FIRE in Natural Communities

by **Alan Herndon**

Pine woods such as this maintain their existence only through fire.

As we approach the end of a widely publicized "extreme" fire year, it is a good time to pause and reflect on what we know...and what we don't know...about the role of fire in natural vegetation. It is only through such information, after all, that we can effectively control fire or use it as a tool for maintaining natural areas.

First, we do know that frequent fires are absolutely essential for the maintenance of some plant communities. The classic examples of this are the pine flatwoods of the southeastern United States. These pine forests are typically characterized by an open overstory of pines (*Pinus palustris* or *Pinus elliottii)* and a thick-to-open, low understory. In the absence of fire, hardwood species present in the understory increase in size and abundance until the ground surface is totally shaded and no pine seedlings can become established. (Pine seeds are very particular about the sites in which they will germinate and grow; soil covered by leaf litter is not suitable for seed germination and shaded areas do not allow the growth of seedlings.) There is always a steady loss of mature pines to disease or lightning, so without continuing recruitment of new seedlings, the pine forest eventually turns into a hardwood forest.

This succession is particularly well documented in pinelands because it occurs quite rapidly. In the Miami Rock Ridge pinelands, complete shading of the ground by hardwoods and a noticeable thinning of the pine overstory can occur within 25 years. Such changes are readily apparent to long-term residents in the region.

Concurrent with the elimination of pine regeneration by excessive shading is the loss of many herbaceous species characteristic of the pineland community. In the Miami Rock Ridge pinelands this is nothing short of a disaster because several of the herbaceous species so affected are not found anywhere else on earth.

Pinelands with a tall understory, sand pine scrub, for instance, also require fire for continued existence. Again, the crucial role played by fire is clearing accumulated litter from the ground surface and opening up the understory to allow the regeneration of new pine trees. Several understory species also require these open conditions for the establishment of new individuals. In the sand pine scrub, as in the Miami Rock Ridge pinelands, many endemic species are dependent on

openings created by fire for continued existence. In these communities the rate of change is much less than in the pine flatwoods, and many decades may pass before a significant change in the structure of the forest occurs. Obviously, a much different fire frequency is necessary to maintain these communities than would be suitable for flatwoods communities.

Unfortunately, we do not know much about how fire behaved in pinelands before civilization intruded. It is possible that pinelands evolved either under conditions of infrequent, intense fires or frequent fires of lesser intensity. All we can say right now is that pinelands are able to recover quite well from either type of fire.

The question has more than academic importance, too. From the viewpoint of fire management, a less intense fire is easier to control, so prescribed burning programs emphasize frequent fires. On the other hand, areas in which fire suppression is normally practiced burn infrequently but intensely. Either of these extremes might have the effect of degrading natural pineland communities over the long term. Ideally, in our management programs, we should strive to follow the natural fire regime under which the pineland communities evolved, but this requires knowing what the natural fire regime was.

In other plant communities, including hardwood forests and prairies, changes occur much more slowly, and it is not so clear that fire plays an important role in maintaining the community. The diversity seen in the tropical hardwood hammocks of southern Florida seems to reflect past episodes of major disturbance, such as windstorm and fire, but the role of such infrequent disturbances has not been established. It is clear from cases recorded in Long Pine Key (Everglades National Park) that a hammock can be totally destroyed by fire and still recover within one or two decades. Still, we do not know whether the hammock communities need periodic disturbances in order to maintain their species diversity. It should be pointed out, since there have been suggestions to the contrary, that there are no known cases of a pineland community invading a burned hammock site and hampering the return of the hammock community to the site.

Prairie communities, on the other hand, do not seem to depend on fire for their maintenance, even though they are clearly adapted to fire and quickly recover from it. Water level and the duration of flooding at any given site seem to be sufficient to determine the characteristics of the prairie community at that site and to prevent invasion by (native) hardwoods. This is not to say that fire had no role in the evolution of the prairie communities. A prairie evolving under conditions in which fires were common would contain only the most fire-tolerant of the available species. A prairie evolving under otherwise identical conditions without fire might contain a totally different set of (less fire-tolerant) species. But, once established, the presence or absence of fire does not seem to make any difference in the maintenance of the community.

It is important to keep in mind that fire-adapted communities are also fire-prone communities. In each such community, there is a source of fuel which accumulates with time. The source of fuel and the rate at which it accumulates depends on the structure and species composition of the community, but the universal presence of an accumulating fuel source has important implications for both fire managers and the public.

In a prairie, fuel is composed mainly of dead and partially decomposed leaf blades of grasses and/or sedges. The rate of decomposition is fairly high in these communities so a steady state condition is reached within a few years. By this time the amount of potential fuel lost to decomposition just balances the amount of potential fuel added by new growth of plant parts so there is no net increase with time in the available fuel. A prairie which has not burned in, say, twenty years has no more fuel and will burn no more intensely than a similar prairie which has not burned in five years.

The situation is different in pinelands, where the major fuel is provided by dead pine needles on the forest floor. These needles decompose slowly — much more slowly than new needles are added to the litter, so fuel can build up for several decades to reach very high levels. Since fire intensity is governed chiefly by the amount of fuel available, fires are much hotter and more difficult to control in areas which burn infrequently than areas which burn frequently. A pineland which has not burned in twenty years will be much hotter and more dangerous when it does catch fire (and it will eventually catch fire, usually during the worst possible season) than a pineland which burns every five years.

The point is that a policy of fire suppression in such communities is self-defeating. It insures that fuel loads will build up to the point where the resultant fires cannot be handled and pose a grave risk to both firefighters and the general public.

Controlled burning can replace wildfire.