Lingua Botanica

The National Newsletter for FS Botanists & Plant Ecologists

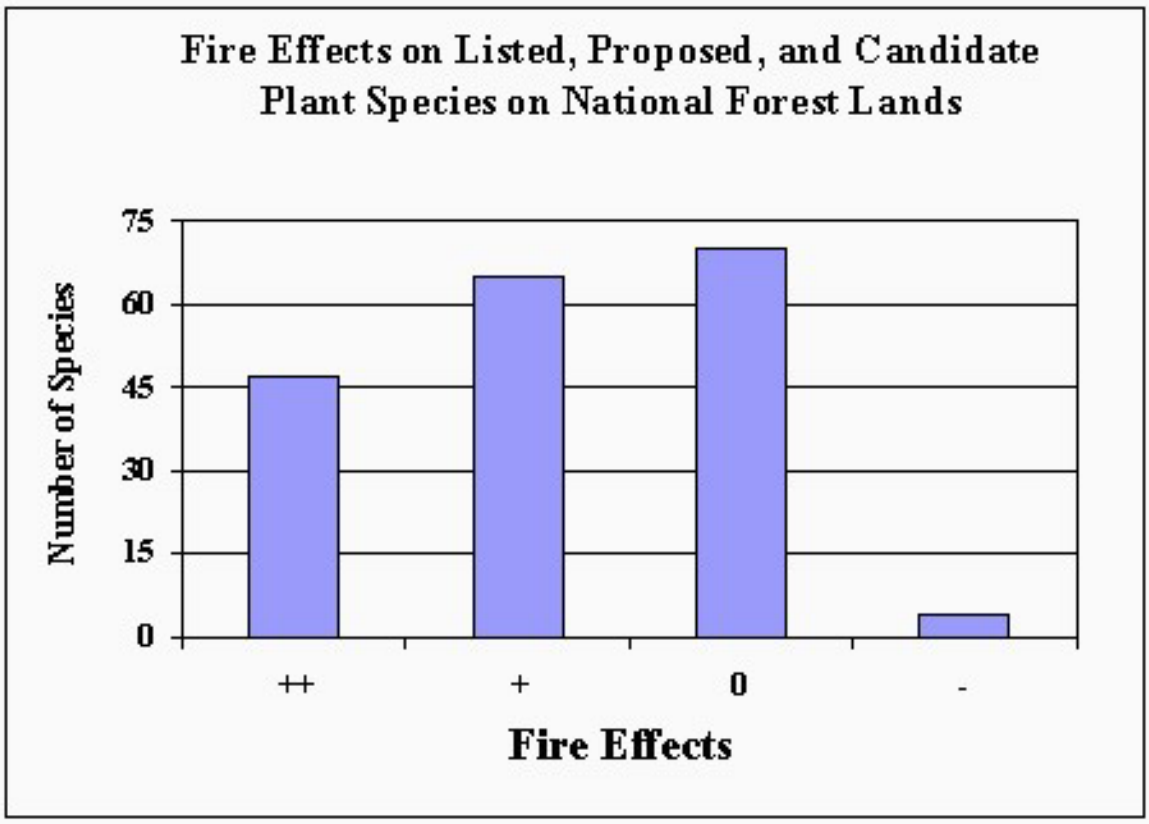
I have an incredible amount of respect for former Forest Service Chief Jack Ward Thomas. He was a bellwether for our agency, especially for biologists. The most important thing that Chief Thomas said during his tenure was, "Tell the truth and obey the law." This is as sound an ethical foundation as you are likely to find. Unfortunately, the quote I most often hear attributed to him is "Ecosystems are not only more complex than we think, they are more complex than we can think." The problem with this snappy little aphorism is that it's wrong. Not only is it wrong, it's also misleading and counterproductive because it implies to some people that we should not act, and has been used by others as an excuse to avoid change. While it may be true that we do not now fully understand all the workings of the smallest parts of all natural ecosystems, it is not true that one needs complete knowledge of a system to understand it. Physicists don't require full knowledge of cosmology to make fabulous predictions about the universe, engineers don't require full knowledge of their materials to build fantastic structures, and doctors don't require full knowledge of a particular patient's physiology to heal them. These same assertions could be made about artists, musicians, and poets. In all of these cases, the best practitioners (virtuoso poets and physicists alike) require substantial knowledge, but ask any virtuoso and they will tell you that intuition plays a critical role in transforming the practitioner from merely capable to inspired. Furthermore, not everyone is a Hawking or Pinsky. Most illuminating and creative work is done by motivated, competent, and dedicated men and women that enjoy what they do. Why should we think the ecosystem sciences would be any different? The human mind, when engaged, is a miracle. And that miraculous organ, when engaged, has a nearly infinite capacity to understand, to intuit, and to find solutions. Ecosystems are not deep dark mysteries. They are complex systems governed by rules. Don't be afraid to know what you know. Free your mind to be inspired. - the editor.

In this Issue

Vol. 4, Issue 2 2003

Don't Forget to Submit New Occurrence Data to Your State Heritage Program!

Plants that are Adversely Affected by Fire (-):
There are just four plants (about two percent) of the 186 listed, proposed, and candidate species occurring on National Forest lands that are actually harmed by fire. All four species occur in the Southeast in southern Appalachian late seral (old-growth) forest types. Two of these species are rare trilliums (*T. persistens* and *T. reliquum*). The large-flowered skullcap (*Scutellaria montana*) is immediately threatened by land conversion (suburbanization) and exotic species. The rock gnome lichen (*Gymnoderma lineare*) is one of only two lichen species protected by the Endangered Species Act.



++ Plants that require fire to maintain their populations or requisite ecological conditions.
+ Plants that tolerate fire without adverse population consequences.
0 Plants that are not effected by fire.
- Plants that are adversely affected by fire.

Data derived primarily from U.S. Fish and Wildlife Service documents and NatureServe Explorer Reports. n=186.

Lichen Conservation in the United States and Canada

Eric Peterson, Ecologist (& Lichenologist), Nevada Natural Heritage Program, Carson City

Over the last half century, conservation has expanded its focus well beyond big game or cute-and-fuzzy animals. Now many conservation organizations are concerned with vascular plants as much as mammals. Some are even beginning to incorporate bryophytes and fungi. The fungi most rapidly gaining conservation attention are lichens.

Lichens are often considered dual organisms: a combination of a fungus (mycobiont) and one or more microscopic photosynthetic partners (photobionts). The photobionts may include green algae, cyanobacteria, or both. The exact definition of 'lichen' and 'lichen species' has been the source of a lot of arguing, but as the understanding of lichen genetics and of the relationships between the partners increases, definition concepts seem to be narrowing.

Within a single lichen body (thallus) there is a single species of mycobiont, but potentially multiple species of photobionts. Each mycobiont species is capable of associating with a limited set of photobiont species, which may not necessarily form a phylogenetic group. For the mycobiont, the association is obligate. The association may be obligate for some photobionts, but for many the association is facultative. Morphology of the lichen seems to be determined mainly by the mycobiont. Thus, a lichen species is now pretty much defined by the mycobiont species. A small number of mycobionts can associate with green algae *or* cyanobacteria and can have very different morphologies depending on the photobiont. These have traditionally been treated as separate species of lichen. However, recent trends have been to consider these morphotypes as a single species.

Comparisons between lichens and mycorrhizae are valid. Both are relationships between fungi and photosynthetic partners where both partners benefit. For lichens, the mycobiont receives photosynthates from the photobiont; the photobiont gains fitness by being able to survive in more harsh environments. (Still, many people regard the photobionts as prisoners of 'controlled parasitism', as the relationship slows their growth rate and apparently limits sexual reproduction.) Also, like mycorrhizae, the lichen association is not limited to a single group of fungi. Most lichens are ascomycetes, but some basidiomycetes form lichen relationships (including mushrooms).

As photosynthetic organisms, lichens are often considered to be plants by a non-phylogenetic definition. Following on the heels of vascular plants, this is likely one reason that lichens are gaining conservation attention more quickly than other fungi.

The work of Conservation can be roughly squeezed into 3 categories: philosophical, scientific, and administrative. 'Philosophical' efforts promote conservation of organisms and habitats for their own sake, on the idea that they have inherent value, and these efforts are generally lead by 'interested amateurs' (e.g. bird-watchers, native plant society members, etc. who lack a strong scientific background) and the environmental movement. 'Scientific' efforts form the field of conservation biology, a synthesis of ecology, genetics, and a variety of other fields that intersect in the study of sustaining species and ecosystems over time. 'Administrative' efforts include decision making and actions of land managers (including habitat restoration) and the legal structure from which those decisions are made. These categories are highly interactive: interested amateurs and environmentalists are generally the driving political force affecting legal requirements from which land managers must make decisions. They do so by publicizing their own philosophies along with scientific information. Land managers also draw on science when making administrative decisions. Many people involved with conservation can admit to participating in more than one category.

Conservation of lichens and other fungi has been slow, in part, due to the fewer number of people aware of them. Until the last few decades, the number of scientists studying lichens in North America could probably have been counted on your fingers.

While lichenologists are still rare, their populations are expanding. At the same time, the number of 'interested amateurs' is skyrocketing. More recently, land managers (and even law-makers) have begun to be aware of lichens.

Conservation efforts for lichens are now underway across the United States and Canada. Two lichens have been added to the U.S. federal Endangered Species list: *Cladonia perforata* (endangered, added 1993, occurs in Florida) and *Gymnoderma lineare* (endangered, added 1995, North Carolina & Tennessee). And the Committee on the Status of Endangered Species in Canada has listed *Erioderma pedicellatum* (vulnerable, decision 2002, Nova Scotia, Newfoundland, and recently rediscovered in Scandinavia).

The lichen *Gymnoderma lineare*, listed as Endangered in the United States. Photograph © Stephen/Sylvia Sharnoff, used with permission.

The Northwest Lichenologists (http://www.proaxis.com/~mccune/nwl.htm), a predominantly scientific group, offers a certification program for people conducting lichen surveys. The California Lichen Society (http://ucjeps.berkeley.edu/rlmoe/cals.html), a mixed group of scientists and interested amateurs, has recently initiated a conservation committee. The American Bryological and Lichenological Society also have a conservation committee. Several less formal lichen groups and individual lichenologists around the continent have examined the rarity of species and supported conservation of some of them. And on a global scope, a number of North American lichens have been proposed for a Global Red List of Lichens (http://www.artdata.slu.se/guest/global.htm).

Erioderma pedicellatum from Salmonier Nature Park, Canada. Image © government of Newfoundland, CA.

The Northwest Forest Plan stimulated the biggest leap forward for lichens, by establishing survey and management requirements for 81 lichen species on federal lands in Washington, Oregon, and northern California. The number has since been reduced, as some species were found to be more common than originally thought and other species found to be more rare have not been added.

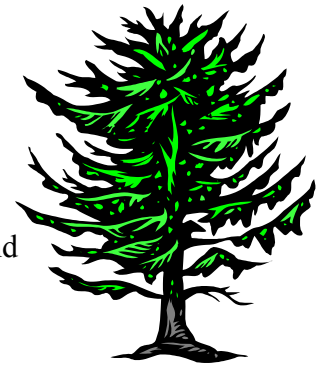
Most of these efforts have one important thing in common which is not obvious: communication and coordination with Natural Heritage Programs (NHPs). NHPs were begun by The Nature Conservancy in the 1970's as science-based offices for

researching and assessing rarity of species and tracking known locations for the rarest. Most NHPs have since transitioned to state or provincial government where they go by a variety of names including Conservation Data Centers, Natural Diversity Databases, Natural Areas Inventories, etc. The programs have kept their scientific basis through this transition to government. Many are even housed within universities. NHPs now exist in all states of the U.S. plus the Navajo Nation, most Canadian provinces, and a number of countries in Central and South America. Programs across the Americas are networked through the non-profit organization NatureServe (www.natureserve.org).

In many states, NHPs maintain the lists of species protected by state laws. Federal agencies are increasingly relying on NHP species lists and location data. A number of U.S. Fish and Wildlife Service offices refer directly to NHP data for rare species information and use it to guide management and planning decisions pertaining to the Endangered Species Act. In Washington, Oregon, and northern California a proposed change to the Northwest Forest Plan may tie U.S. Forest Service and Bureau of Land Management sensitive species lists directly to NHP lists. Since NHP scientists regularly and continuously maintain their databases, the NHP lists are more flexible for the removal of more common species as well as the addition of other rare species. And since these lists are maintained by separate, science-based state organizations, federal agencies may find the NHP lists to be more defensible than current Survey and Manage lists. Natural Heritage Programs also work with native plant societies, and various animal conservation organizations. Thus, NHPs bring together scientific, philosophical, and administrative thrusts of conservation.

Like most conservation organizations, Natural Heritage Programs paid little attention to fungi at first, but are gradually incorporating them now. Natural Heritage Programs were recently surveyed for the number of lichen species and the number of other fungal species tracked or watch-listed (considered for tracking or may deserve tracking in the foreseeable future). The information received from responding programs is presented in Table 1. Many programs do not track lichens or other fungi, but that is not due to unwillingness. Rather, they stated that they simply lack adequate data to begin tracking lichens and fungi.

These results are just a snap-shot in time as the numbers are changing rapidly. With the proposed changes to the Northwest Forest Plan, there is a flurry of work in western states to more seriously examine lichens and other fungi. Many of the organizations supporting lichen conservation are also involved with NHPs. The California Lichen Society's conservation committee is working closely with the California Natural Diversity Database. Actually, the California Lichen Society is a de facto southwest lichen society and the conservation committee has discussed working on rare lichens in Nevada and Arizona. And many of the less-formal lichen groups and individual lichenologists who have promoted conservation of species have done so at least in part through NHPs.



Interest in lichens is expanding and conservation efforts will increase. Natural Heritage Programs are poised to gather and solidify the scientific data, supporting lichen conservation.

Table 1: Numbers of taxa on watch lists and tracking lists of responding Natural Heritage Programs. A * indicates one program that tracks a rare cyanobacterium endemic to a thermal spring.

	Watch				Sensitive (Tracked)			
Location	Vascular Plant	Bryophyte	Lichen	Fungi	Vascular Plant	Bryophyte	Lichen	Fungi
Alberta	49	6	0	0	482	403	478	0
Arkansas					448	0*	0	0
California					2056	28	6	0
Colorado	22	0	0	0	511	96	23	1
Delaware	147	13	0	0	403	52	0	0
Florida							1	
Georgia	239	0	0	0	621	24	2	0
Idaho		11	6	0	270	15	23	
Kansas					450	0	0	0
Kentucky	112	1	0	0	359	17	1	0
Maine	23	0	0	0	373	0	0	0
Massachusetts	193	0	0	0	256	0	0	0
Michigan					417	0	16	0
Mississippi	42	0	0	0	384	3	0	0
Missouri					493	106	26	0
Montana	215	49	112	0	337	62	2	0
Nevada	69	0	0	0	243	5	1	0
New Mexico	-	-	-	-	289	0	2	0
New York	65	0	0	0	588	163	0	0
North Carolina	456	36	8	0	582	133	24	0
Ontario					737	272	102	0
Oregon	157	37	24	125	408	60	15	2
Pennsylvania		0	7	0		0	0	0
Saskatchewan	2	0	0	0	470	0	2	0
South Carolina							1	
South Dakota	0	0	0	0	212	0	0	0
Tennessee	0	0	0	0	465	36	1	0
Texas	508	0	0	0	453	0	0	0
Utah	633	0	10	0	435	0	0	0
Vermont	151	2	0	0	535	13	0	0
Virginia	432	0	0	0	609	28	4	0
Washington	150	0	0	0	363	79	113	57
Wisconsin	138	0	0	0	335	79	0	0
Wyoming	25	0	0	0	482	0	0	0