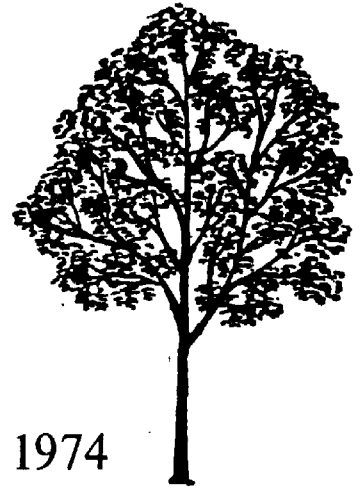


Pennsylvania Forest Resources



No. 8 June 1974

Succession

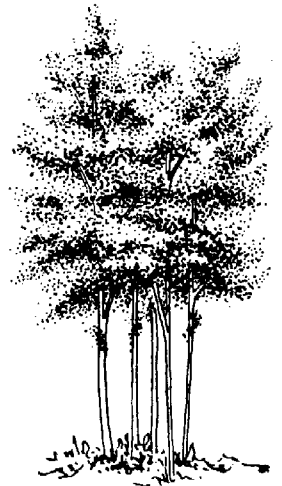
If the phrase "here today, gone tomorrow" were changed slightly to read "field today, forest tomorrow," and if it is understood that "tomorrow" meant 150 years from now, the phrase would be a nutshell description of ecological succession. Defining ecological succession in a more formal way, it is the orderly and progressive replacement of one community by another until a relatively stable community comes to occupy the area. The term "community" as it is used in the definition refers to the groups of plants and animals that occupy a given area.

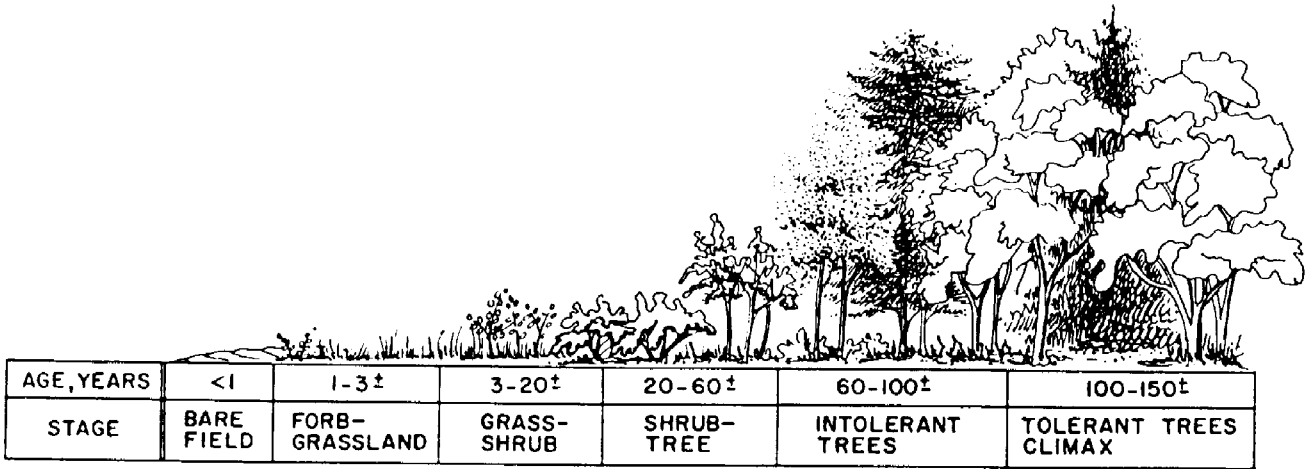
PRIMARY AND SECONDARY SUCCESSION

Ecologists distinguish between primary and secondary succession. Primary succession begins on bare rock. Through thousands of years the bare rock will break down and eventually form soil that can support higher plants such as weeds, grasses, and shrubs. Finally, a mature hardwood forest will occupy the site, in the case of a Pennsylvania environment. In climates markedly different from those in Pennsylvania, the terminal community is likely to be something other than a deciduous forest.

Succession in a very cold or very dry climate will terminate in tundra and grassland communities, respectively.

In Pennsylvania secondary succession takes place on sites that once supported mature forests but where forests no longer exist. Most land that no longer supports trees was cleared for agricultural purposes. Today much of this cleared land is being taken out of agricultural production. It reverts to forest land when no new use is found for the abandoned farm land and it is left undisturbed. This is secondary succession, and it can probably be observed in all but the very best agricultural counties of the state.





SUCCESSIONAL STAGES

Ecologists divide succession into a number of stages. This is done merely for convenience of studying and communicating effectively about it. If the land remains undisturbed, succession is a continuous, relentless process much like the golfer's or batter's swing. It has a beginning and an end, but in between it is continuous and uninterrupted. Nevertheless, the various stages will be identified to help you decide how far along succession has progressed for an area you may happen to observe (see the illustration above).

SUCCESSION IS PREDICTABLE

A key word in the formal definition is "orderly." For any special set of environmental conditions, the changes that will take place are predictable. Environmental conditions are relatively uniform throughout Pennsylvania. Thus certain groups of plants and even specific plants appear in abandoned fields at certain stages in the successional process. The predictability of succession permits the forester or wildlife manager to know what vegetational changes to expect from his management practices. He relies upon that predictability.

CLIMAX AND PRECLIMAX

The "relatively stable community" of the definition is also called the climax community by ecologists. A climax community is one that will perpetuate itself on the site indefinitely, barring any major disturbance such as clear-cutting, fire, or a major storm. Communities existing prior to the establishment of a climax community are referred to as preclimax communities or stages.

To better understand secondary succession it is advantageous to begin with an abandoned cultivated field and follow the changes occurring over the years. The year following the last plowing will find forbs (broad-leaved weeds) and grasses growing in the field. Seeds of some tree species germinate and thrive on bare soil so that a few tree seedlings may appear in the abandoned field within a year of its abandonment. Usually, however, trees appear later. The forb-grass stage may persist for 2 to 3 years.

At this point certain shrubs may begin to appear in the field. Raspberries and blackberries that may be growing along an edge begin encroaching into the field. Seed-eating birds that nest in the field may bring seeds of raspberries, blackberries, or other shrubs into the field with their droppings. Once a single

plant is established it can give rise to others through seeds or underground stolons (branches). Where the tips of branches touch the ground, roots may develop, giving rise to another plant. Consequently, once they are established, many shrubs spread and cover a relatively large area in a short time. This stage is called the grass-shrub stage.

Shrubs shade the grasses and weeds and they begin to disappear from the field, especially underneath the shrubs. Small intolerant trees (refer to issue number 3 of the series for definitions of tolerant and intolerant trees) will usually begin to invade the field along with various shrubs. They include such species as quaking aspen, fire cherry, black cherry, and white pine.

These trees will appear scattered among the clumps or colonies of shrubs. There they receive the full sunlight they need in order to survive. The grass-shrub stage will persist from about the third year after abandonment through about the twentieth year. Beyond the twentieth year, trees will assume a role of increasing dominance.

Just as the invading shrubs shaded the grasses and weeds, the trees will be able to shade and "out-compete" the shrubs. For a number of years, however, trees and shrubs will coexist in the field. This is known as the tree-shrub stage and may persist through about the sixtieth year following abandonment. During the tree-shrub stage some of the more tolerant trees will begin to appear in the old field.

An explanation of how intolerant trees are eventually replaced by tolerant trees will also show why succession takes place as it does. Why, for example, doesn't succession proceed to the intolerant tree-shrub stage and then stop at that point? In general, the plants that are found growing in the abandoned field at any point tend to make conditions favorable for other plants that are better able to compete for space, water, and nutrients than they themselves are.

Aspen and fire cherry, for example, are intolerant of shade. As long as there are no other trees close by, representatives of these two species can get all the sunlight they need and grow very well. As they grow, however, they create shade of their own. An aspen clone (colony produced by root suckering) will shade a large area. As a result young aspen trees cannot grow in the shade of the old parent trees. Tolerant trees can.

As a result, trees which can tolerate some shading, such as ash, beech, oaks, and maples, will form the understory in stands of aspen, fire cherry, and other intolerant species. When one of the intolerant trees dies, the young tolerant trees established in the understory will take over the space occupied by the intolerant tree before a new intolerant tree can become established. In this way all intolerant trees are eventually replaced by tolerant trees, and they make up the climax forest.

The climax forest can perpetuate itself because of tolerance to shade of those species comprising the climax. Seedlings of hemlock, sugar maple, beech, and other tolerant trees can become established in the shade of parent trees. When one tolerant tree dies it is usually replaced by one of its own kind, or certainly by another tolerant tree making up the climax forest. On balance, however, there will be no net change in the species composition of the climax forest.

To put it another way, it may take 150 years to develop a mature oak-hickory forest on what once was an abandoned field. Once the oak-hickory climax is established, it will remain an oak-hickory type indefinitely, barring any major

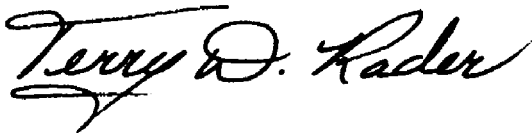
disturbance of the site or any climatic change. A major storm, clearcutting, a forest fire, or similar disturbance will obviously destroy the climax forest and succession will once again operate to return it to the oak-hickory type. The time required will depend upon the extent of the disturbance.

WILDLIFE

So far the discussion has centered upon changes in the plant communities of an area. Wildlife, too, will undergo a succession because the plants used by different species for food and cover are undergoing changes. Issue number 6 of the series described woodcock habitat as brushland. The woodcock obviously does not take up permanent residence in a bare, plowed field, nor does it live in mature forests. But it does find the grass-shrub and shrub-tree preclimax stages of succession suited to its needs.

Deer also find the grass-shrub and shrub-tree stages better suited to their needs than other successional stages. Turkeys, squirrels, and bears do best in the climax forest and are not found as permanent residents in preclimax stages. Some species use different successional stages for different purposes.

The forester or wildlife manager must become thoroughly familiar with succession and the specific plants that will be involved for his area. It is essential to enlightened forest, wildlife, and watershed management. See if you can identify some secondary successional stages on abandoned fields in your area!



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