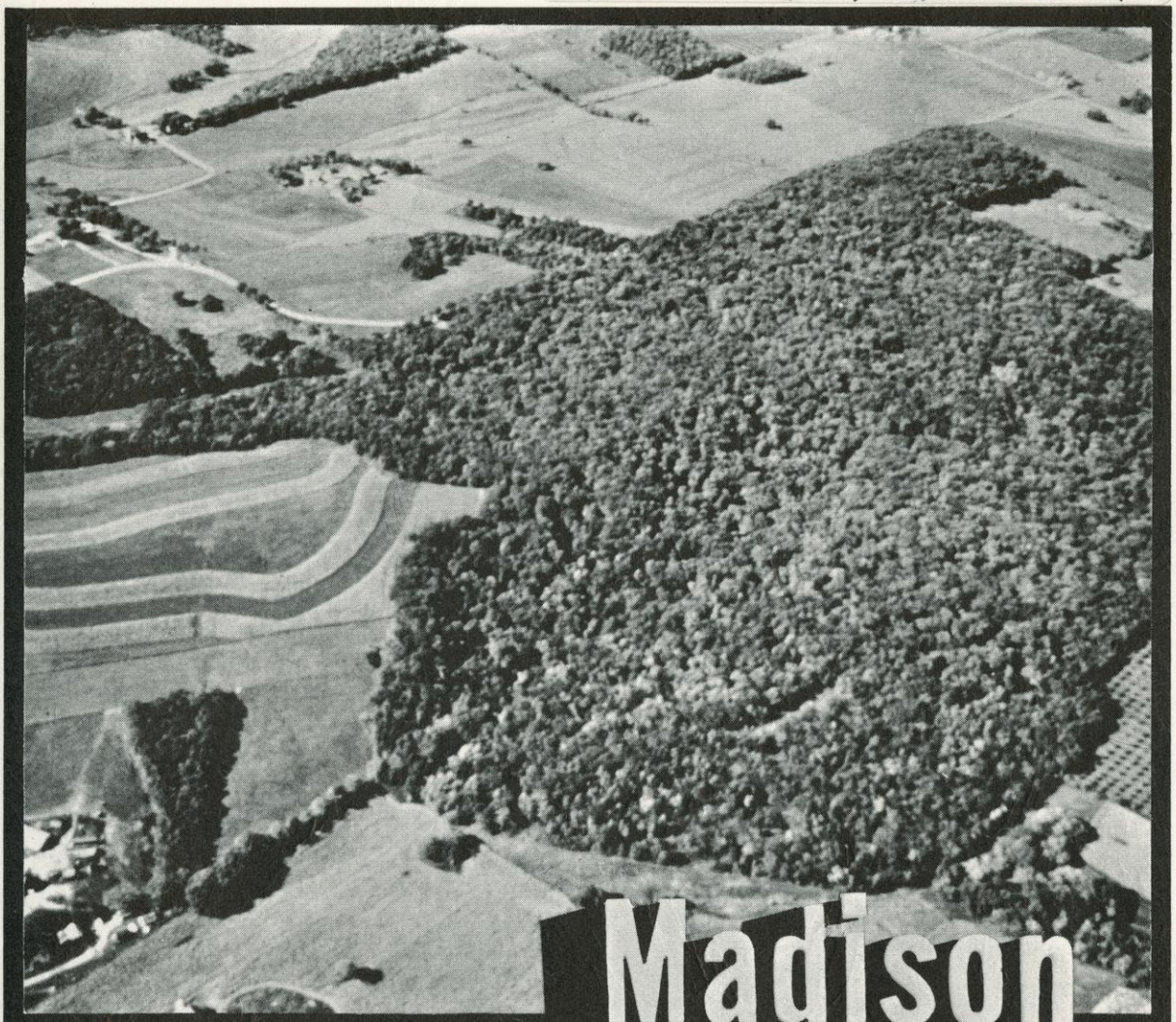
Madison School Forest. 1963?

Madison School Forest



Madison School Forest

ESEA TITLE III

LOCAL MATERIALS PROJECT OF IMC

MADISON PUBLIC SCHOOLS

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"MADISON SCHOOL FOREST"

The work presented or reported herein was performed pursuant to a grant from the United States Office of Education, Department of Health, Education, and Welfare.

Duplicate Copies Available From

Visual Education Consultants, Inc.

P.O. Box 52, Madison, Wisconsin 53701

OBJECTIVES

The materials were developed as an aid to teachers planning a class trip to the Madison School Forest. The theme of plant succession was chosen as a suitable focus to heighten the student's understanding of this natural oak forest community.

The slides start the students anticipating the happenings of the field trip. In addition, the use of slides gives a special opportunity to show what cannot be seen on such a trip; that is, what the forest looked like before the days of settlement, and how parts of it may look decades from today.

Increased awareness can lead to greater enjoyment in the out-of-doors, as well as to responsible attitudes toward conservation of our natural resources. If our efforts in this area result in a few more young people choosing fields related to ecology, well and good. But of greater importance will be the development of attitudes of environmental awareness and concern in the young people who will choose other fields — the doctors, craftsmen, businessmen, homemakers, teachers, artists, legislators of the future. In their hands will lie the decisions affecting our land. Their attitudes may mean the difference between destruction and preservation, between exploitation and conservation — perhaps between a land barely habitable and a land worth inhabiting.

SUGGESTED USES

The materials will be especially useful to classes planning a trip to the School Forest, both as a preview and follow-up.

The slides and script are divided into:

Part I — Clues to the Past

Part II — Signs of the Future

The two parts are best presented on separate days, allowing time for discussion after each part. Another discussion might explore other examples of succession, such as succession on bare rock, succession in a wetland, succession in an abandoned field.

Valuable resource material available from Wisconsin Department of Natural Resources, 4802 Sheboygan Avenue, Madison, Wisconsin.

"Parade of Plants I. Wetlands"

"Parade of Plants II. Upland Fields"

"Parade of Plants III. Forest"

The slides would be useful for high school classes studying ecology. In this case, the teacher might wish to make up his own narration to emphasize parts that best fit his own objectives for the use of the materials.

SETTING THE SCENE

This is the story of a piece of land. It is a small piece of land as we measure our state — only one half mile square — and yet, as is the case with every piece of land, every part of the earth's surface, this half mile has had its part in the vast and often violent changes that are the earth's history. In that sense, any spot on which you stand, anywhere upon the earth, you are on historic ground, because no place is ever always the same.

Looking backward, one is impressed with the sense of change, and this chapter will seek briefly to outline some of these changes. Our half mile, for example, has on several occasions been part of the ocean floor. The last time is thought to have been about 380 million years ago during what geologists call "Ordovician" time. It was then that the sand and lime that form the mantle rocks of our half mile were washed in as sediment in ancient shallow seas. Later, came an uplifting of the earth's crust in our part of the world, and what had been ocean floor became the land forms we know now.

During all these ages since the last great uplifting, erosion has been tirelessly at work, and much of the earlier sedimentary rock has long since been washed away. Thus, those rocks which we find so quickly beneath our feet and which record the earth's past history are only eternal in that they are long lasting, but they were not always there, and much of their upper layers has already disappeared. Eternal means only a long time and is best understood in terms of man's brief history.

The Glaciers

The most recent of the many changes our half mile has witnessed was an event that just missed our piece of land. Only three and one half miles away, and not very long ago compared to those earlier ages that built the mantle rocks, the massive ice sheets we call "glaciers" inched past. Four times the green-blue ice, thousands of feet thick, ground down out of its centers in Labrador and Keewatin and four times the ancient and now worn-away mountains to the North shunted the ice sheets away from our half mile.

These now vanished mountains that served as a shield to our area record a history much earlier than even our Ordovician seas — they are the remnants of our state's "dawn" history when volcanic action and all its attendant violence pushed up the igneous or "fire-formed" rocks during that earliest period labeled "precambrian".

But the northern mountain shield was here during the glacial period, and the ice was shunted aside. Here in southwestern Wisconsin and northern Illinois was the land "the ice forgot" called the "Driftless" by geologists. All around the Driftless as far South as the Ohio Valley, extending to the Atlantic Ocean and as far West as the Rocky Mountains the glaciers plowed, ground, and reshaped North America in the greatest earth moving project in history. The Driftless, and tucked barely inside the Driftless, our half mile, stood on the sidelines.

The Driftless Not Truly an Island

Sometimes this Driftless area is called an island, but really the term is not correct. It is thought that at no one time was the Driftless ever completely surrounded by ice. Rather the various glaciers at various times appeared on all sides, but never on all sides at once. Thus, a connection was never lost between the area and other larger land masses not covered with ice.

This sort of peninsular connection with other areas is important when one considers the source of plants which moved in to reclothe the land following glaciation. It is equally important to remember that there were long interglacial periods when the ice melted back into the North before renewing its assault.

However, because the Driftless always escaped the ice, its surface character is different. It is an "older" preglacial face of the land — more hilly, more deeply carved by erosion, more perfectly and completely drained and hence, with fewer lakes and marshes. Also, although its climate was different during glacial periods, it was probably not severely different than it is today. Certainly, plants and animals survived here when the ice destroyed all life nearby. It thus may be that the Driftless was the major "refugium" from which plants and animals moved out to reclaim the newly uncovered and nearby soils.

The Layer of "Loess"

Although the soils of our half mile escaped the bulldozing of the glacier, the area did receive a rich glacial gift. Rock flour, finely ground and pulverized was carried by the melt waters down a then much greater, much vaster Mississippi River and deposited in mud flats along the shores as the waters slowed down. Westerly wind then carried this rock flour as dust in great storms, depositing the dust as far East as Milwaukee in our state. Dust must have drifted much as snow does today all along the east bank of the Mississippi and all along its long course. On our half mile this wind-blown, dusty soil runs as deep as forty-two inches. Near the Mississippi the "loess" (wind deposited dust soil) is as deep as twenty-four feet.

Changes Since the Glacier

Since the last glacier (called the Wisconsin) all of our state, in fact all of the Middle West, has experienced less exciting and vigorous times. The word exciting, may turn out to be not the right word because some of the changes brought by living things may seem even more dramatic and certainly more complex.

Climate Since the Glacier

Climate did not stand still although the ice was gone. Pollen studies show the vegetational and with it the climatic history of the past 12,000 years. Pollen studies are made in bogs — areas of deep peat which were once a lake, then a swamp, and now an area filled in with largely vegetational remains. Pollens of plants have a waxy coating and although very small are exceedingly long lasting. Wind today, as in the past, blows this pollen about and some of it settles on lakes and in sinking to the bottom becomes part of the lake bed.

By careful use of auger-like drills botanists can sample different levels of a peat bog. They can then identify the pollens and reconstruct a picture of the vegetation at the time that level of peat was laid down. Dating these levels is difficult, but recent advances in radioactive carbon dating help greatly here.

The Story From the Bogs

These bogs which have been called "the History Books with the Quaking Covers" tell this story about climate since the last glacier. The immediate post-glacial period was cool and wet much as one might expect; next came a still somewhat cool but more dry period; then came a considerably warmer and much more dry period (about 3,000 years ago) and now we are back to a somewhat cooler and more moist period than the one immediately past.

How can the bogs tell us this? Well, the pollen in the lowest layers of the peat (the earliest period) comes from Spruce and Pine, a vegetation now found largely north of Lake Superior. (One theory has it that the Spruce may have grown directly on top of the glacier itself in a layer of thin wind deposited soil.) The second layer finds the Spruce gone and Pine dominant, much like northern Wisconsin today. In the warm-dry period we find Oak and a considerable amount of grass pollen which would indicate a prairie-like climate, and finally, in the upper layers we find again the Oaks and with the grasses greatly diminished, our present climate.

The Story of the Land is the Story of Change

Thus, one cannot escape the conclusion that the story of the land is the story of change — change brought by violence, by the rising and sinking of continents, by vast ice sheets of continental size, by tremendous ancient dust storms, by continual erosion and down-hill wash, by even an earlier history of volcanic action, and there is also the change on the face of the land brought by living things that call it home.

These living things, the plants and animals, work their changes in the upper layers — the soil. Most of this book will now be confined to these changes. We will try to record and to give some understanding of those changes which come about through the activity of life — of living and dying — of the struggle of plants and animals to obtain from the earth those needs which will permit them to continue in their time and place upon the earth and to leave progeny to follow them.

We will continually point out that no place is ever quite the same when some life has lived there. We will declare that inhabiting the earth changes it, and we will argue slyly that mere inhabiting the earth does not guarantee that offspring will in turn inherit a good earth. The greatest lesson of the "Forest Story" may be that lesson.

And so now, the story of our half mile becomes the story of the changes which living things cause and bring. Very briefly we have leaped through billions of years to reach our day. Our backwards looks will now be much shorter ones and our forward looks will be those which present knowledge and uses of the land seem to force upon us. Everywhere we look in the forest we will find some of the life so abundantly present — our job is to try to understand this life.

Wisconsin~ showing extent of glaciation

PLANT COMMUNITIES AND PLANT SUCCESSION

In precolumbian days, before the white man had changed the face of our state, Wisconsin was largely a forest. The term "largely a forest" is accurate enough but it must be remembered that Wisconsin was not entirely a forest or entirely one kind of a forest. As a matter of fact, our Dane County and considerable area around us existed in what was known as "Oak opening", a sort of combination forest and grassland.

Pre-Settlement Vegetation

(Map — "Early Vegetation of Wisconsin" — available from Wisconsin Geological Survey, 1815 University Avenue.)

The Early Vegetation Map of Wisconsin shows the "original" or pre-settlement (early 1800) vegetation of Wisconsin. You will note grasslands or prairies — the so-called prairie peninsula — extending as fingers into southern Wisconsin and existing as well as scattered islands both in southern and western Wisconsin. You will note most of our own area is an "Oak Savannah" or "Oak Opening".

The areas represent undisturbed vegetation cover — that is undisturbed in relation to white man and the forces he has used to influence the land. These areas represent, then, many thousands of years of adjustment but it should not be understood to have always been that way even before man, nor would these communities have continued exactly like they were had white man not come to Wisconsin.

Nature Dynamic

The important point to remember is that natural communities of especially plants, and to a nearly equal degree animals, are dynamic — that is, they change. Plant associations or communities are subject to these changes by many natural forces outside of the influence of man — climatic changes involving temperature and rainfall — erosion even when original cover was undisturbed, disease and insect infestations, fire of so-called natural origin, even vast uplifting and lowering of continents in geologic change. As a factor or factors change and press in upon a community, conditions are created that throw the balance -- the margin of success — from one type of plant to another. In a later chapter we will note that animals too react to changing conditions.

Towards the Climax

Basically it can be said, however, that barring changes of a catastrophic nature (such as glaciation, fire, etc.) plant communities move towards a position of balance in which they can reasonably maintain themselves. This condition is called the "climax".

Some Success Factors in a Community

There exists in any plant or animal community both competition and cooperation. Plants compete or struggle with each other for water, for sunlight, for soil fertility or nutrients (food), for living space. This competition is most intense as the supply of these essentials becomes limited. Plants compete with members of their own kind or "species" as well as other species — it is a continual, relentless struggle. This never ending competion gives rise to the notion of the "survival of the fittest", and there is much to be said for this point of view.

Dependence

Sometimes overlooked in the emphasis given competition is the opposite factor of dependence and, indeed, cooperation. Many dependent species are not so large, showy or noticeable, but these species can exist only because of some special condition (such as shade) which other plants create. Sometimes the dependent species are harmlessly dependent, sometimes they are parasitic and can on occasions reach such proportions that they destroy their friendly host and with it themselves. On the other hand we have species whose role is entirely cooperative (such as many soil bacteria) and whose presence is vital to the well being of a community.

Forest a Complex Community

Perhaps it can best be summed up by saying that a forest or a prairie is a complex community of living things. It is not just trees nor is a prairie just grass. A forest is literally hundreds of competing, dependent and cooperating organisms both very large and very small, which struggle together and work together to achieve some degree of livability in close space relationship to each other.

Impact of Agriculture on Plant Communities

Man is and has been very successful in changing and reorganizing these plant communities. His greatest success perhaps has been in agriculture, where he has "favored" certain food plants by preparing the ground, sowing seeds, cultivating to eliminate competition from other plants, fertilizing and irrigating to provide even further cooperation, and generally smoothing the path for the success of these favored plants. Whether or not continued favoring of certain plants over all others and at all times and the ever more total destruction of wild plants can be successful in the long run is not yet clear. Certainly there has been enormous success to date, but there is also apparent certain danger signals such as excessive erosion, apparent moisture loss and reduced natural fertility and less desirable soil structure which loom in the picture.

From the theoretical standpoint the organization of a cultivated field is more simple than a natural one. The many, the almost unbelievably large number of complex relationships which exist in nature, are greatly reduced. Thus, in agriculture we seem to turn aside from the processes by which nature built the things we are now losing, and thus, from a theoretical standpoint, we may be heading for so much trouble that even a greater degree of "favoring" may not turn the trick.

The Theory of Plant Succession

One of the most useful notions leading to an understanding of the outdoors is the theory of plant succession. This is quite a recent theory although the facts upon which the theory is based have been observed and discussed for centuries. Very roughly and briefly stated, the theory holds that under given conditions of climate (largely temperature and to a lesser degree rainfall) there is a certain type of plant community that must develop. Before this final community which must develop can develop, there will be a history of many other communities which thrived for a time preparing the way for this, the later communities of plants. This final or last community which must develop can then maintain itself indefinitely if climatic conditions do not radically change, and this community is called the "climax". It represents to a degree the "end of the road".

Role of Temperature in the Climax Pattern

One of the most important factors in determining which climax will finally occur is temperature. Thus, the climax forest of the temperate regions will be different forest than that of the tropics, which will in turn differ most markedly from a boreal (or northern) forest. Rainfall also enters the picture. If rainfall is too slight the climax will not be a forest at all, but a prairie or under even and much more severe conditions, a desert community.

The variation from one type of climax (or finally best suited association of plants) to another based on temperature and rainfall can be best illustrated by ascending a mountain. Here "life zones" of vegetation can be easily and quickly observed. In a short drive up a mountain temperature varies so greatly that the warmer vegetation of the foothills quickly disappears and "zonation" appears, which if the mountain is high enough finally reaches conditions similar to arctic "tundra". To a degree when one ascends a mountain one is "traveling north with the sun" — that is, one is experiencing a climate change of several thousand miles in climbing only several thousands of feet.

Unfortunately we have no mountains in Dane County to illustrate this change, but on your next trip West, look for it — watch the changing plant scene slip beneath your car as you go up, and remember that these plants did not "just happen" to be there. You will be looking at one of the fundamental processes or laws of nature.

Primary Succession

We want to pursue the idea of plant succession ever further because it will be a fundamental notion in your study of both forestry and wildlife, and our attempts to manage an area for such purposes.

Primary succession starts from a bare area — a spot so cruel that originally no plant life exists. There are not many such areas — none in our forest — but a totally bare rock ledge or an area of extreme erosion or perhaps a recent lava flow would serve to illustrate such "cruel" places. Here the conditions are so inhospitable to life that the plants which first invade them — the so-called pioneers — must have special adaptation (or abilities) in order to exist at all.

Moisture conditions are especially critical and control what kinds of plants these first pioneers will be. If the "habitat" or spot is very dry, such as bare rock, it is called "xeric"; if very wet, such as a lake, it is called "hydric"; if intermediate it is "mesic", but to any habitat whichever it is, plants will come. These plants will be suited to survive in the area and under the conditions — lichens or mosses, perhaps, on the rock, floating leaved aquatics on the lakes.

Now comes a most important notion — the plant succession, the gradual taking over of a habitat by a very slow invasion of plants and with them soils — will always change the habitat towards average moisture conditions. Thus, whether we start with a lake or a rock we will in enough time arrive at an in-between or average moisture condition and one that is clothed with soil, and with a plant cover that thrives in these new conditions.

All nature moves toward the average — the medium, the least extreme situation. Xeric habitats become more moist, hydric become more dry, and thus although the original pioneer plant species vary greatly if enough time goes by, both habitats will be the same and will finally be covered with the same plant community.

Secondary Succession

Much more common and easily noticed is secondary succession. Here a field might be laid bare by cultivation, lumbering, fire or some other factor. However, in most such cases the moisture conditions are already reasonable, the soil is not too greatly damaged, and the future is close at hand. There are always dormant seeds in the ground and roots ready to sprout and nearby there are always established plant communities of a satisfactory or nearly satisfactory type to serve as sources of the new colony. Then plant cover will appear quickly and here succession may be at first most rapid.

The usual first year cover is often annual weeds. Another year or two and the annuals will give place to perennials and then to brush or shrub growth and then after a time to a young forest if moisture is sufficient. As the centuries roll past that first forest, too, will change to a different sort of forest.

The kind of trees which make up a "climax" forest — a final "end of the road" forest are largely dependent upon shade as the final factor. Thus, while Jack Pine frequently is the first invader or pioneer on a central Wisconsin "burn", Jack Pine cannot continue itself because young Jack Pine needs considerable sunlight. More shade tolerant trees must now move in (such as White Pine) and after soils and perhaps moisture and finally deep shadows come to the forest only those shade tolerant trees such as Maple, Basswood, Beech, Birch and Hemlock can thrive. We have come to a "Maple climax".

Each Stage in Succession Carries Within It its Own Defeat

We come then to the summary of an important idea. Each successional step — each plant community is for a time successful because conditions are right for its particular requirements. This association becomes dominant, but as it becomes increasingly dominant it creates its own disaster by changing the conditions that were initially favorable. Litter increases on the forest floor, shade increases, moisture moves one way or the other toward the average, soil acidity and with it soil bacteria may change and finally a community "successes" itself out of business. Because a community changes conditions as a result of its own prosperity, it creates conditions no longer suitable to itself but now suitable to other communities.

Thus, a new succession, a new community, takes over in force after first existing weakly on the site. It in turn prospers and again changes the habitat and then bows out to still another succession until finally we arrive at a community which no longer creates its own death trail — this is the climax.

Rarity of the Climax

Now such conditions as described are on the face of things highly improbable. The chances of having a succession go all the way to the finish is unlikely because of the enormous time span needed. In the time needed so many things, so many accidents, can happen that the fact is that they usually do. A fire can, for example, turn back the succession as can certainly lumbering or farming. However, climaxes can and do exist. There are, of course, many more examples of succession at various stages short of the climax.

Importance of the Climax in Management

It should be quite clear by now that if we are managing an area with our sights set on climax conditions and if our present conditions are near or at climax we are lucky, because all nature is working with us. Also it should be clear that if we seek to continue conditions at less than climax stages, we will need to put forth much greater effort and skill. This is abundantly clear in farming, which aims at a very early stage (that of annual plants) and requires much labor and a continuing increase in skill to keep the show going. However, this too can be done.

THE PAST CENTURY

You will recall from earlier pages something of the earlier "geological" history of our forest. We turn now especially to the last 100 years of plant history.

This Was Not Always A Forest

The Madison School Forest was not always a forest. In fact, this is a very young forest — it really represents only one generation of mature trees. At the time of settlement and the original survey (1830's), this area was an "Oak opening".

Oak openings were a quite common occurrence in southern Wisconsin in those days and are a condition almost totally gone today. An Oak opening was a sort of park-like combination of most Bur Oaks in single trees or scattered clumps of trees and prairie (grasslands).

Why The Oak Openings?

There is some debate among botanists on "why a prairie" in Wisconsin, where rainfall is sufficient to support a forest and forests are better competitors in the succession. We are going to settle for the fire theory as by far the best explanation although drought and disease are other factors to be thought about.

One of the most common errors in the thinking of most people is to assume that fire greatly increased with the coming of the white man. Fire is thought of as sort of a modern curse we have placed upon the land. We are so used to hearing and thinking about the "burning of the north" following lumbering that we assume that fire is a new factor in our state. Just the opposite was true in southern Wisconsin.

Fire stopped in our area with the coming of settlement. Early roads and fields split up the area in fire breaks, farmers made efforts to control fires and the annual burning, largely Indian set, stopped. It should be remembered that despite what one reads, prairie fires are easier to set than forest fires and a more valuable means of driving game. Also a forest fire is a thing of fierceness but a prairie fire is a fire gone briefly mad.

The constant burning of the grasslands kept the forest of our area from developing and thereby shading out the grass. Each year such seedling trees as grew from seeds or sprouted ambitiously from older roots were killed back. Each year the grass was given the advantage and grass can withstand fires where trees cannot. It should also be stated that grass can also withstand drought. Grass has a great advantage — it can wait.

One of the features of the grasslands described by early naturalists was the presence of "grubs" — huge underground Oak roots in some cases already a century old and threw up annual shoots into the prairie. These grubs were most difficult for early farmers to remove and represented a continual nuisance in their hard won fields.

The Importance of Oak in the Openings

But Oak trees did survive the fires here and there. Luck and fortunate placement gave them a start and then the fire resistant and insulating qualities of their bark kept them going. A prairie fire while disastrous in its progress is not a long lasting fire, and trees of some size frequently survive the effects. Bur Oaks are the most fire resistant of the Oaks and early surveyors' notes indicate that originally our area had mostly Bur Oaks. White Oaks are a good second and they, too, were found in numbers, and perhaps especially on our half mile. These Oaks, "veterans of the prairie war", were scattered throughout the grasslands or existed in small groups. Seldom were they so closely spaced that their tops interlaced. A rather remarkable piece of research working from early surveyors' notes places these trees about sixty feet apart on the average. When the fires ceased acorns from these Oaks and sprouts from the "grubs" supplied a thick growth of young trees to start our forest.

A Century of Growth

About 100 years ago then, in the period just prior to 1860, the Madison School Forest made its start. The new trees were remarkably closely crowded and caused much debate about this sudden "irruption" of Oak trees in Wisconsin and in those places where plow and cattle did not keep them down. In a short time these new trees were overtopping and gradually killing the earlier and open grown trees. Thus, our forest has its "veterans" now moving into the end of their time upon the land, gnarled, knobby and spreading with most of the Bur Oaks (less shade tolerant) already gone and the new forest of straight and tall trees, much better timber, growing around them. Together they show the history of a century on the land.

More Trees Here Now

We hear so much about our forests having been removed or destroyed that it is instructive to realize that such is not true here. We have at least ten times as many trees in the Madison Forest as we had a century ago. Furthermore from a lumber standpoint we have more lumber. This is true, of course, because the forest is a new feature of the land — but there are many other hillsides in our county where this is equally true. It should also be pointed out that this is not true in the originally forested counties of the North.

Going Back Even a Longer Time

It is interesting to try to piece together the history of our forest for an even longer period of time. We have seen how today we have a young forest which sprang from the Oak openings of pre-settlement. What was it even earlier?

Probably for long periods of time and at least prior to about 1650 it was then too a forest. This seems true because its soils are forest soils — that is, the upper layers of soil are those typically laid down by the accumulation of forest litter (duff) on a forest floor. The soil is not at all the kind laid down under a grass cover. Furthermore the scatter pattern of trees and their age at the time of the survey suggests a few trees grimly hanging on as the remnants of an

earlier forest rather than the invasion of the grasslands by trees pushing in from its borders. You can observe this forest invasion on any abandoned field, look for it especially in the sand counties as you drive North on a fishing trip.

So probably long ago we had a forest, that forest was destroyed — perhaps by drought, perhaps by disease, but most likely by fire — a few trees continued and the prairie moved in beneath them — the delicate balance was kept open by Indian fires and finally with the control of fire in our century, the forest won again.

How About Glacial Days?

One more look at the history of the land before we move on. Although the area of our forest was not covered with ice and the scraping and filling of the glacier did not occur here, the vegetation of the period no doubt suffered from cold. Actually, areas near a glacier are not anywhere near as cold necessarily as you might think, and certainly the Pines and Spruces of the North moved South with the ice sheet and then fought their way back again. Probably Pines and even Spruces grew once in our Oak-Hickory community and we still have some under-story plants which are typical of such a community.

These northern under-story plants are "relics" — pages torn from a book long past and existing now because of special favor shown then in certain parts of our woods. When we point these plants out to you we will do so with a certain special pride. They don't really belong here and they certainly will not always survive. They show the surprising toughness of both plants and animals to "make a go of it" in areas not really suitable. They are not colonists but remnants fighting a rear guard action against the better suited and therefore more prosperous Oak community.

Probable Future of Our Forest

In part of our forest we proposed to manage the trees for timber stand improvement. This means that here we shall attempt to remove the poor trees, poor both as to kind and individual specimen value. We will try to raise more and better Oak. This will mean favoring Oak over all other plants and eliminating competing factors. We will attempt to "freeze" the succession of the Oak sub-climax stage.

In the rest of the forest and in a long enough period of time and if nothing happens — no great fires, no extreme outbreaks of disease or insects, no big climatic change such as a very prolonged and extreme drought — if these things do not happen, our forest at least to the most part will move over into a Maple climax. The botanists call it an Acer-Tilia stage. Maple and Basswood are already making a small start but only a careful eye over a period of time will note this change.

The Oak-Hickory community is a long lasting one. There are experts who argue that Oak-Hickory is itself a climax and certainly it is so long lived a period that the term "sub" climax is deserved. But we are going to accept the Maple climax as the most probable end point of our forest story. You and I won't see this prediction come true, but we may see quite a stride in that direction. The climax species are deadly competitors. In time they always win.

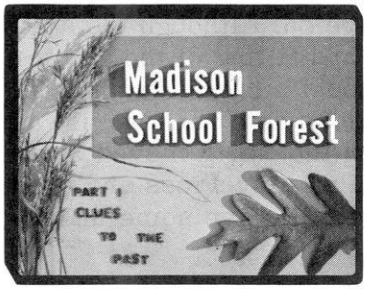
1

Colophon

(Bird Calls)

SPECIAL NOTE:

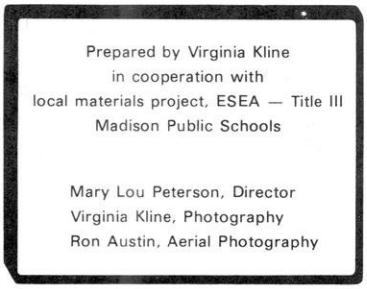
Please do not judge the quality of the beautiful full-color pictures in the Filmstrip by the appearance of the black-and-white photos in this Guide! Obviously, there is no comparison between full-color and black and white pictures.



2

Title

On June 16, 1969, the Madison School Forest was officially renamed the "Col. Joseph W. Jackson School Forest, Madison Public Schools" in honor of the man who made the forest possible.



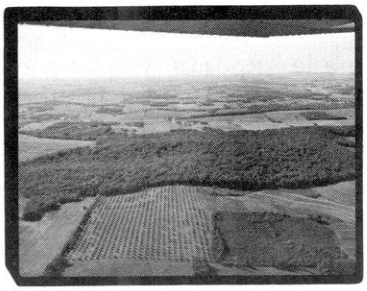
3

Credit Frame

4

Citizens of Madison are owners of an exciting piece of land in southwestern Dane County — nearly 300 acres of steep hills and valleys clothed with forest, teeming with life. This is the Madison School Forest.

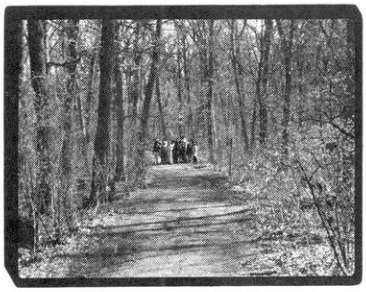
The view is toward the northwest.



5

The forest contrasts with the agricultural land surrounding it. Unique in its lack of disturbance, the forest was never grazed and few trees were cut by the former owners.

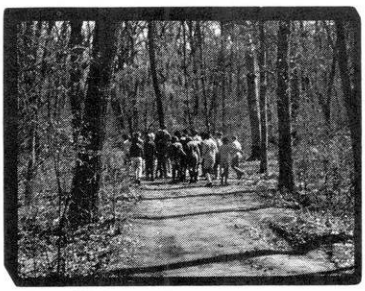
The view is toward the west.



6

Within the forest, each year brings new exploration and discovery as teachers and students come to hike the trails.

Pictures taken at different times of year are included in this set. In several cases the season chosen is the one during which the feature being discussed is most readily observable.



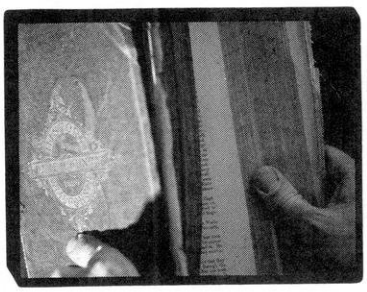
7

Here a class walks through the forest on the old wagon road which once was part of the route into Madison. Tall trees surround them, stretching branches over the road. It's easy to imagine a horse drawn wagon going through the wilderness on such a road. Perhaps Indians once hunted here. But has the forest always looked like this? How could you find out what the land was like in Indian and early pioneer days?

8

One way would be to look at some of the old records. This "History of Dane County, Wisconsin" was written nearly one hundred years ago.

History of Dane County by C. W. Butterfield.



9

Here is the way the writer described the township in which the School Forest now lies. "The surface of the country is rolling, with prairie land, diversified by hills and valleys". Another old book says, "On the banks of the streams there are excellent marsh and meadow lands. The land is oak opening interspersed with prairie". Apparently there are no forests to write about.

10

Another way to find out about the past is to look for clues in the forest itself. Here are four clues you might find:

11

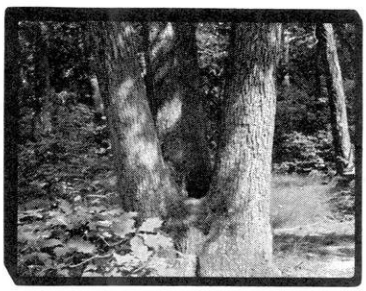
(1) Almost all the trees are oaks, which appear to be about the same age.

12

(2) Such oaks grow straight and tall with smooth trunks, but there are a few older looking oaks with protruding lumps and bumps.

13

(3) Oak trees usually grow with a single trunk but many of the oaks in the forest have double . . .



14

. . . or even triple trunks.

15

(4) Most of the plants growing beneath the trees in the forest are plants which thrive and bloom in the shade — such as wild geranium . . .

16

. . . and false Solomon's seal, . . .

17

. . . but here and there through the forest grow plants which can thrive and bloom only where sunshine is plentiful. These plants, among them wild rose . . .

18

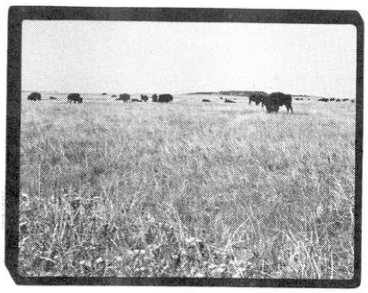
. . . and lead plant, appear to be doing very poorly and seldom have flowers.

19

All these things are clues to the past which can be seen in the forest today. The clues pose some questions: Why are most of the large oaks about the same age? What caused the bumps on the older trees? What might cause double or triple trunks in oak trees? How does it happen that there are sun loving plants growing in a shady forest? The pictures that follow will illustrate some of the past history of our 300 acres as it is revealed by such clues. Because the School Forest has changed so much since Indian times the photographer had to visit other areas to obtain the pictures. As you follow the story try to tell where the clues fit.

20

For at least two centuries before the first settlers came to this part of Wisconsin, the area was not in forest. The hills and valleys were clothed with sunlit grasses and flowers. Winds created waves in the grasses and caused the flowers to bend and spring back endlessly. This was the land of the prairie . . .



21

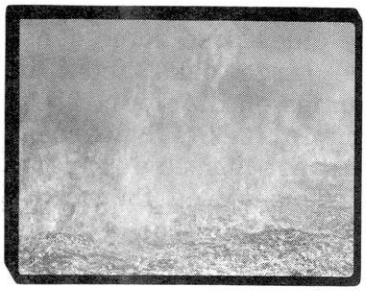
. . . the land of bison, elk and prairie dog; the land of prairie chicken, meadowlark and upland plover. The prairie lands of the western plains reached across the Mississippi River into southern Wisconsin.

22

The forests of the east also reached out toward our piece of land; there were trees as well as prairie grasses — a few tough oak trees with large round crowns and low spreading branches. The oaks were grouped in groves of widely spaced trees, these groves alternating with expanses of open prairie to create a pattern of trees and grass. The oaks produced acorns; many of these sprouted into young trees. You can see young oak trees showing above the grass to the right in this picture.

23

Decades would pass before the young oaks would have a chance to grow tall.



24

Every year, often in the fall, fires swept across the land, sweeping through the grasses and prairie flowers, burning for miles across the prairie. The young trees were burned down to their roots.

25

Older trees were protected by thick corky bark.

26

Some fires may have been set by lightning, but many were set by the Indians, who used fire as a hunting aid. Animals fleeing the fire were easy targets for skilled Indian hunters. In addition, the fire removed the tall grass stalks, often as high as six feet, improving the visibility for later hunting. Buds for a new season's growth of grass and flowers lay safe beneath the soil. These underground buds provided fire insurance for the prairie.

The fresh green growth after the fires probably attracted game into the area. Fire may have been especially important to the Indian hunters because they lacked horses.

27

The burned-off seedling trees resprouted from the roots, and as is often the case when a young tree is injured, each root now produced more than one sprout. Each year another crop of acorns yielded additional young oak trees.

28

Only a few trees escaped the fires long enough to grow that thick protective bark.

29

Most of the trees enlarged only underground, developing large roots which year after year produced new sprout growth to be burned back by the fires.

30

Thus when the first pioneers arrived in this open Indian country there was an underground forest of large oak roots lying unseen beneath the prairie grass.

31

The newcomers called the groups of spreading oak trees "oak openings" — open enough to drive a team through unhindered.

32

They marveled at the unfamiliar sight of grasses "knee high to a man on horseback", and suspected that the prairie soil must be poor. "What kind of land is this that won't grow trees?" The prairie sod resisted wooden plows — only a steel plow could efficiently break through that close-packed mat of roots. A suitable plow was invented at about the time southern Wisconsin was settled. Breaking the prairie sod was not the only problem. Underneath the small oak sprouts the farmers found oak roots so large that it required a team of horses to drag them out.

John Deere invented a steel plow capable of effectively breaking prairie sod in 1837, the year the first house was built in Madison.

33

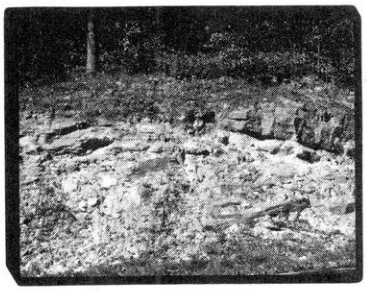
The land that had seemed too poor to grow trees actually provided some of the country's richest farmland.

Dane County farm

34

Some of the large open grown trees were left in the fields. A few of these are living still, such as this old sentinel at a busy intersection. Its lifetime spans a period from prairie to farm to city. Bison may once have found shade beneath its branches.

Oak at Midvale Blvd., and Odana Road



35

Some areas, such as our 300 acres, were too steep and had soil too thin and sandy to plow.

Road cut, School Forest

36

In such unplowed places, as settlement put a stop to the Indian fires, the underground forest of oak roots at last grew unhindered. Sometimes two or more of the sprouts from one root would live long enough to produce a tree with more than one trunk; often one of the sprouts would dominate and the others would die.

Early settlers were amazed at how quickly the unplowed areas of southern Wisconsin grew up into forest. It is interesting that there are more forests in Dane County today than there were in 1850.

37

Many trees, growing close together and starting at about the same time, resulted after a century in the School Forest as we see it today. Crowded together and shading each other as they grew, these trees never developed large low branches as did their open-grown parents.

38

Shrubs grew along with the young oaks. They too had had to wait for the fires to stop. These shrubs still persist in the forest today, a tangle of blackberries, gray dogwood and hazelnut beneath the canopy of century old trees.

The light effect makes the white oak trunks appear very very white in this picture.

39

The tree canopy is made up mainly of the oaks — bur, white, black, red — . . .

40

. . . but a few black cherry and shagbark hickory trees are found as well. How might the seeds of these trees have come to this place?

View of shagbark hickory

41

Set back by fire for decades, finally the trees stand tall. Today our 300 acres are home for squirrel, fox, and deer . . .

42

. . . and for rose-breasted grosbeak, scarlet tanager, ruffed grouse, and whippoorwill.

43

The old giants, because of the shade of their close growing offspring, have lost their low branches, leaving only stumps as testimony to a less crowded past. The loss of these branches has left openings in the bark, making the trees susceptible to rot. Animals and birds find shelter and living quarters in such hollow trees. Many of the old giants, weakened at the center, have gone down in the wind.

The long scar on the truck of this tree probably was caused by lightning. Perhaps the lightning struck this tree when it grew in the prairie and a prairie fire resulted!

44

The shade which affected the low branches of the old oaks also affected the sun-loving prairie plants. Most of them have died out as the shade increased, but a few linger on, relics of sunnier days. Occasionally, where windfall or disease or the making of a parking lot makes a sunny spot, once again a prairie flower such as a buttercup may have a chance to bloom.

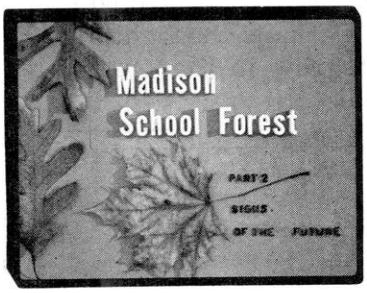
45

Thus through living clues the present forest reveals its prairie past.

This is the end of Part I. Stop here for discussion. Part II is best shown on a later day.

1

Colophon
(Bird Calls)



2

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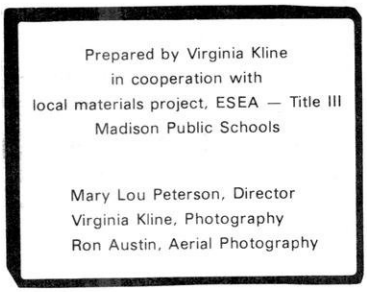


3

Credit Frame

4

The story doesn't end with the replacement of prairie by oak forest. Very gradually another change is beginning to take place. Signs of the future can be seen in the forest today; here are three such signs:

5

(1) In some parts of the forest there are almost no young oak trees, although thousands of acorns fall to the ground each year. In the places where young oaks are found they often appear very small and stunted.

6

(2) In contrast, some other kinds of young trees appear to be growing vigorously beneath the oak canopy. These include young sugar maple (such as the tree with green leaves in this picture), elm, basswood, and ironwood trees. They are especially apparent where the soil is moist and rich, as in the sheltered valley areas.

7

(3) Much of the forest is very brushy, with many shrubs. Notice the growth of shrubs at the base of the white oak here.

8

But beneath the vigorous young maples, elms, basswoods and ironwoods few shrubs are found. Notice the sparse growth at the base of the basswood tree in this picture.

9

In winter, snow dramatizes this effect. The tree in the foreground here is a slippery elm. Beneath its branches the snow lies smooth and unbroken. Beyond the fallen log, beneath the oak trees, many bushes make their silhouettes against the snow.

10

These signs of the future raise questions such as these: What determines the kind of trees which are successful in an open situation such as a prairie? What determines the kind of trees which are successful beneath tall oaks? Why didn't maples, elms, ironwoods, and basswoods grow in the prairie along with the oaks? Why are they growing here now? What change do they make which affects the shrubs?

11

You will remember that the oaks that today make up the canopy overhead had their beginning in an open prairie in which grew a few widely spaced oaks — a situation that was hot in summer and subject to drying winds.

12

An acorn sprouting in such a place would have an open sunny view overhead. A young oak tree requires ample sunshine to get started and soon develops a deep tap root to help cope with the dryness.

13

The oaks which grew so well after the prairie fires stopped have changed the view overhead. Beneath the canopy of oak leaves it has become increasingly shady.

14

Thousands of acorns fall from these trees each year, but young oak trees, like the prairie grasses and flowers, grow poorly in shade. Only in openings or at the forest edge can the acorns produce vigorous young trees. The parent trees have created an unfavorable situation for their offspring. However, the changing conditions are benefiting a group of trees long kept out by the fires and hot dry winds. These trees have shallow roots and fire susceptible bark — characteristics which make them poor invaders of prairie. A moist location, protected from wind, suits them better; this the canopy of oaks is creating. The valleys between the hills provide additional protection and moisture.

15

The first saplings of this new group of trees are found in the forest today — they are the sugar maples, elms, ironwoods and basswoods which are growing so well beneath the oaks. These newcomers are shade tolerant. They have leaves that are held horizontally and overlap like shingles to catch all the available light. Sugar maples, the foliage shown here, and basswoods benefit from large leaf size as well.

Shade tolerant: able to survive and grow in shade.

16

About forty years ago, beneath the shade of the two large oaks shown here, two trees began to grow. Between the two large trunks you can see the trunks of the two young trees as they look today. The very small one on the left is an oak. To the right of it is an elm. Which best tolerates the shade of the large oaks? The elm now has branches reaching over the top of the small oak, making even more shade. What does the future hold for the young oak? Some of the shade tolerant newcomers have reached seed bearing age; because of this we can expect to see an increase in the number of seedling maples, elms, ironwoods, and basswoods.

17

Some photographs of other forests will help us look into the future. Perhaps after many years parts of our forest will look like this. The large dark trunks are oaks. Beneath the oaks grow many small shade tolerant trees — in this case young sugar maple trees which show yellow fall color. There are no young oaks. When one of the canopy oaks dies of age or disease, the tree ready to take its place will be not a young oak, but a young maple. In this way, very gradually the canopy will change until it is no longer dominated by oaks.

Forest at Devil's Lake State Park

18

This picture shows a forest in which most of the original oak trees have been replaced by shade tolerant trees, many of them sugar maples. Notice the absence of shrubs as far as you can see in this forest. The whole forest is as free of shrubs as the small area beneath the elm you saw in the winter view. There is sunshine in this spring picture but in summer this type of forest is very dark. Dense summer shade prevents the growth of shrubs. The only plants on this forest floor are those with special habits of growth which help cope with deep shade.

View of sugar maple forest, Sauk County

19

One such adaptation to shade is early bloom. A sugar maple forest often has a carpet of early spring wild flowers. Some of them, such as yellow trout lily, finish the whole season's work of food manufacture and flower and seed production before the tree leaves appear overhead to shade them.

20

By the first of June trout lily leaves are yellow — it is "fall" for this plant of shady places.

21

Toothwort uses the same shade escaping method. This flower is already found in one part of the School Forest where there is a group of basswood and elm trees. As more basswoods, elms, maples, and ironwoods begin to grow in the School Forest, we can expect to see more of such early blooming spring flowers.

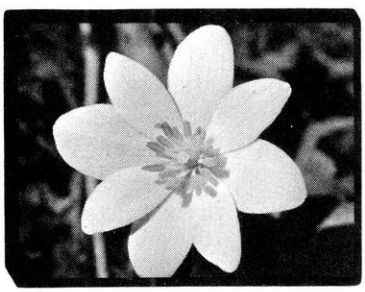
22

We may also expect to see many plants with broad horizontal leaves as the Forest becomes more shady. In what way would such leaves be an advantage in a shady forest?

Trillium

23

Between the forest floor and the tree canopy of the maple forest, there is another layer. Instead of shrubs, it consists almost entirely of young sugar maple trees. These grow in the shade at an incredibly slow rate, waiting for an older tree to come down so that once more there will be "room at the top". Few trees can match the maple's ability to "sit and wait". Thus when an old maple tree dies, a young one will be waiting to take its place, and the forest will continue to be a maple forest. Its overall composition will show little change unless there is a disaster such as fire, widespread disease or tornado. When plant succession reaches such an end point, the final community is called a climax community. In this part of Wisconsin that climax community tends to be what you see here in an early spring view — the sugar maple forest with some basswood, elm, and ironwood trees — a forest with few shrubs, . . .



24

. . . many early spring flowers, . . .

Bloodroot

25

. . . and dense summer shade.

Summer view of maple forest.

These pictures have described just one example of plant succession, and one type of climax community. There are many variations on the theme of replacement of one type of community by another in response to changing conditions.

26

Some variations are the effect of climate. For example, in northern Wisconsin the climax forest and the stages leading to it will include evergreen trees.

27

In some areas west of Wisconsin, the climax community is prairie. There is insufficient rainfall for trees.

This discussion has been limited to one example of "secondary" succession. Some groups may wish to discuss "primary" succession as well — that is, the succession that takes place where there is no soil. See Chapter 2 of the Madison School Forest book, reprinted in this guide.

28

Usually an undisturbed piece of ground in southern Wisconsin will produce trees, and eventually a sugar maple forest. The rainfall here, however, is near the minimum necessary to support the growth of trees.

Annual rainfall in Dane County is approximately 30 inches.

29

Topography and soil which tip the balance toward the drier prairie climate may delay or perhaps even prevent the forest succession. Thus on a few very dry rocky hills near Madison, prairies do still exist today. This picture shows a true prairie — not a pasture — on a gravelly hill above a cornfield in Dane County. What keeps trees from growing on the hill? What keeps trees from growing in the cornfield?

30

On some dry sites oaks have managed to grow, but the succession appears to be stopped at that point. For example, on some of the wind and sun exposed ridges and southwest slopes in the School Forest, the soil is very dry and sandy. Here the 100 year old oak trees tend to be smaller and the canopy more open. Many young oak trees are found in such places. The young oaks are easily recognized in fall because of the reddish-brown color of their leaves.

31

All of the trunks in this picture, taken on a dry ridge at the School Forest, are those of oaks. Note the different ages of these oaks — from seedling to small sapling to mature tree. It looks as if this area will remain in oak forest for at least another generation of trees. When an old oak dies in such an area, young oaks will be available to fill the gap. Why young oaks survive and grow in such parts of the Forest is not completely understood. Perhaps you can think of some possible reasons.

One possibility: More light reaches the ground because the canopy is less dense and because the slope is toward the sun.

32

A hike through the School Forest will therefore afford a chance to see some variation, as well as many signs of a natural succession of plant communities from . . .

33

. . . the oak opening of the past, maintained by fire, . . .

34

. . . to the brushy oak forest of the present . . .

School Forest trail

35

. . . and, at least in the moist protected areas, to the climax sugar maple forest of the future.

For review and discussion repeat the last three pictures, having the class point out characteristics of each of the three communities illustrated.

36

The End

(Bird Call)

Fall Color of large sugar maple

Local Materials
ESEA Title III
Project of IMC
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