* (Bailey) Fern. Wet prairies, fields, and marshes.  
*C. bicknellii* Britt. Wet prairies.  
*C. blanda* Dew. Mixed oak, maple, basswood forests and wet ditches.  
*C. brevior* (Dewey) Mackenzie. Wet roadside ditch.  
*C. brunnescens* (Pers.) Poir. In woods. Northern part of county.  
*C. buxbaumii* Wahl. Wet prairies, ditches.  
*C. comosa* Boott. Marshy shores, floating bogs.  
*C. conoidea* Schk. Roadside prairie.  
*C. convoluta* Mack. Woods.  
*C. crawfordii* Fern. Shallow marsh.  
*C. cristatella* Britt. Flood plain forests, marshes.  
*C. deweyana* Schwein. Swampy woods.  
*C. debilis* Michx. Pine and red maple woods.  
*C. emoryi* Dew. Damp shores.  
*C. gracillima* Schw. Wet woods, marshes.  
*C. granularis* Muhl., var. *haleana* (Olney) Porter. Marshes, damp shores.  
*C. graviga* Bailey. Small roadside marsh with *Larix*. One record.  
*C. grayii* Carey. Seems to be confined to flood plain forests.  
*C. haydenii* Dew. Wet woods, shores of lakes.  
*C. hirtifolia* Mack. Woods, with *Pinus*.  
*C. hystericina* Muhl. Marshes.  
*C. interior* Bailey. Small roadside marsh with *Larix*.  
*C. intumescens* Rudge. Wet woods, flood plain forests.  
*C. lacustris* Willd. Open marshes.  
*C. lasiocarpa* Ehr., var. *americana* Fern. Sedge meadow.

- C. lasiocarpa* Ehr., var. *latifolia* (Boeckl.) Gilly = *C. lanuginosa* Michx. Wet woods, prairies, and marshes.
- C. laxiflora* Lam. Swampy woods.
- C. leptoneuria* Fern. Sandy woods.
- C. lupulina* Muhl. Wet places in woods, marshes and flood plain forests.
- C. molesta* Mack. Shallow marsh.
- C. muskingumensis* Schwein. Flood plain forests.
- C. pennsylvanica* Lam. Edge of deciduous woods.
- C. projecta* Mack. Woods.
- C. pseudo-cyperus* L. Edge of bog. Peat soil.
- C. retrorsa* Schw. Open marshes and wet woods.
- C. rosea* Schk. In woods.
- C. rostrata* Stokes. Marshes, floating bogs.
- C. sartwellii* Dew. Wet marshes, lake shores.
- C. sparganioides* Muhl. Woods.
- C. stipata* Muhl. Marshes.
- C. stricta* Lam. Wet prairies, marshes, wet shores.
- C. tenera* Dewey. Sandy woods.
- C. tetanica* Schk. Near shore of Lake Butte des Morts.
- C. tribuloides* Wahl. Sandy woods.
- C. trisperma* Dew. Cedar swamp.
- C. tuckermanii* Boott. Flood plain forests.
- C. vesicaria* L. Floating bogs, sedge meadows.
- C. vulpinoidea* Boott. Damp woods, wet ditches.
- Cyperus aristata* Rottb. Awned *Cyperus*. Mapped (Marcks, 1974) and as *C. inflexus* Muhl. (Greene, 1953).
- C. diandrus* Torr. Low *Cyperus*. Sandy shore of Fox River, floating sedge mats.
- C. engelmannii* Steud. Mucky sand, marshes, floating sedge mats. Common.
- C. esculentus* L. Yellow nut grass. Weed in corn field.
- C. erythrorhizos* Muhl. Bank of Fox River.
- C. filiculmis* Vahl. = *C. lupulinus* (Spreng.) Marcks, comb. nov. Slender stemmed *Cyperus*.
- C. odoratus* L. Coarse *Cyperus* (Marcks, 1974).
- C. rivularis* Kunth. Shining *Cyperus*. Wet shores, wet sand.
- C. schweinitzii* Torr. Sandy farm lane. One record.
- C. strigosus* L. Straw colored *Cyperus*. Mapped (Marcks, 1974).
- Dulichium arundinaceum* (L.) Britt. Mucky soil. Uncommon.
- Eleocharis compressa* Sulliv. Wet meadow.
- E. erythropoda* Steudel. Common.
- E. elliptica* Kunth. Wet soil.
- Eriophorum angustifolium* Honckeny. Marshes. Uncommon.
- Scirpus acutus* Muhl. ex Bigel. Hardstem bulrush. Often in deeper water than *S. validus*.
- S. acutus* Muhl. x *S. heterochaetus* Chase.
- S. acutus* Muhl. x *S. validus* Vahl.
- S. atrovirens* Willd. Wet ditches and marshes.
- S. cyperinus* (L.) Kunth. Common in wet ditches, marshes and lake shores.
- S. fluviatilis* (Torr.) Gray. A common component of shore-land marshes of the large lakes.
- S. heterochaetus* Chase. Apparently rare.
- S. pendulus* Muhl. Marshes, damp soil, wet roadside ditches.
- S. pungens* Vahl. Three square. On sand bar in Fox River near Eureka and mixture of clay and sand on two lake shore locations.
- S. validus* Vahl. Softstem bulrush. Marshy wet soil.
- ARACEAE (Arum Family)
- Acorus calamus* L. Sweet flag. Wet shores, marshes.
- Arisaema dracontium* (L.) Schott. Green dragon. Flood plain forests. Known from only two locations.
- A. triphyllum* (L.) Schott. Jack-in-the-pulpit. Woods.
- Calla palustris* L. Wild calla lily. Very wet ditches, swamps.
- Symplocarpus foetidus* (L.) Nutt. Skunk cabbage. Wet marshes, low places, especially in mucky soil.
- LEMNACEAE (Duckweed Family)
- Lemna minor* L. Duckweed. Floating on water. The most common of the duckweeds.
- L. trisculca* L. Duckweed. Floating on water.
- Spirodela polyrhiza* (L.) Schleiden. Duckweed. Floating on water.
- Wolffia columbiana* Karst. Floating on water.
- W. punctata* Giseb. Floating on water.
- COMMELINACEAE (Spiderwort Family)
- Commelina communis* L. Day flower. Aggressive escape.
- Tradescantia bracteata* Small. Dirt pile at excavation site. Garden escape.
- T. ohioensis* Raf. Prairies, fields, railroad rights-of-way. Uncommon.
- PONTERIACEAE (Pickerel Weed Family)
- Pontederia cordata* L. Pickerel weed. Shallow water.
- Zosterella dubia* (Jacq.) Small. Water star grass. Floating in water.
- JUNCACEAE (Rush Family)
- Juncus alpinus* Vill. Wet sand and along railroad tracks.
- J. articulatus* L. Heavy clay soil in roadside ditch.
- J. balticus* L. Toad rush. Wet sand and gravel.
- J. canadensis* J. Gay in La Harpe. Edge of partially dry drainage ditch, peaty soil.
- J. compressus* Jacq. A state and county record. A salt tolerant species found at edge of State Highway 21 near Highway 41 overpass where heavy road salting occurs annually.
- J. dudleyi* Wieg. Damp soil. Common.
- J. pylaei* La Harpe. One record.
- J. nodosus* L. Marshy places, sedge meadows with *Spartina* and *Typha*.
- J. tenuis* Willd. Path rush. Disturbed damp soil.
- J. torreyi* Cov. Marshy places, wet clay.
- Luzula campestris* (L.) DC., var. *multiflora* (Ehrh.) Celak. Grassy edge of woods and in woods.

## LILIACEAE (Lily Family)

- Allium canadense* L. Wild onion. Roadsides, open fields.
- A. tricoccum* Ait. Wild leek. Woods.
- Asparagus officinalis* L. Asparagus. Escape from cultivation. Roadsides, railroads.
- Clintonia borealis* (Ait.) Raf. Blue bead lily. Woods Northern part of county only. Uncommon.
- Convallaria majalis* L. Lily of the valley. Spreading from cultivation.
- Erythronium albidum* Nutt. White dog tooth violet; trout lily. Woods Common in suitable habitats.
- E. americanum* Ker. Yellow dog tooth violet, trout lily. Common in suitable habitats.
- Hemerocallis fulva* L. Day lily. Garden escape. Dumps, roadsides.
- Lilium michiganense* Farw. Michigan lily. Wet prairies, damp roadside ditches.
- L. philadelphicum* L. var. *andinum* (Nutt.) Ker. Wood lily. Rare in one undisturbed railroad prairie.
- Maianthemum canadense* Desf. Canada mayflower. Woods. Uncommon.
- Medeola virginiana* L. Indian cucumber root. In one pine woods where it is abundant.
- Muscari botryoides* (L.) Mill. Grape hyacinth. Spreading from cultivation and appearing naturalized.
- Polygonatum biflorum* (Walt.) Ell. Solomon's seal. Woods, hedgerows, railroad prairies.
- P. pubescens* (Willd.) Pursh. Solomon's seal. Woods.
- Scilla sibirica* Haw. Squill. Garden escape.
- Smilacina racemosa* (L.) Desf. False Solomon's seal. In deciduous woods.
- S. stellata* (L.) Desf. Starry false Solomon's seal. Roadsides, prairies, wood lots.
- Smilax ecirrata* (Engelm. ex Kunth) S. Watson. Carrion flower. Woods, roadsides.
- S. hispida* Torr. Greenbrier. Mixed evergreen and deciduous woods.
- S. illinoensis* Mangaly. Carrion flower. Woods, hedgerows.
- S. lasioneura* Hook. Carrion flower. Hedgerows, woods.
- Trillium cernuum* L. Nodding trillium. Woods.
- T. grandiflorum* (Michx.) Salisb. Trillium. Woods.
- Uvularia grandiflora* Sm. Bellwort. Woods.

## DIOSCOREACEAE (Yam Family)

- Dioscorea villosa* L. Wild yam. Stream banks, woods.

## AMARYLLIDACEAE (Amaryllis Family)

- Hypoxis hirsuta* (L.) Cov. Star grass. Prairies, open roadsides.

## IRIDACEAE (Iris Family)

- Iris germanica* L. Railroad prairie. Garden escape.
- I. pseudacorus* L. Wet ditch. One location.
- I. virginica* L., var. *shrevei* (Small) E. Anders = *I. shrevei* Small. Wild iris. Wet places.

- Sisyrinchium albidum* Raf. Wet prairie.

- S. atlanticum* Bickn. Railroad prairie.

- S. campestre* Bickn. Blue-eyed grass. Railroad prairies, damp roadsides. Fairly common.

- S. mucronatum* Michx. Damp field.

## ORCHIDACEAE (Orchid Family)

- Aplectrum hyemale* (Muhl. ex Willd.) Torr. Adam and Eve. Woods with maple, basswood, pine. One location.

- Corallorhiza maculata* Raf. Coral root. Woods. With oak, hickory, maple. One record.

- Cypripedium calceolus* L., var. *pubescens*. Yellow lady slipper. Old specimen with no date or location. Labeled, Winnebago County, Wisconsin, W. A. Kellerman.

- C. candidum* Muhl. White lady slipper. Mapped (Case, 1964).

- C. reginae* Walt. Showy lady slipper. Mapped (Fuller, 1933).

- Habenaria leucophaea* (Nutt.) A. Gray. Prairie white fringed orchid. Open wet prairie. Known from two locations.

- H. psycodes* (L.) Spreng. Purple fringed orchid. Rare. Open shrub marsh.

- Spiranthes cernua* (L.) Rich. Ladies' tresses. Railroad prairies. Known from two locations.

## SALICACEAE (Willow Family)

- Populus alba* L. White poplar. Roadsides, escape (not apparently planted).

- P. balsamifera* L. Balsam poplar. Pioneer tree in disturbed soil in quarry, roadsides.

- P. deltoides* Marsh. Cottonwood. Damp places, shores.

- P. grandidentata* Michx. Big tooth aspen. Disturbed woods.

- P. tremuloides* Michx. Trembling aspen. Disturbed woods.

- Salix alba* L. White willow. Railroads, waste areas. Not planted.

- S. amygdaloides* Anderss. Peach leaved willow. Lake shores.

- S. babylonica* L. Weeping willow. Vacant lot. Appearing native.

- S. bebbiana* Sarg. Beaked willow. Roadside ditches, damp places.

- S. candida* Fluegge. Undisturbed wet meadows.

- S. fragilis* L. Roadsides, ditches, shores. The most common large willow tree.

- S. glaucophylloides* Fern. Blue leaved willow. Railroad prairie.

- S. humilis* Marsh. Upland willow. Railroad prairies, marshes.

- S. interior* Rowlee. Sandbar willow. Roadsides, ditches, shores, sandbars. A pioneer shrub.

- S. lucida* Muhl. Shown for the county by Argus (1954).

- S. pedicellaris* Pursh. Woods Northern part of county.

*S. petiolaris* J. E. Smith. Slender willow. Bottom lands along creeks, rivers.

*S. rigida* Muhl. Roadside ditches, railroad rights-of-way.

#### JUGLANDACEAE (Walnut Family)

*Carya cordiformis* (Wang.) K. Koch. Bitternut hickory. Woods.

*C. ovata* (Mill.) K. Koch. Shagbark hickory. Common component of oak-hickory forest.

*Juglans cinerea* L. Butternut. Woods.

*J. nigra* L. Black walnut. Woods, especially in the southern part of the county near Lake Winnebago.

#### BETULACEAE (Birch Family)

*Alnus rugosa* (Du Roi) Spreng. Speckled alder Swamps.

*Betula glandulosa* Michx. Bog birch. Swamps with *Larix*, *Rhus vernix*, *Ilex*, *Alnus*. Uncommon.

*B. alleghaniensis* Britt. Yellow birch. In northern part of county only.

*B. papyrifera* Marsh. Paper birch. Woods. In northern part of county.

*Carpinus caroliniana* Walt. Ironwood. Damp woods.

*Corylus americana* Walt. Hazel nut. Woods, low prairies.

*Ostrya virginiana* (Mill.) K. Koch. Hop hornbeam. Woods.

#### FAGACEAE (Beech Family)

*Fagus grandifolia* Ehrh. Beech. Uncommon, limited to an area east of Little Lake Butte des Morts near Fox River.

*Quercus alba* L. White oak. Woods.

*Q. bicolor* Willd. Swamp white oak. Wet woods.

*Q. borealis* Michx. f. Red oak. Woods.

*Q. ellipsoidalis* E. J. Hill. Hill's oak. Hedgerows, pastures, woods.

*Q. macrocarpa* Michx. Bur oak. Woods, prairies, roadsides.

*Q. velutina* Lam. Black oak. Woods.

#### ULMACEAE (Elm Family)

*Celtis occidentalis* L. Hackberry. Woods.

*Ulmus americana* L. American elm. Low woods, yards, city streets. Now becoming less common because of Dutch Elm Disease.

*U. thomasi* Sarg. Rock elm. Mapped (Costello, 1933)

*U. rubra* Muhl. Slippery elm. Woods, hedgerows.

#### MORACEAE (Mulberry Family)

*Cannabis sativa* L. Hemp. Waste places.

*Humulus lupulus* L. Hops. Hedgerows, railroads.

*Morus alba* L. White mulberry. hedgerows, waste places.

*M. rubra* L. Red mulberry. Mapped (Costello, 1933).

#### URTICACEAE (Nettle Family)

*Boehmeria cylindrica* (L.) Sw. Wet woods, flood plains of rivers.

*Laportea canadensis* (L.) Wedd. Wood nettle. Wet woods, flood plain forests.

*Parietaria pensylvanica* Muhl. Pellitory. Occasional. Damp soil.

*Pilea fontana* (Lunnell.) Rydb. Clearweed. Damp soil.

*P. pumila* (L.) Gray. Clearweed. Damp soil, marshes.

*Urtica dioica* L., var. *procera* (Muhl.) Wedd. Stinging nettle. Wet soil in woods, flood plain forests, marshy places. Common. Sometimes forming a monoculture.

#### SANTALACEAE (Sandlewood Family)

*Comandra umbellata* (L.) Nutt. Bastard toadflax.

Railroad prairies, roadsides, woods.

#### ARISTOLOCHIACEAE (Birthwort Family)

*Asarum canadense* L. Wild ginger. Moist woods.

#### POLYGONACEAE (Smartweed Family)

*Fagopyrum esculentum* Moench. Buckwheat. Woods. Probably escaped from cultivation.

*Polygonum achoreum* Blake. Roadsides, railroads.

*P. amphibium* L., var. *natans* (Michx.) Eat. = *P. natans* Michx. An illegitimate name. See (Hitchc., C. L., 1964).

*P. aviculare* L. Lawn and garden weed.

*P. coccineum* Muhl. Water smartweed. Shallow water, shores, marshes.

*P. convolvulus* L. Black bind weed. Roadsides, hedgerows, railroads.

*P. cuspidatum* Sieb. & Zucc. Mexican bamboo. Barnyards, railroads. Garden escape.

*P. hydro Piper* L. Marshes, mucky soil.

*P. lapathifolium* L. Most soil, marshes.

*P. orientale* L. Prince's feather. Waste places, disturbed fields, old dumps. Escape from cultivation.

*P. pensylvanicum* L. Waste places, moist soil.

*P. persicaria* L. Waste places, shores.

*P. punctatum* Ell. Marshes, shores.

*P. sagittatum* L. Tear thumb. Marshes.

*P. scandens* L. False buckwheat. One record.

*P. virginianum* L. Jumpseed. Flood plain forest, damp woods.

*Rheum rhaponticum* L. Rhubarb. Persistent after cultivation.

*Rumex acetosella* L. Sheep sorrel. Weedy in poor soil.

*R. altissimus* Wood. Water dock. Wet prairie.

*R. crispus* L. Sour dock. Roadsides, disturbed sites.

*R. mexicanus* Meissn. Wet soil, especially disturbed sites.

*R. orbiculatus* A. Gray. Great water dock. Marshes.

*R. verticillatus* L. Water dock. Marshes, shores.

#### CHENOPODIACEAE (Goosefoot Family)

*Atriplex patula* L. Disturbed soil.

*Chenopodium album* L. Roadsides, gardens.

*C. hybridum* L. Roadsides, gardens.

*Cycloloma atriplicifolium* (Spreng.) Coulter. Winged pigweed. Open sand.

*Kochia scoparia* (L.) Schrader. Summer cypress. Disturbed soil.

*Salsola kali* L. Russian thistle. Disturbed sites, especially sand or sterile soil.

## AMARANTHACEAE (Amaranth Family)

- Amaranthus blitoides* S. Wats. = *A. graecizans* L.  
Tumbleweed. Disturbed sites.  
*A. retroflexus* L. Pigweed. Disturbed sites, fields and gardens.  
*A. tuberculatus* (Moq.) Sauer. Shores, bottom lands, marshes.

## NYCTAGINACEAE (Four-o'clock Family)

- Mirabilis nyctagineus* (Michx.) MacM. Railroads, roadsides.

## AIZOACEAE (Carpet-weed Family)

- Mollugo verticillata* L. Carpet-weed. Sand, sterile soil.

## PORTULACACEAE (Purslane Family)

- Claytonia virginica* L. Spring beauty. Woods.  
*Portulaca oleracea* L. Purslane. Gardens, disturbed sites.

## CARYOPHYLLACEAE (Pink Family)

- Agrostemma githago* L. Corn cockle. Old specimen labeled only Butte des Morts, 1900-1908.  
*Arenaria lateriflora* L. Sandwort. Not uncommon in woods, and edges.  
*A. serpyllifolia* L. Weed in cemetery lawn.  
*Cerastium nutans* Faf. Weed. Disturbed sites.  
*C. vulgatum* L. Weed in cemetery lawn.  
*Dianthus deltooides* L. Pink. Probably an escape from cultivation.  
*Gypsophila scorzonifolia* Ser. in DC. In gravel at junction of Osborn Rd. and Morrissey Rd. near Rush Lake.  
*Lychnis alba* Mill. Champion. Common weed of fields and disturbed sites.  
*Myosoton aquaticum* (L.) Moench.  
*Saponaria officinalis* L. Soapwort, bouncing Bet. Weed. Disturbed sites.  
*Silene antirrhina* L. Catchfly. Sandy soil, waste places.  
*S. armeria*. Sweet William. Escape from cultivation.  
*S. cserei* Baumg. Railroads.  
*S. vulgaris* (Moench.) Garcke. Bladder campion. Railroads, fields, roadsides.  
*S. noctiflora* L. Garden weed. Fields.  
*Spergularia marina* (L.) Grisebach. Shoulder of road.  
*Stellaria graminea* L. Low meadow.  
*S. longifolia* Muhl. Sedge meadow.  
*S. media* (L.) Cyrill. Chickweed. Garden weed.

## CERATOPHYLLACEAE (Hornwort Family)

- Ceratophyllum demersum* L. Coontail. Rivers, lakes.

## NYMPHAEACEAE (Water-lily Family)

- Nelumbo lutea* (Willd.) Pers. Lotus. Scattered locations. Rivers, lakes. Forming extensive beds.  
*Nuphar variegatum* Engelm. Spatterdock. Lakes, rivers.  
*Nymphaea odorata* Ait. Quiet water.  
*N. tuberosa* Paine. Quiet water.

## RANUNCULACEAE (Buttercup Family)

- Actaea pachypoda* Ell. White baneberry. Woods.

- A. rubra* (Ait.) Willd. Red baneberry. Woods.  
*Anemone canadensis* L. Windflower. Wet prairies, low fields.  
*A. cylindrica* A. Gray. Railroad prairies.  
*A. quinquefolia* L. Wood anemone. Woods.  
*A. virginiana* L. Dry woods.  
*Anemonella thalictroides* (L.) Spach. Rue anemone. In some woods so common it may form a ground cover.  
*Aquilegia canadensis* L. Wild columbine. Woods.  
*Caltha palustris* L. Marsh marigold. Swamps, wet soil.  
*Clematis virginiana* L. Clematis. Hedgerows.  
*Coptis trifolia* (L.) Salisb. Rare. Restricted to pine woods in the northern part of the county.  
*Delphinium ajacis* L. Larkspur. Escape from cultivation. Persistent on dirt fill.  
*Hepatica nobilis* Schreb., var. *acuta* (Pursh) Steyerl.  
*Isopyrum biternatum* (Raf.) T. & G. False rue anemone.  
*Ranunculus abortivus* L. Buttercup. Woods.  
*R. acris* L. Weed in moist soil, roadsides.  
*R. aquatilis* L. White water crowfoot. Quiet water.  
*R. circinatus* Sibth. Slow moving water of Eight Mile creek.  
*R. fascicularis* Muhl. Dry pasture.  
*R. flabellaris* Raf. Shallow water.  
*R. hispidus* Michx.  
*R. longirostris* Godr. White water crowfoot.  
*R. pensylvanicus* L.f. Moist soil.  
*R. recurvatus* Poir. Woods. Moist soil.  
*R. repens* L. In lawns and grassy areas.  
*R. rhomboideus* Goldie. Pond edge.  
*R. sceleratus* L. Cursed crowfoot. Moist organic soil.  
*R. septentrionalis* Poir. Moist soil.  
*Thalictrum dasycarpum* Fisch. & Ave-Lall. Meadow rue.  
*T. dioicum* L. Maple-basswood woods.  
*T. revolutum* DC., var. *glandulosior* Boivin. Wet prairies.

## BERBERIDACEAE (Barberry Family)

- Berberis thunbergii* DC. Barberry. Escape, woods.  
*Caulophyllum thalictroides* (L.) Michx. Blue cohosh. Maple-basswood forests. Uncommon.  
*Podophyllum peltatum* L. May apple. Open woods.

## MENISPERMACEAE (Moonseed Family)

- Menispermum canadense* L. Moonseed. Woods.

## PAPAVERACEAE (Poppy Family)

- Papaver rhoeas* L. Corn poppy. Garden escape.  
*P. somniferum* L. Opium poppy. Persistent, dump area.  
*Sanguinaria canadensis* L. Bloodroot. Woods.

## FUMARIACEAE (Fumitory Family)

- Fumaria officinalis* L. Fumitory. Well established in dump area and edge of baseball field.  
*Dicentra cucullaria* (L.) Bernh. Dutchman's breeches. Woods.

## CRUCIFERAE (Mustard Family)

- Arabis glabra* (L.) Bernh. Rock cress. Old Field.  
*Armoracia aquatica* (Eat.) Wieg. In pool in intermittent stream. Collected once and not found again.  
*A. rusticana* Gaertn., Mey. & Scherb. Horse-radish. Persistent along railroads.  
*Barbarea vulgaris* R. Br. Winter cress. Roadsides, fields, railroad, waste places. Weed.  
*Berteroa incana* (L.) DC. Hoary alyssum. Roadsides, fields, waste places. Weed.  
*Brassica hirta* Moench. Woods. One location.  
*B. kaber* (DC.) Wheeler. Roadsides, fields, disturbed sites. Weeds.  
*B. rapa* L. sensu Fl. Eur. Railroads.  
*Capsella bursa-pastoris* (L.) Medic. Shepherd's purse. Roadsides, fields. Weed.  
*Cardamine bulbosa* (Schreb.) BSP. Wet meadows.  
*C. douglassii* Britt. Moist woods and flood plain forests.  
*C. pensylvanica* Muhl. Moist woods and flood plain forests. Lucky soil.  
*Dentaria laciniata* Muhl. ex Willd. Toothwort. Woods.  
*Descurainia pinnata* (Walt.) Britt., var. *brachycarpa* (Richards) Fern. Disturbed soil.  
*D. sophia* (L.) Webb. Dump site. Probably from a garden.  
*Diplotaxis muralis* (L.) DC. Disturbed site.  
*Draba reptans* (Lam.) Fern. Limestone rock. One location.  
*Erucastrum gallicum* (Willd.) O. E. Schulz. Roadside.  
*Erysimum cheiranthoides* L. Roadside, Weed.  
*E. inconspicuum* (S. Wats.) MacM.  
*Hesperis matronalis* L. Dame's rocket. Garden escape.  
*Lepidium campestre* (L.) R. Br. Disturbed soil. Weed.  
*L. densiflorum* Schrader. Pepper grass. Disturbed soil. Weed.  
*L. ruderales* L. Barn yard. One record.  
*L. virginicum* L. Pepper grass. Disturbed soil. Weed.  
*Lobularia maritima* (L.) Desv. Sweet alyssum. Garden escape.  
*Lunaria annua* L. Honesty. Appearing spontaneous. Garden escape.  
*Nasturtium officinale* R. Br. Water cress. Moist ditch, springs.  
*Rorippa islandica* (Oeder) Borbas. Marsh cress. Marshes, shores.  
*R. sylvestris* (L.) Besser. Field, rip-rapped shore.  
*Sisymbrium altissimum* L. Tumbling mustard. Dump area. Weed.  
*S. officinale* (L.) Scop. Hedge mustard. Disturbed soil. Weed.  
*Thlaspi arvense* L. Penny cress. Roadsides, fields, waste places.

## CAPPARIDACEAE (Caper Family)

- Cleome spinosa* L. Spider flower. Garden escape.  
*Polanisia dodecandra* (L.) DC. Railroads.

## CRASSULACEAE (Orpine Family)

- Penthorum sedoides* L. Ditch stone crop. Damp soil. Woods.  
*Sedum telephium* L. Stone crop. Railroad. Garden escape.

## SAXIFRAGACEAE (Saxifrage Family)

- Heuchera hirsuticaulis* (Wheelock) Rydb. Alum root. Railroad prairies.  
*Mitella diphylla* L. Bishop's cap. Rich woods.  
*M. nuda* L. With *Thuja* in northern part of county. Rare.  
*Parnassia glauca* Raf. Grass of Parnassus. Wet meadows and fens. Rare.  
*Ribes americanum* Mill. Wild black currant. Woods.  
*R. cynosbati* L. Gooseberry. Woods, thickets.  
*R. hirtellum* Michx., var. *calcicola* Fern.  
*R. odoratum* Wendl. Persistent from cultivation.  
*R. sativum* Syme. Garden currant. Appearing native.  
*Saxifraga pensylvanica* L. Swamp saxifrage. Woods, wet prairies.

## ROSACEAE (Rose Family)

- Agrimonia gryposepala* Wallr. Agrimonia. Woods.  
*A. pubescens* Wallr. Woods.  
*Amelanchier laevis* Wieg. Juneberry. Woods.  
*A. sanguinea* (Pursh) DC. Roadsides, hedgerows.  
*A. spicata* (Lam.) K. Koch.  
*Aronia melanocarpa* (Michx.) Ell. Chokeberry. Roadside ditch.  
*Crataegus calpodendron* (Ehrh.) Medic. Hawthorn.  
*C. crus-galli* L.  
*C. mollis* (T. & G.) Scheele.  
*C. punctata* Jacq.  
*C. succulenta* Link.  
*Fragaria vesca* L. Woodland strawberry. Mapped (Mason & Iltis, 1958).  
*F. virginiana* Duchesne. Wild strawberry. In woods and edges.  
*Geum aleppicum* Jacq., var. *strictum* (Ait.) Fern. Roadsides, woods.  
*G. canadense* Jacq. Damp woods.  
*G. laciniatum* Murr. Edge of field.  
*G. rivale* L. Water avens. Swamps.  
*G. triflorum* Pursh. Prairie smoke. Railroad prairies.  
*Physocarpus opulifolius* (L.) Maxim.  
*Potentilla anserina* L. Silver weed. Along railroad rights-of-way. Light soil.  
*P. argentea* L. Silvery cinquefoil. Railroad prairies.  
*P. canadensis* L. One location along railroad in Oshkosh.  
*P. fruticosus* L. Shrubby cinquefoil. Edge of cedar bog. One record.  
*P. intermedia* L. Dry cinders along railroad track.  
*P. norvegica* L. Railroads, fields, waste places.  
*P. palustris* (L.) Scop. Marsh cinquefoil. Marshes.

- P. recta* L. Drywoods, prairies, roadsides.  
*P. simplex* Michx. Old field cinquefoil. Open woods, fields.  
*Prunus americana* Marsh., var. *lanata* Sudw. Wild plum. Hedgerows, woods, railroads.  
*P. nigra* Ait. Canada plum. Hedgerows, woods, railroads.  
*P. pensylvanica* L.f. Pin cherry. Hedgerows, openings.  
*P. serotina* Ehrh. Black cherry. Woods, hedgerows.  
*P. virginiana* L. Choke cherry. Hedgerows, openings.  
*Pyrus ioensis* (Wood) Carruth. Wild crab apple. Woods, railroads.  
*P. malus* L. Apple. Persistent after cultivation.  
*Rosa acicularis* Lindl. Prairies, roadsides.  
*R. arkansana* Porter. Roadside.  
*R. blanda* Ait. Meadow rose. Prairies, roadsides.  
*R. carolina* L. Pasture rose. Prairies, roadsides.  
*R. palustris* Marsh. Swamp rose. Prairies.  
*Rubus allegheniensis* Porter. Common blackberry. Roadsides, railroads, fields, open woods.  
*R. idaeus* L. Red raspberry. Open fields, roadsides.  
*R. occidentalis* L. Black raspberry. Hedgerows, woods.  
*R. ostryifolius* Rydb. Blackberry. Railroad prairies.  
*R. pubescens* Raf. Moist woods, swamps.  
*Sorbaria sorbifolia* (L.) A. Br. False spiraea. Damp roadside. Escape from cultivation.  
*Sorbus aucuparia* L. European mountain ash. Hedgerows. Apparently planted by birds.  
*Spiraea alba* Du Roi. Meadow sweet. Marshes, wet meadows, railroads.  
*S. tomentosa* L., var. *rosea* (Raf.) Fern. Wet meadow. Northern part of county.  
*Waldsteinia fragarioides* (Michx.) Tratt. Mapped (Mason & Iltis, 1958).
- CAESALPINIACEAE (Caesalpina Family)  
*Gymnocladus dioica* (L.) K. Koch. Kentucky coffee-tree. Woods along creek, and lake shore at three locations.
- FABACEAE (Bean Family)  
*Amorpha canescens* Pursh. Lead plant. Railroad prairies.  
*Amphicarpa bracteata* (L.) Fern. Hog peanut. Woods, thickets.  
*Apios americana* Medic. Wild bean. Near Lake Winnebago.  
*Astragalus canadensis* L. Milk vetch. Railroad prairies.  
*Baptisia leucantha* T. & G. Wild indigo. Railroad prairies, roadsides, open woods.  
*Desmodium canadense* (L.) DC. Tick trefoil. Railroad prairies and roadsides.  
*D. dillenii* Darl. Railroad prairies, roadsides.  
*D. glutinosum* (Muhl.) Wood. Woods.  
*D. illinoense* Gray. Open roadside north of Oshkosh. Buckstaff 39-4 (Buckstaff Collection).
- D. nudiflorum* (L.) DC. Woods.  
*Glycine max* (L.) Merr. Soy bean. One plant, roadside. Accidental. Rill 3349 (RILL).  
*Lathyrus ochroleucus* Hooker. Vetch. Woods.  
*L. palustris* L. Grassy marshes, wet prairies, damp roadsides.  
*L. venosus* Muhl., var. *intonsus* Butters et St. John. Wet prairies.  
*Lespedeza capitata* Michx. Bush clover. Railroad prairies.  
*Lotus corniculatus* L. Bird's foot trefoil. Roadsides. Planted and spreading.  
*Lupinus x regalis*. Fence line along Hw. 41. Probably site of abandoned farm.  
*Medicago falcata* L. Roadside. One record.  
*M. lupulina* L. Black medic. Lawns, roadsides, disturbed sites. Weed.  
*M. sativa* L. Alfalfa. Roadsides, fields.  
*Melilotus alba* Desr. White sweet clover. Roadsides, railroads, fields.  
*M. altissima* Thuill. Roadsides, railroads, fields.  
*M. officinalis* (L.) Desr. Yellow sweet clover. Roadsides, railroads, fields.  
*Petalostemum candidum* (Willd.) Michx. White prairie clover. Railroad prairies. Uncommon.  
*P. purpureum* (Vent.) Rydb. Purple prairie clover. Railroad prairies.  
*Robinia pseudoacacia* L. Black locust. Hedgerows, forming thickets. Spreading from cultivation.  
*Trifolium aureum* Pollich. Edge of field.  
*T. campestre* Schreb. in Sturm. = *T. procumbens* L., nom. ambig. (Gillett & Cochrane, 1973).  
*T. hybridum* L. Alsike clover. Roadsides, fields.  
*T. pratense* L. Red clover. Roadsides, fields.  
*T. repens* L. White clover. Roadsides, fields.  
*Vicia americana* Muhl. Purple vetch. Railroads, fields, roadsides.  
*V. caroliniana* Walt. Pale vetch. Woods.  
*V. cracca* L. Tufted vetch. Low field.  
*V. sativa* L. subsp. *nigra* (L.) Ehrh. as given in Fl. Europaea = *V. angustifolia* Reichard. Railroad prairies.  
*V. villosa* Roth. Russian vetch. Roadsides, fields.
- OXALIDACEAE (Oxalis Family)  
*Oxalis corniculata* L. Field, woods. Two records.  
*O. dillenii* Jacq. Roadsides, lawns, waste places, railroads.  
*O. stricta* L. Roadsides, lawns, waste places, railroads.
- GERANIACEAE (Geranium Family)  
*Erodium cicutarium* (L.) L'Her. Filaree. Lawn weed.  
*Geranium bicknellii* Britt. Marshy woods. One record.  
*G. maculatum* L. Wild geranium. Woods.
- LINACEAE (Flax Family)  
*Linum usitatissimum* L. Common flax. Escape along railroad. One record.

## RUTACEAE (Rue Family)

*Zanthoxylum americanum* Mill. Prickly ash. Forming thickets. Disturbed woods.

## POLYGALACEAE (Milkwort Family)

*Polygala senega* L. Seneca snakeroot. Railroad prairies. Uncommon.

## EUPHORBIACEAE (Euphorbia Family)

*Acalypha rhomboidea* Raf. Three seeded mercury. Roadsides, disturbed sites. Weed.

*Chamaesyce maculata* (L.) Small. Wartweed. Roadsides, lawns and gardens.

*C. nutans* (Lag.) Small. Occasional. Along railroad tracks.

*C. vermiculata* (Raf.) House. Roadsides, lawns. Weedy.

*Euphorbia corollata* L. Flowering spurge. Railroads and dry roadsides.

*E. cyparissias* L. Cypress spurge. Railroads, dry roadsides.

*E. glyptosperma* Engelm.

*E. marginata* Pursh. On fill. Garden escape.

*E. myrsinites* L. Adventive in garden.

*E. peplus* L. Disturbed roadside. One record.

*E. podperae* Croiz. Leafy spurge. Noxious weed.

*Poinsettia dentata* (Michx.) Kl. & Gke. Railroads.

## CALLITRICHACEAE (Water-starwort Family)

*Callitriche palustris* L. Water starwort. Exposed mud, drainage ditches.

## ANACARDIACEAE (Cashew Family)

*Rhus glabra* L. Smooth sumac. Roadsides, railroads, openings. More common than *R. typhina*.

*R. radicans* L., var. *rydbergii* (Small) Rehd. Poison ivy. Roadsides, hedgerows, woods, railroads, openings. Abundant.

*R. typhina* L. Staghorn sumac. Roadsides, railroads, openings.

*R. typhina* L., f. *laciniata* (Wood) Rehd. Cut leaf sumac. Escape from cultivation.

*R. vernix* Marsh. Poison sumac. Swamp, with *Ilex*, *Larix*, *Alnus*. One location in bog where it was abundant.

## AQUIFOLIACEAE (Holly Family)

*Ilex verticillata* (L.) Gray. Holly. Uncommon. Swamps, with *Larix*, *Thuja*, *Alnus* and in moist areas in white pine, red maple forest in northern part of county.

## CELASTRACEAE (Staff-tree Family)

*Celastrus scandens* L. Bittersweet. Hedgerows. Threatened by "clean farming."

*Euonymus atropurpureus* Jacq. Burning bush. Edge of swamp. Not apparently planted.

## STAPHYLACEAE (Bladder-nut Family)

*Staphylea trifolia* L. Bladder-nut. Edge of Woods. Two locations near Rush Lake.

## ACERACEAE (Maple Family)

*Acer negundo* L. Box elder. Hedgerows, woods, roadsides.

*A. nigrum* Michx. f. Black maple. Woods.

*A. rubrum* L. Red maple. Woods.

*A. saccharinum* L. Silver maple. Damp woods. Flood plain forests.

*A. saccharum* Marsh. Sugar maple. Woods.

*A. spicatum* Lam. Wet woods, flood plain forest of Rat River. One location.

## BALSAMINACEAE (Touch-me-not Family)

*Impatiens capensis* Meerb. = *I. biflora* Walt. Jewelweed. Damp soil.

## RHAMNACEAE (Buckthorn Family)

*Ceanothus americanus* L. Railroad prairies.

*Rhamnus cathartica* L. Buckthorn. Edge of woods, disturbed woods where it may form thickets.

*R. frangula* L. Edge of woods, and brushy places. Not as common as the former.

## VITACEAE (Grape Family)

*Parthenocissus vitacea* (Knerr) Hitchc. Woodbine. Hedgerows, woods, shores.

*Vitis riparia* Michx. Grape. Hedgerows, woods, shores.

## TILIACEAE (Linden Family)

*Tilia americana* L. Basswood. Large forest tree.

## MALVACEAE (Mallow Family)

*Abutilon theophrasti* Medic. Velvet leaf. Common weed of corn fields, disturbed sites.

*Alcea rosea* L., var. *sibthorpii* Boiss. Hollyhock. Persistent in dump area.

*Hibiscus trionum* L. Flower-of-an-hour. A common weed of gardens, disturbed soil.

*Malva neglecta* Wallr. Common mallow. Gardens, disturbed sites.

## HYPERICACEAE (St. John's-wort Family)

*Hypericum canadense* L. Peaty ditch.

*H. majus* (Gray) Britt.

*H. perforatum* L. Klamath weed. Oldest record for the county, collected 1900-1908 by Mr. and Mrs. Jay Davis.

*H. punctatum* Lam. Edge of woods.

*Triadenum fraseri* (Spach.) Gleason. Marsh St. John's wort. Marshes, swamps.

## CISTACEAE (Rock-rose Family)

*Helianthemum bicknellii* Fern. Frost weed. Dry soil near railroad.

## VIOLACEAE (Violet Family)

*Viola adunca* Sm. Sand violet. Woods, railroads.

*V. affinis* LeConte. Moist woods.

*V. canadense* L., var. *canadense*. Canada violet. Woods.

*V. canadense* L., var. *rugulosa* (Greene) C. L. Hitchc. Mapped (Russell, 1965).

*V. conspersa* Reichenb. American dog violet. Woods.

*V. cucullata* Ait. Marsh violet. Damp woods, swamps.

*V. novae-angliae* House. Northern part of county.

*V. novae-angliae x sagittata*.

*V. odorata* L. Lawn weed, Oshkosh.



- V. papilionacea* Pursh. Meadow violet. Railroad prairie, roadside.  
*V. pedata* L. Bird's foot violet. Dry place in woods, sandy hillside. Two records, 1925 and 1930.  
*V. pedatifida* G. Don. Uncommon. Railroad prairies and dry hillside.  
*V. pubescens* Ait., var. *eriocarpa* (Schwein.) Russell. Yellow violet. Woods.  
*V. pubescens* Ait., var. *pubescens*. Downy yellow violet. Woods.  
*V. sagittata* Ait. Arrow leaved violet. Northern part of county. One record.  
*V. septentrionalis* Greene. Woods.  
*V. sororia* Willd. Woods.

## LYTHRACEAE (Loosestrife Family)

- Decodon verticillatus* (L.) Ell. Water willow. Edge of Rush Lake.  
*Lythrum alatum* Pursh. Railroad prairies, meadows.  
*L. salicaria* L., var. *tomentosum* (DC.) DC. Purple loosestrife. Wet soil. Escape, becoming a problem in wetlands.

## ELAEAGNACEAE (Oleaster Family)

- Elaeagnus angustifolia* L. Escape near Lake Butte des Morts bridge.

## ONAGRACEAE (Evening Primrose Family)

- Circaea alpina* L. Enchanter's nightshade. With *Thuja*. One location.  
*C. lutetiana* L., subsp. *canadensis* (L.) Asch. & Magnus.  
*Epilobium angustifolium* L. Fire weed. Railroads, roadsides.  
*E. coloratum* Biehler. Willow herb. Marshes, wet ditches.  
*E. glandulosum* Lehm., var. *adenocaulon* (Hausk.) Fern.  
*E. leptophyllum* Raf. Roadside marsh near Fox River.  
*Guara biennis* L., var. *biennis*. Roadsides, railroads.  
*Ludwigia palustris* (L.) Ell., var. *americana* (DC.) Fern. & Griscom. Water purslane. Cattail marsh.  
*Oenothera biennis* L. Evening primrose. Roadsides.  
*O. oakesiana* (A. Gray) Robins. Along railroad track.  
*O. parviflora* L. Railroads, roadsides, fields. Common.  
*O. perennis* L. Sundrops. Marsh, on higher ground, with shrubs. One record.  
*O. pilosella* Raf. Landfill site. One record. Probably brought in with fill material.  
*O. villosa* Tunb. = *O. strigosa* (Rydb.) Mack. & Bush of American authors.

## HALORAGACEAE (Water Milfoil Family)

- Myriophyllum spicatum* L., var. *exalbescens* (Fern.) Jepson = *M. exalbescens* Fern. Lakes, rivers.

## ARALIACEAE (Ginseng Family)

- Aralia nudicaulis* L. Wild sarsaparilla. Woods.  
*A. racemosa* L. Spikenard. Moist soil.  
*Panax quinquefolium* L. Ginseng. Woods. Rare.

## UMBELLIFERAE (Parsley Family)

- Aethusa cynapium* L. Fool's parsley. Appearing as a weed in gardens. First Wisconsin record, 1968.  
*Angelica atropurpurea* L. Angelica. Marshes, wet ditches.  
*Carum carvi* L. Caraway. Railroads, roadsides, fields.  
*Cicuta bulbifera* L. Marshes, ditches, damp meadows.  
*C. maculata* L. Water hemlock. Marshes, ditches, damp meadows.  
*Cryptotaenia canadensis* (L.) DC. Honewort. Woods.  
*Daucus carota* L. Queen Anne's lace. Roadsides.  
*Heracleum lanatum* Michx. Cow parsnip. Moist soil. marshes, wood lots.  
*Osmorhiza claytonii* (Michx.) Clarke. Sweet cicely. Woods.  
*O. longistylis* (Torr.) DC. Anise root. Woods.  
*Oxypolis rigidior* (L.) Raf. Wet prairies, damp roadsides, wet meadows, wet woods.  
*Pastinaca sativa* L. Wild parsnip. Weed. Railroads, meadows, roadsides.  
*Pimpinella saxifraga* L. Roadsides, often with grasses.  
*Sanicula gregaria* Bickn. Black snakeroot. Woods.  
*S. marilandica* L. Woods.  
*S. trifoliata* Bickn. Woods.  
*Sium suave* Walt. Water parsnip. Wet meadows, marshes, wet forests.  
*Taenidia integerrima* (L.) Drude. Prairies, dry woods.  
*Zizia aurea* (L.) Koch. Golden alexanders. Railroad prairies, meadows.

## CORNACEAE (Dogwood Family)

- Cornus alternifolia* L. Alternate leaved dogwood.  
*C. canadensis* L. Canada dogwood. Rare. In northern part of county in pine and red maple woods.  
*C. obliqua* Raf. Railroad prairies, roadsides. In damp soil.  
*C. racemosa* Lam. Railroad prairies, roadsides. In damp soil.  
*C. rugosa* Lam. Northern part of county in *Thuja* swamp.  
*C. stolonifera* Michx. Red osier. A common component of shrub swamps.

## ERICACEAE (Heath Family)

- Chimaphila umbellata* (L.) Bart. Prince's pine. Woods with *Pinus strobus*. Uncommon.  
*Gaylussacia baccata* (Wang.) K. Koch. Huckleberry. Woods with *Pinus strobus*.  
*Monotropa hypopitys* L. Pine sap. Woods with *Pinus strobus*.  
*M. uniflora* L. Indian pipe. Woods. One plant.  
*Pyrola elliptica* Nutt. Shinleaf. Woods. Uncommon.  
*P. rotundifolia* L. Woods, northern part of county. Rare.  
*P. secunda* L. Woods, northern part of county. Rare.

*Vaccinium angustifolium* Ait. Uncommon. In a few woods in northern part of county.

*V. lamarckii* Camp. Blueberry. Uncommon.

PRIMULACEAE (Primrose Family)

*Anagallis arvensis* L., var. *arvensis*. Pimpernel. Abandoned garden, waste area. Two locations.

*Dodecatheon meadia* L. Shooting star. Railroad prairies, roadsides, oak openings.

*Lysimachia ciliata* L. Fringed loosestrife. Marshes, wet meadows, flood plain forests.

*L. nummularia* L. Moneywort. Escape in cemetery, river banks, and flood plain forests. Forming a ground cover in some locations.

*L. quadriflora* Sims. Railroad prairies, roadsides.

*L. terrestris* (L.) BSP. Swamp candles. Marshes, swamps. Uncommon.

*L. thyrsiflora* L. Marshes, swamps.

*L. vulgaris* L. Mucky shore of Lake Butte des Morts. Not planted.

*Trientalis borealis* Raf. Star flower. Woods. Northern part of county. Uncommon.

OLEACEAE (Olive Family)

*Franxinus americana* L. White ash. Woods.

*F. pennsylvanica* Marsh., var. *pennsylvanica*. Red ash. Wet woods. The most common ash.

*F. pennsylvanica* Marsh., var. *subintegerrima* (Vahl.) Fern. Green ash. Wet woods.

*F. nigra* Marsh. Black ash. Swamps, low forests.

GENTIANACEAE (Gentian Family)

*Gentiana andrewsii* Griseb. Wet prairies, meadows and shores.

*G. quinquefolia* L., var. *occidentalis* (Gray) Gillett. Railroad. Damp clay. Uncommon.

*Menyanthes trifoliata* L. Buckbean. Swamps. Uncommon.

APOCYNACEAE (Dogbane Family)

*Apocynum adrosaemifolium* L. Dogbane. Railroads, roadsides. Common.

*A. medium* Greene. Railroad prairies.

*A. sibiricum* Jacq. Indian hemp. Railroads, roadsides.

ASCLEPIADACEAE (Milkweed Family)

*Asclepias exaltata* L. Poke milkweed. Edge of woods, quarry. Two records. Uncommon.

*A. incarnata* L. Swamp milkweed. Marshes, shores. Common in suitable habitat.

*A. ovalifolia* Decne. Prairie. One record. Rare.

*A. purpurascens* L. Mapped (Noamesi & Iltis, 1957).

*A. syriaca* L. Common milkweed. Railroads, roadsides, fields.

*A. tuberosa* L. Butterfly weed. Uncommon. Railroad prairies.

*A. verticillata* L. Whorled milkweed. Railroad prairies.

CONVOLVULACEAE (Morning Glory Family)

*Convolvulus arvensis* L. Bindweed. Roadsides, waste places. Weed.

*C. sepium* L. (*Calystegia sepium* (L.) R. Br.) Hedge bindweed. Roadsides, waste places. Weed.

*Cuscuta cuspidata* Engelm. Dodder. Twining on vegetation.

*C. gronovii* Willd. Dodder.

*C. polygonorum* Engelm.

*Ipomoea hederacea* Jacq. Railroad. Escape. One record.

*I. purpurea* (L.) Roth. Morning glory. Edge of marshy ditch. Six miles from Oshkosh on Hw. 110. Collected by *H. Buchholz*, Sept. 10, 1969, s.n. (WIS). Escape from cultivation.

POLEMONIACEAE (Phlox Family)

*Phlox divaricata* L. Wild blue phlox. Woods.

*P. pilosa* L. Prairie phlox. Railroad prairies.

*P. subulata* L. Moss pink. Roadside. Escape from cultivation.

HYDROPHYLLACEAE (Waterleaf Family)

*Hydrophyllum virginianum* L. Water leaf. Wet to mesic woods. Forming a ground cover at times.

*Ellisia nyctelea* L. Landscape plantings and dump area.

BORAGINACEAE (Borage Family)

*Cynoglossum officinale* L. Hound's tongue. Upland woods.

*Echium vulgare* L. Blue weed. Roadside.

*Hackelia virginiana* (L.) Johnst. Stickseed.

*Lappula echinata* Gilib. Stickseed.

*Lithospermum canescens* (Michx.) Lehm. Hoary puccoon. Railroad prairies.

*L. officinale* L. Weed in sidewalk crack.

*Myosotis scorpioides* L. Forget-me-not. Shore of Wolf River.

*Symphytum officinale* L. Common comfrey. Escape. Mapped (Kruschke, 1944).

VERBENACEAE (Vervain Family)

*Phyla lanceolata* (Michx.) Greene. Frog fruit. Riprapped shore of Wolf River.

*Verbena bracteata* Lag. & Rodr. Open ground.

*V. hastata* L. Vervain. Marshes and low forests.

*V. x illicita* Moldenke. Mapped (Tans & Iltis, 1979). Only location in Wisconsin. Collected in 1909.

*V. stricta* Vent. Along railroad tracks.

*V. urticifolia* L., var. *urticifolia*. Weed in moist soil.

*V. urticifolia* L., var. *leiocarpa* Perry & Fern. Weed.

LABIATAE (Mint Family)

*Agastache nepetoides* (L.) Kuntze. Giant hyssop. Woods, uncommon.

*Dracocephalum parviflorum* Nutt. Specimen collected by *Kellerman*, s.n., labeled only Oshkosh, Wis. (WIS).

*Glechoma hederacea* L. Ground ivy. Lawn weed.

*Hedeoma hispida* Pursh. False pennyroyal. Dry locations.

*H. pulegioides* (L.) Pers. American pennyroyal. Garden weed.

*Isanthus brachiatus* (L.) BSP. Railroads.

- Lamium ampelicaule* L. Dead nettle. Weed in gravel, around shrubs in landscape planting.
- Leonurus cardiaca* L. Motherwort. Disturbed weedy places.
- Lycopus americanus* Muhl. Damp soil.
- L. asper* Greene. Shore of Lake Winnebago, banks of Fox River. Two locations.
- L. uniflorus* Michx. Damp soil.
- L. virginicus* L. In marshes.
- Mentha arvensis* L. Mint. Damp soil.
- M. cardiaca* Baker. Mapped (Koeppen, 1957).
- M. piperita* L. Peppermint. Shore of Lake Winnebago. One record.
- Monarda fistulosa* L. Wild bergamot. Railroad prairies, roadsides.
- Nepeta cataria* L. Catnip. Disturbed weedy places.
- Physostegia virginiana* (L.) Benth. = *P. formosior* Lunell. False dragon head. Wet woods, marshy places.
- Prunella vulgaris* L. Self heal. Common. Weed in lawns, low meadows and woods.
- Pycnanthemum virginianum* (L.) Durand & Jackson. Mountain mint. Railroad prairies, meadows.
- Scutellaria galericulata* L. Skull cap. Wet soil, marshes, shores.
- S. lateriflora* L. Wet soil, marshes, shores.
- S. parviflora* Michx., var. *leonardii* (Epling) Fern. Railroad prairies.
- Stachys hispida* Pursh. Hedge nettle. damp soil.
- S. palustris* L. Damp soil. Common.
- Teucrium canadense* L. Germander. Damp soil. Common.
- SOLANACEAE (Nightshade Family)**
- Datura stramonium* L. Jimson weed. Waste area. One record.
- Lycium halimifolium* Mill. Matrimony vine. Railroad. One record.
- Lycopersicon esculentum* Mill. Tomato. Spontaneous in field. One record.
- Nicotiana tabacum* L. Spontaneous on dirt fill. One record.
- Physalis heterophylla* Nees. Ground cherry. Railroads, roadsides.
- P. ixocarpa* Brot. Spontaneous in garden.
- P. longifolia* Nutt. Edge of cornfield. One record.
- Solanum carolinense* L. Horse nettle. Railroads. One record.
- S. dulcamara* L. Bittersweet nightshade. Lake shores, hedgerows, gardens, marshes. Common weed.
- S. nigrum* L. Black nightshade. Disturbed sites.
- S. rostratum* Dunal. Buffalo bur. Disturbed site.
- SCROPHULARIACEAE (Figwort Family)**
- Agalinis purpurea* (L.) Pennell. In clay soil along railroad.
- A. tenuifolia* (Vahl.) Raf. Damp soil.
- Aureolaria grandiflora* (Benth.) Pennell, var. *pulchra* Pennell. False foxglove. Mapped (Salamun, 1951).
- Castilleja coccinea* (L.) Spreng. Indian paint brush. Mapped (Salamun, 1951).
- Chaenorrhinum minus* (L.) Lange. Railroads.
- Chelone glabra* L. Turtlehead. Marshes, wet meadows, shores.
- Gratiola neglecta* Torr. Hedge hyssop. Damp soil.
- Kickxia elatine* (L.) Dum. Cancer wort. Spontaneous in garden. First Wisconsin record.
- K. spuria* (L.) Dum. Spontaneous in garden. First Wisconsin record.
- Linaria vulgaris* Hill. Butter and eggs. Railroads, roadsides, disturbed sites. Common.
- Lindernia anagallidea* (Michx.) Pennell. Wet soil in fallow field.
- Mimulus ringens* L. Monkey flower. Marshes, shores.
- Pedicularis canadensis* L. Lousewort. Railroad prairies.
- P. lanceolata* Michx. Marshes, shores.
- Penstemon digitalis* Nutt. Beard tongue. Roadsides, fields.
- Scrophularia lanceolata* Pursh. Figwort. Railroads, roadsides.
- S. marilandica* L. Carpenter's square. Railroads, roadsides, woods.
- Verbascum blattaria* L. Moth mullein. Weed in planted shrubbery.
- V. thapsus* L. Mullein. Railroads, roadsides, open fields. Weed.
- Veronica anagallis-aquatica* L. Wet mucky shores.
- V. arvensis* L. Speedwell. Weed in lawns.
- V. longifolia* L. Garden escape. One record.
- V. peregrina* L. Roadsides, weedy fields.
- V. persica* Poir. Garden weed.
- V. scutellata* L. Partially dry drainage ditch.
- V. serpyllifolia* L. Lawn weed.
- Veronicastrum virginicum* (L.) Farw. Culver's root. Railroad prairies, wet woods.
- LENTIBULARIACEAE (Bladderwort Family)**
- Utricularia vulgaris* L., var. *americana* Gray. Shallow water.
- PHRYMACEAE (Lopseed Family)**
- Phryma leptostachya* L. Lopseed. Railroads, wet woods.
- PLANTAGINACEAE (Plantain Family)**
- Plantago arenaria* Waldst. & Kit. = *P. psyllium* L., nom. ambig., and *P. indica* L., nom. illegit. (See Tutin, *Flora Europaea*, 4:43.)
- P. lanceolata* L. English plantain. Lawns, disturbed sites. Weed.
- P. major* L. Common plantain. Lawns, disturbed sites.
- P. rugelii* Decne. Lawns, disturbed sites. Weed.
- RUBIACEAE (Madder Family)**
- Cephalanthus occidentalis* L. Button bush. River banks.
- Galium aparine* L. Cleavers. Woods.
- G. boreale* L. Northern bedstraw. Wet prairies.

- G. circaezans* Michx., var. *hypomalacum* Fern. Wild licorice. Woods.
- G. concinnum* T. & G. Shining bedstraw. Woods.
- G. labradoricum* (Wiegand) Wiegand. Undisturbed sedge meadow.
- G. obtusum* Bigel., var. *ramosum* Gleason. Damp roadsides, woods.
- G. tinctorium* L. Marsh.
- G. trifidum* L. Small bedstraw. Marshes, shores.
- G. triflorum* Michx. Sweet scented bedstraw. Woods.
- Houstonia longifolia* Gaertn. Mapped (Urban & Iltis, 1957).
- Mitchella repens* L. Partridge berry. Northern part of county. Woods in association with *Pinus strobus* Rare.
- CAPRIFOLIACEAE (Honeysuckle Family)**
- Diervilla lonicera* Mill. Bush honeysuckle. Uncommon. Roadsides, edges of woods.
- Lonicera x bella* Zabel. Bell's honeysuckle.
- L. dioica* L., var. *dioica*. Wild honeysuckle. Moist woods.
- L. dioica* L., var. *glaucescens* (Rydb.) Butters.
- L. morrowii* Gray. Escape.
- L. prolifera* (Kirchner) Rehder., var. *prolifera*. Grape honeysuckle.
- L. tartarica* L. Tartarian honeysuckle. Escape in woods.
- Sambucus canadensis* L. Elderberry. Railroads, roadsides, thickets.
- S. racemosa* L., ssp. *pubens* (Michx.) Hulten. In woods in northern part of county. Less common than preceding species.
- Symphoricarpos occidentalis* Hooker. Wolf berry. Railroads.
- Triosteum aurantiacum* Bicknell. Horse gentian.
- T. perfoliatum* L. Marshy woods.
- Viburnum acerifolium* L. Woods. Occasional.
- V. lentago* L. Nannyberry. Hedgerows, woods, and thickets.
- V. opulus* L., var. *americanum* Ait. American high bush cranberry. Woods.
- V. opulus* L., var. *opulus*. European high bush cranberry. Escape.
- V. rafinesquianum* Schult., var. *rafinesquianum*. Maple basswood forest.
- VALERIANACEAE (Valerian Family)**
- Valeriana edulis* Nutt. Railroad prairies. Uncommon.
- V. officinalis* L. Valerian. Freely spreading and persistent from cultivation.
- DIPSACACEAE (Teasel Family)**
- Cephalaria tatarica* Schrad. Spontaneous in one location. No longer present. Site developed.
- Dipsacus laciniatus* L. Cut leaved teasel. Waste area near cemetery.
- D. fullonum* L. = *D. sylvestris* Hudson of Am. authors. Spontaneous in cemetery and one other area. A county record.
- CUCURBITACEAE (Gourd Family)**
- Echinocystis lobata* (Michx.) T. & G. Wild cucumber. Hedgerows, marshes, thickets. Damp soil.
- CAMPANULACEAE (Harebell)**
- Campanula americana* L. Tall bell flower. Occasional in woods.
- C. aparinoides* Pursh. Marsh bell flower. Marshes.
- C. rapunculoides* L. Escape. Roadsides, railroads, thickets.
- C. rotundifolia* L. Harebell. Rare in county. Along railroad track. One record.
- LOBELIACEAE (Lobelia Family)**
- Lobelia cardinalis* L. Cardinal flower. Wet shores, flood plain forests.
- L. inflata* L. Indian tobacco. Field near Menasha. One record.
- L. kalmii* L. Sedge meadow. One record near Rush Lake.
- L. siphilitica* L. Great blue Lobelia. Marshes, shores.
- L. spicata* Lam. Spiked Lobelia. Railroad prairies, roadsides.
- COMPOSITAE (Composite Family)**
- Achillea millefolium* L. Yarrow. Railroads, roadsides, fields.
- A. ptarmica* L. Established along one roadside. Garden escape.
- Ambrosia artemisiifolia* L. Ragweed. Railroads, roadsides, fields. Common weed.
- A. trifida* L. Giant ragweed. Railroads, roadsides, fields.
- Antennaria neglecta* Greene. Pussy toes. Railroads, roadsides, woods.
- A. plantaginifolia* (L.) Richards. Railroads, roadsides, woods.
- Anthemis cotula* L. Dogfennel. Roadsides, waste places, marshy fields. Weed.
- Arctium minus* (Hill) Bernh. Common burdock. Disturbed sites. Common weed.
- Artemisia absinthium* L. Absinth. Railroads, roadsides, hard packed gravel.
- A. biennis* Willd. Disturbed sites.
- A. caudata* L. Wormwood. Edge of sand quarry.
- A. ludoviciana* Nutt. White sage. Railroad prairies. Uncommon.
- Aster azureus* Lind. Railroads.
- A. brachyactis* Blake. Clay fill, edge Lake Winnebago; railroad tracks on campus of University of Wisconsin, Oshkosh.
- A. ericoides* L. Heath aster. Railroad prairies, roadsides. Common.
- A. falcatus* Lindl. Near water filled pits in sand quarry. One location.
- A. furcatus* Burgess. Railroad. One record. Rare. A northern extension of range (Tans & Read, 1975).
- A. hesperius* Gray. Railroads, wet meadows.
- A. junciformis* Rydb. Undisturbed sedge meadow.
- A. lateriflorus* (L.) Britt. Woods, edge marsh.

- A. laevis* L. Railroad prairies, fields.  
*A. lucidulus* (Gray) Wieg. Damp soil.  
*A. macrophyllus* L. Large leaved aster. Moist woods.  
*A. novae-angliae* L. New England aster. Railroad prairies, roadsides, fields. Common.  
*A. pilosus* Willd. Roadsides.  
*A. prenanthoides* Muhl. Woods. *Buckstaff* 38-56 (Buckstaff Collection).  
*A. sagittifolius* Willd. Railroads, roadsides.  
*A. sericeus* Vent. Railroads. Two records.  
*A. shortii* Lindl. Dry woods.  
*A. simplex* Willd. Woods, fields, waste areas.  
*A. umbellatus* Mill. *Rill* 5597 (RILL).  
*Bidens aristosa* (Michx.) Britt. Marshes, wet meadows.  
*B. bipinnata* L. Yard weed. Probably introduced accidentally.  
*B. cernua* L. Sticktight. Wet shores, ditches. The most common *Bidens*.  
*B. coronata* (L.) Britt. Marshes, wet meadows.  
*B. frondosa* L. Bur marigold. Marshes, wet meadow.  
*B. tripartita* L. Waste area near Fox River. One record.  
*B. vulgata* Greene. Waste areas.  
*Boltonia asteroides* L'Her. Low ground. One record, 1935.  
*Carduus acanthoides* L. Plumed thistle. Field. Also one white flowered plant. Introduced; not a common thistle at this time.  
*Centaurea maculosa* Lam. Centaury. Railroads, roadsides, weedy.  
*Chrysanthemum leucanthemum* L. Daisy. Railroads, roadsides.  
*C. uliginosum* Pers. High daisy. Escape. Appearing native. Two records.  
*Cichorium intybus* L. Chicory. Railroads, roadsides, disturbed sites. Common weed.  
*Cirsium altissimum* (L.) Spreng. Wood thistle. Railroads, roadsides. Uncommon.  
*C. altissimum* (L.) Spreng x *C. discolor* (Muhl.) Spreng. One location.  
*C. arvense* (L.) Scop. Canada thistle. Common weed.  
*C. discolor* (Muhl.) Spreng. Prairie thistle. Railroads. Uncommon.  
*C. muticum* Michx. Swamp thistle. Wet meadows, damp roadsides.  
*C. vulgare* (Savi) Tenore. Bullthistle. Roadsides, fields, waste places. Common weed.  
*Conyza canadensis* (L.) Cron. Horseweed. Roadsides, disturbed sites. Weed.  
*Coreopsis palmata* Nutt. Tickseed. Railroad prairies.  
*C. tinctoria* Nutt. Disturbed site. Weed in landscaped planting.  
*Crepis tectorum* L. Roadside. Weed of disturbed sites. Becoming more common.  
*Erigeron annuus* (L.) Pers. Railroads, roadsides.  
*E. philadelphicus* L. Daisy fleabane. Railroads, roadsides.  
*E. strigosus* Muhl. Roadsides.  
*Eupatorium altissimum* L. Tall boneset. Along railroads. Range extension and county record. One location.  
*E. maculatum* L. Joe-pye weed. Damp soil.  
*E. perforatum* L. Boneset. Damp soil.  
*E. purpureum* L. Woods. One record.  
*E. rugosum* Houtt. White snakeroot. Woods, roadsides, marshes.  
*Galinsoga ciliata* (Raf.) Blake. Disturbed soil. Weed.  
*Gnaphalium obtusifolium* L. Cudweed. Open sandy field, cinders near building, open woods.  
*G. uliginosum* L. Planting near building. One record.  
*Grindelia squarrosa* (Pursh) Dunal. Tarweed. Railroads, roadsides.  
*Helenium autumnale* L. Sneezeweed. Marshes, wet ditches, wet meadows.  
*Helianthus annuus* L. Escape or a remnant of cultivation.  
*H. hirsutus* Raf. Railroads, roadsides.  
*H. giganteus* L. Roadsides.  
*H. grosseserratus* Martens. Railroads, roadsides.  
*H. laetiflorus* Pers. Railroad prairie. One location.  
*H. maximilianii* Schrader. Undeveloped field in city of Oshkosh.  
*H. strumosus* L. Edge marshy woods.  
*H. tuberosus* L. Railroads, roadsides.  
*Heliopsis helianthoides* (L.) Sweet. Railroads.  
*Hieracium aurantiacum* L. Orange hawkweed. Pastures, lawns. Weed.  
*H. kalmii* L. Railroads.  
*H. scabrisculum* Schwein. Railroads, woods.  
*Iva xanthifolia* Nutt. Marsh elder. Beside driveway. One record.  
*Krigia biflora* (Walt.) Blake. Dwarf dandelion. Uncommon. Undisturbed railroad prairies.  
*Lactuca canadensis* L., var. *longifolia* (Michx.) Farw. Railroads.  
*L. pulchella* (Pursh) DC. Railroad.  
*L. serriola* L. Prickly lettuce. Railroads, roadsides.  
*Liatris aspera* Michx. Blazing star. Prairies. Uncommon.  
*L. pycnostachya* Michx. Prairie gayfeather. Wet prairies. Uncommon.  
*Matricaria chamomilla* L. Disturbed site.  
*M. matricarioides* (Less.) Porter. Pineapple weed. Disturbed sites.  
*Polymnia canadensis* L. Marshy shore of Rush Lake.  
*Prenanthes alba* L. Rattlesnake root. Damp woods.  
*P. racemosa* Michx. Railroad prairies. Uncommon.  
*Ratibida columnifera* (Nutt.) Woot. & Standl. Cone flower. One location. Railroad.  
*R. pinnata* (Vent.) Barnh. Yellow cone flower. Railroad prairies, roadsides. A fairly common prairie element persisting along roadsides.  
*Rudbeckia hirta* L. Black-eyed Susan. Railroad prairies, fields.  
*R. laciniata* L. Roadsides.

*R. triloba* L. Occasional. Fields, roadsides.  
*Senecio aureus* L. Ragwort. Woods.  
*S. pauperculus* Michx. Woods, pastures.  
*S. plattensis* Nutt. Dry upland woods.  
*S. vulgaris* L. Weed in plantings and disturbed soil.  
 Common.  
*Silphium laciniatum* L. Compass plant. Railroad prairies, undisturbed roadsides.  
*S. terebinthinaceum* Jacq. Prairie dock. Railroad prairies, undisturbed roadsides. More common than the former.  
*Solidago canadensis* L. (Including *S. altissima* L.) woods, railroads.  
*S. flexicaulis* L. Zig-zag golden rod. Woods.  
*S. gigantea* Ait. Railroads, roadsides.  
*S. graminifolia* (L.) Salisb. Railroads, roadsides.  
*S. juncea* Ait. Wet woods, shores.  
*S. nemoralis* Ait. Railroads, fields.  
*S. riddellii* Frank. Railroads, damp clay soil.  
*S. rigida* L. Stiff goldenrod. Railroad prairies, fields. A common prairie element.  
*S. speciosa* Nutt., var. *rigidiuscula* Rydb. Showy goldenrod. Along railroad tracks.  
*S. uliginosa* Nutt. Sedge meadow.  
*S. ulmifolia* Muhl. Elm leaved goldenrod. Open fields.  
*Sonchus arvensis* L. Sow thistle. Roadsides, disturbed sites. Weed.  
*S. asper* (L.) Hill. Roadsides, disturbed sites.  
*S. oleraceus* L. Roadsides, disturbed sites.  
*S. uliginosus* Bieb. Roadsides, disturbed sites.  
*Tanacetum vulgare* L. Tansy. Escape. Railroads, roadsides, fields.  
*Taraxacum officinale* Weber. Dandelion. Lawns, disturbed sites. Common weed.  
*Tragopogon dubius* Scop. Greater goat's beard. Railroads, roadsides, fields.  
*T. dubius* Scop. x *T. pratensis* L. Field.  
*T. porrifolius* L. Spontaneous in my garden, not planted.  
*T. pratensis* L. Lesser goat's beard. Railroads, roadsides, fields.  
*Vernonia fasciculata* Michx. Ironweed. Marshes, wet meadows.  
*Xanthium strumarium* L. Cocklebur. Disturbed sites, waste places.

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