February/March 1992 ** SAGE NOTES ** A Publication of the Idaho Native Plant Society ** Vol 15(1)

Annual Field Trip

Mark May 9 and 10 on your calendar for the INPS annual field trip. Visit the beautiful Salmon River and view Idaho's only federally endangered species, *Mirabilis macfarlanei*, Macfarlane's four o'clock. It and other spring flowering species should be in full bloom. The field trip will begin at 11:30 (Pacific time, 12:30 Mountain time) at the Skookumchuck Rest Area near the bottom of Whitebird Hill. After lunch, the group will tour the *Mirabilis* sites. Camping is available at the BLM Hammer Creek campground near Whitebird Village. Supper will be a potluck. Maps will be included in the April SAGENOTES.

New Procedure to Monitor Plants

--Jill Blake, Botanist
Idaho Panhandle National Forest

The Forest Service has recently adopted a new and creative procedure to evaluate plant population dynamics. Last year in September, seven monitoring plots were established on the Priest Lake Ranger District in a population of deerfern (*Blechnum spicant*), a Region 1 Forest Service Sensitive and State Priority 2 plant species, using a "high tech" instrument. The instrument itself is actually a land survey tool that engineers and surveyors commonly use when measuring distances and establishing land boundaries.

Imagine physically counting individual plants within a set amount of space and manually plotting each on a map, then recounting the plants year after year in this same manner. This kind of technique will generally give the researcher the information desired, but can sometimes be a very slow process, and difficult to duplicate accurately each time.

Three land surveyors with the Idaho Panhandle National Forest (IPNF) and myself operated the surveying instrument-- one at the instrument and one or two within the plot holding "range poles". The base of the range pole is set upon each of the individual deerfern plants within the plot.

When the instrument cross hairs focus in on the prism at the top of the range pole, a button is pushed and an

Blechnam spicant photo

infrared beam measures the distance between the instrument and the range pole. Each plant then has a unique x,y and z coordinate along with a description and point number recorded on a handheld data recorder. This information is later downloaded to a PC where the data is organized, managed and mapped in AutoCad (computerized graphic aid) which ultimately produces a series of plot maps that show the number of plants and their relationship to each other within the plot.

The Forest Service has recognized the importance of maintaining the biological diversity of natural species found on national forest lands. Threatened, endangered and sensitive plants and animals are a part of this diversity, and though controversial at times, the importance of each member of the forest community is seen as an integral part of a healthy, productive ecosystem.

This particular population of deerfern is found in a timber sale area west of Priest Lake, and is one of only four populations known for the IPNF. Portions of the population have been affected by past timber harvest activity.

Observing these plants through time using this highly accurate method will provide valuable information about the effects of timber management on deerfern and its habitat. The success of the procedure will surely have wider application in other similar projects.

Rare Plant Conference: Musings

Kristin Fletcher *Wood River Chapter*

Each year I look forward to attending the annual Rare Plant Conference in Boise, sponsored by the INPS. It's a good opportunity to shed a little of winter's cabin fever and take a road trip, see some old friends and make some new ones.

But for me it's more than simply an excuse to journey forth in the dead of winter to socialize with other plant lovers. It has become an ongoing educational experience, an opportunity to learn about the natural history of Idaho, its botany and geology and the consequences of climatic change including glaciers, mountain building and drought. It also is a chance to learn about land use issues and the multiple agencies and individuals involved in policy making.

The first thing I learned was what a rare plant was. As most people know, plants require certain conditions be met in order to flourish. Sometimes they are easy going in their requirements and are widespread, like Great Basin wildrye (*Elymus cinereus*) which is found throughout the Intermountain west.

Sometimes, however, they are very particular, and exist only in isolated locations. Idaho's only federally listed species, MacFarlane's four-o'clock (*Mirabilis macfarlanei*) is a case in point. Globally, it is only found in 12 locations, all within the canyons of the Snake and lower Salmon Rivers in Idaho and Oregon.

The participants at the Conference, which include botanists, professionals from federal and state agencies, rare plant experts, and other interested individuals (that's me!), review the lists of plants that are rare in the state. After discussing the current status of a plant, and whether it is threatened by any activity, a decision is made whether or not to change the plant's classification. These decisions are then forwarded to the Fish and Wildlife Service, the agency responsible for the implementation of the Endangered Species Act.

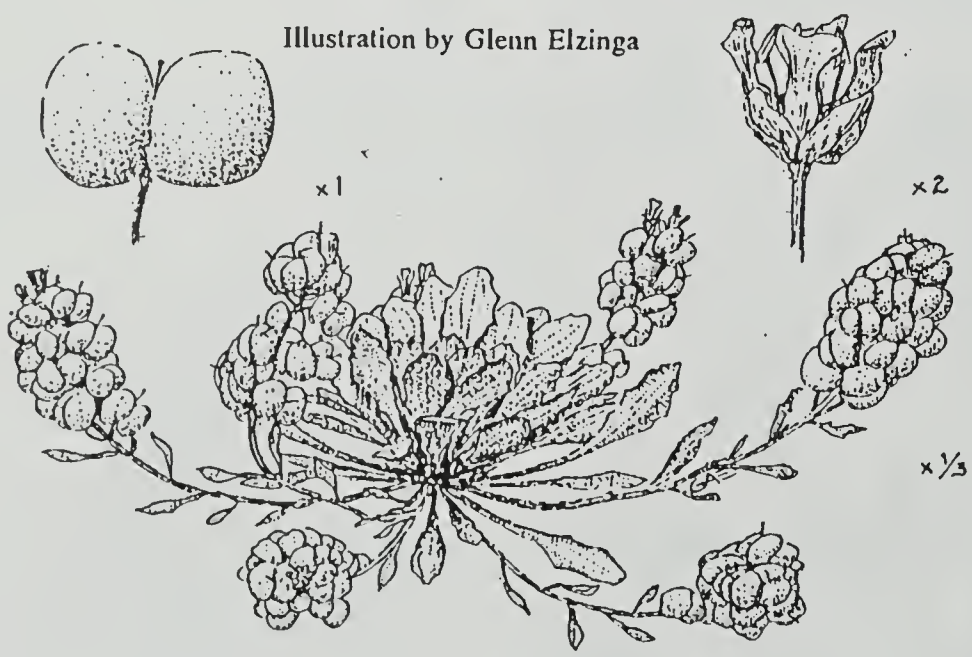
Sometimes the news is good. With the increased awareness and legal requirements that come with being a federally listed species, the populations of MacFarlane's four-o'clock seem to be enjoying a recovery. Sometimes species are dropped from the lists altogether when further research shows their populations are substantially greater than previously known or, because of an increase in taxonomic understanding, the "rare" species becomes known to be just a slight variant of a more common species.

Sometimes the news is not so good. The Salmon Twin Bladderpod (*Physaria didymocarpa* var. *lyrata*), an interesting little mustard with large, very beautiful inflated fruits, is found (globally) in only four sites near Salmon, Idaho. Although a conservation agreement is in effect and the BLM has begun several conservation efforts, threats to the populations continue to be a concern. The conference participants felt forced to request an Emergency listing for the species to save it from extinction.

But the real reason I go to the Rare Plant Conference every year is because I have started to care about these darn plants. I want to know what happens to the little Salmon bladderpod. I want to know about Aase's Onion (*Allium aaseae*), which grows primarily in Boise's sandy foothills directly in the way of major development plans. Suddenly motorcycle clubs, subdivision developers, city

Physaria didymocarpa var. *lyrata*

Illustration by Glenn Elzinga



The Washington Post reported that scientists at the University of Wisconsin-Madison have cross-bred a wild Mexican bean gene into a food variety of dried been and created a bean that is "resistant to the weevils that often destroy much of the stored crop in Third World countries". The secret is a protein called arcelin- toxic to insects that feed on the unsprouted seed, but harmless once cooked. "Plant breeders at the International Center for Tropical Agriculture in Cali, Columbia.. are installing the gene in other varieties of bean and testing their safety," the Post continues. "Although initially aimed at the countries of Latin America and East Africa where beans supply half or more of the protein intake, the new varieties could help industrialized farmers avoid the chemical fumigation now used to protect stored beans from insects."
(From Douglasia XII(3). A newsletter of the Washington INPS)

government, newspapers, as well as federal and state agencies are very aware of Aase's onion and are (maybe) beginning to work together to discover creative solutions to prevent either its demise or the very real possibility of listing it under the Endangered Species Act.

I go to find out how the Pacific dogwood (*Cornus nuttallii*) is faring. A small tree with beautiful flowers, the dogwood is common along the west coast. A small, isolated population occurs along the Lochsa and Selway Rivers in northern Idaho nearly 1,000 miles away from the rest, the result of climatic changes brought about by the lifting of the Cascade Range.

Changes continue and Idaho's dogwoods, which in earlier decades brought flocks of tourists to enjoy the spring bloom, are in a precipitous decline. Whether from drought or from many years of fire suppression or from some as yet unknown factor, we are close to losing this lovely and unique stand of trees. Various remedies are being suggested including controlled burns and artificial propagation to preserve the unique genetic material of this disjunct (separated) population.

These are just a few examples of the waning and waxing of plant species in our midst, of their special responses to geology, moisture, disturbance and other factors based on their history and genetic make-up. The Rare Plant Conference monitors these changes as they affect the rarest and most sensitive plants within the state of Idaho. By monitoring them we learn about subtle and not so subtle changes affecting our environment and we learn to differentiate between those we have the power to change and those to which we must learn to adapt. And perhaps, too, we will learn to care.

Another New Grass For Idaho?

As you may have heard, this past summer Bob Moseley of the Idaho Conservation Data Center located little ricegrass (*Oryzopsis micrantha* [Trin.&Rupr.] Thurber) on a limestone outcrop near Blue Dome. That plant turned out to be a new species for the state of Idaho. Now it seems another grass species has been discovered which may also be new to Idaho. Tall dropseed (*Sporobolus asper* [Michx.] Kunth) was found early this year below Milner Dam along the Snake River corridor. Steve Popovich, a newly-hired botanist for the BLM's Shoshone District, discovered about 50 individuals. Tall dropseed is an attractive perennial that looks similar to sand dropseed (*S. cryptandrus*) but with larger fruit and a more compact inflorescence. The plants occur on sandy rock soils of a weak ephemeral drainage in a small side canyon which feeds into the Snake River. Associated species include sand dropseed, needle-and-thread (*Stipa commata*), indian ricegrass (*Oryzopsis hymenoides*), three-awn (*Aristida purpurea*), bluegrasses (*Poa* spp), snakeweed (*Gutierrezia sarothrae*) and Rocky Mt. Juniper (*Juniperus scopularum*).

Steve views the area as a special place because of its representation of native plant communities and the presence of juniper, which is locally uncommon. He believes that floristically the area is more similar to assemblages found farther south in Utah and Nevada.

Tall dropseed is most common in the true prairie uplands of the mid-west. It is known to occur infrequently in eastern Oregon and Washington, and is more prominent during drought years. Three days of searching BLM and private land in the area revealed no additional plants. There is promising habitat in other side canyons downstream from the site, and the BLM plans to explore them this summer.

Endemism and Rarity in Plants

Thomas Kaye *Corvallis Chapter, NPS Oregon*
(Reprinted from the Bulletin of the Oregon NPS; March, 1989.)

Mention endemic species to a botanist and you are likely to receive an enthusiastic response. Mention rare species, and the response may be the same. Embodied in both terms is a horn-of-plenty of potential research topics and fascinating stories of ecology and evolution. Some discussions treat endemism and rarity in the same breath. But they are distinct concepts, overlapping only in certain cases. The recent passage of the Oregon Endangered Species Act provides explicit protection for

*The next issue of **SageNotes** will focus on riparian systems and issues. These wetlands are some of the most botanically rich areas of the state, and are important contibutors to biodiversity within Idaho. The management of these areas is controversial.*

Submission of articles on riparian areas, or on other issues of interest to Native Plant Society members is encouraged. Please send your submissions to the editor by 15 April (P.O Box 182, Carmen, ID 83462).

many rare plants, a percentage of which are endemic to Oregon. This note will discuss the difference between endemism and rarity, then focus on endemism among plants with a few examples from the flora of northwestern North America.

Endemism

An endemic species (or other taxonomic group) is one restricted to a particular region, occurring nowhere else. Among plants, biologists are generally interested in those endemics limited to a small area, the so-called "narrow endemics" (Kruckeberg and Rabinowitz 1985). Such plants may have stringent habitat requirements--prospering only on limestone or in bogs, for example-- and may maintain large or only small populations where they occur. Narrow endemism is a special form of rarity.

Rarity

Rarity among organisms is blessed with no single, simple definition. While grappling with the concept in her work at the University of Michigan, the late Deborah Rabinowitz deliniated at least seven forms of rarity (Rabinowitz 1981). She based her distinctions on geographic range (large vs. small), habitat specificity (wide vs. narrow), and local population size (large, dominant vs. small, non-dominant). If a species is diminutive in any of these traits, it can be considered rare. With this multiplicity of definitions, it seems reasonable that not all rare plants are endemics, nor vice-versa. If narrow endemics are typically locally abundant in a specific habitat and restricted geographically, imagine the opposite extreme: a species constantly sparse but in several habitats over a large range. Prickly phlox (*Leptodactylon pungens*) has this sort of sparse but broad distribution east of the Cascades in the Pacific Northwest. Such a plant may rightly be considered "rare", but it is difficult to call it a narrow endemic. Now consider a plant that is widespread and locally abundant but occurs also as isolated populations beyond the margin of its central range. Such a species is rare in these peripheral areas only. Black lily (*Fritillaria camschatcensis*) is most common on Kodiak Island and coastal Alaska. Its range extends southward, but populations are very infrequent by the time it reaches Washington and Oregon. Rare plant lists often include this type of rarity, usually under a heading such as "rare in our area, but common elsewhere". Rabinowitz called plants in this category "pseudo-rare". The types of rarity from a continuum between narrow endemics and sparsely distributed, widespread species. Not all forms warrant protection as endangered species.

Levels of Endemism

Endemism can be recognized on any spatial or taxonomic scale, and reflect any level of abundance. Douglas fir (*Psuedotsuga menzeisii*) and sword fern (*Polystichum munitum*) are species endemic to western North America. Note, however, that no one would describe them as rare, nor are they narrow endemics.

Not only may a species be endemic, but endemism may act on the level of family, genus, subspecies and variety as well. For example, the checkermallow genus (*Sidalcea*) is endemic to northwestern North America. The genus itself is not rare, but some of its constituent taxa may soon be near extinction. In other cases, an entire genus may be endemic and rare. *Kalmiopsis*, for example, has only one species (*K. leachiana*) and occurs only in southwestern Oregon in a rather specific habitat.

At the other taxonomic extreme are narrowly restricted (and rare) varieties of widespread species. Olympic milkvetch (*Astragalus australis* var. *olympicus*) is known from only a few populations in the northern Olympic Mountains of Washington, but the rest of the species is distributed from the Rocky Mountains, through Alaska, into Eurasia and the Italian Alps! Although one definition of endemism may suffice, the scales we measure endemism with, taxonomic and geographic, vary tremendously.

Causes of Endemism

The causes of endemism are diverse, even idiosyncratic. They encompass all modes of speciation. Any discussion of these mechanisms is in danger of becoming a description of all forms of evolution-- a monumental task rather beyond our scope. But if, artificially, there is to be only one by-word in the evolution

The Washington Post reported that scientists from Genclabs, Inc., and the University of California, San Francisco, have shown that "the root of a Chinese cucumber, used in China to induce abortion and treat cancer, appears to kill AIDS-infected cells in laboratory tests." The drug, called GLQ223, "inhibits AIDS virus production in infected white blood cells called T-cells and perhaps more importantly, kills chronically infected macrophages, the scavenger cells which form a crucial reservoir of AIDS virus in the body." Scientists hope to begin human clinical tests of GLQ233, a highly purified form of the plant protein trichosanthin. However, they warn AIDS patients "against attempting to inject any crude plant extracts," because such self-experimentation can be "dangerous, even lethal."

(From Douglasia, XII(3). A newsletter of the Washington NPS)

of endemics, let it be isolation. Islands are notorious for high levels of endemism in their biotias. In the Northwest, however, our most conspicuous endemic floras occur in mountain ranges. The Siskiyou Mountains are a center of endemism, as are the Olympics, the Wallowas, and the Wenatchee Mountains. Mountains, in a sense, are climatic islands rising above a lowland sea. They are environmentally isolated from the surroundings. Other forms of "islands" in the northwest are odd or constrasting soil substrates that isolate a group of organisms from a more common, more habitable surrounding soil type. Outcrops of serpentine in California, Oregon and Washington, for example, are known for unusual plants, some of them local endemics, such as species of the mustard genus, *Streptanthus* (Kruckeberg, 1984). One researcher (Ornduff, 1965) has even described plants that grow only on bird fecal deposits ("guano endemism")!

Much of the biogeographic isolation encountered in our area is the result of historical factors, such as Pleistocene glaciation. Previously widespread species were wiped out by glaciers in intervening areas leaving only isolated populations in local refugia. After the Pleistocene glaciations, a warm dry period known as the Hypsithermal allowed the northward migration of many species. Subsequently, climatic conditions cooled, and these southern emigrants were eliminated in the north, except for a few populations that persisted in local microhabitats they could tolerate. Some cases of sudden speciation in isolated populations of the genus *Clarkia* resulting in narrow endemics may have been caused by climatic shifts of this type (Lewis, 1972). These sorts of processes, and I have only sketched them, lead to fragmented distributions and isolation of the remaining populations.

The most common process of evolution may be gradual speciation through natural selection and random genetic drift. Cut off from a stable population network, a group of organisms on an island, mountain, or obscure soil type may continue to evolve according to changing environmental conditions. Or, such a population may simple "go its own way" through accumulations of random mutations. Alas, a plant in this hypothetical population may eventually have the misfortune to be stumbled upon by a human, plucked, and described as a new taxonomic entity.

Age of Endemics

Historically, endemics have been divided in two main categories: new and old. Neoendemics are youthful species, only recently evolved from a parent taxon. Their limited distribution may indicate time has not yet allowed them to expand to their full potential. Alternatively, they may represent unsuccessful evolutionary branches that, given their present environmental conditions, never will increas in distribution. Malheur skeletonweed (*Stephanomeria malheurensis*) is a narrow endemic restricted to a single population on a small hill in Harney County. A closely related but more common plant, small skeletonweed (*S. exigua* var. *coronaria*) reaches its northern limit at this very place. There is strong evidence that through some recent and rapid genetic changes, malheurensis" was born from "coronaria" (Gottlieg, 1973). This single population has a very tenuous existence, however, shifting yearly between several hundred to only a few, or zero, observed individuals.

Paleoendemics respresent very old species that, at one time, were more abundant in a world that has since changed. As climates warm and cool through the millenia, widespread species may be forced to retreat to small refugia. Populations of *Kalmiopsis leachiana* occur in the Siskiyou Mountains on Oregon's oldest rocks. This unique plant is thought to be a representative of an ancient flora, more common in the Miocene epoch, which has since lost sway.

Endemism, rarity and humans

Rarity and endemism meet again today in what one person (Gentry, 1986) has described as "anthropogenic endemism"--highly restricted distributions due to human intervention and habitat destruction. The golden paintbrush (*Castilleja levisecta*) once found from Vancouver Island to the Willamette Valley, is now extinct in Oregon and known from pitifully few sites to the north. Snake River goldenweed (*Happlopappus radiatus*), once perhaps more common in northeastern Oregon and adjacent Idaho, is presently restricted to a handful of degraded

A new insecticide, offered under the trede nemes of Bioneem end Neemisis is further evidence of the wonders residing in the plant resources of the world. The insecticide, mede from the seeds of the neem tree (*Azadirirachta indica*) is safe for humens and wildlife, yet kills or repels more than 170 kinds of harmful insects. The ingredients break down repidly in sunlight, end within weeks in the soil.

Seeds from the neem tree have been used in India for centuries to keep insects from stored grain. The tree, also called Margosa tree, is e member of the Mahogany family and is netive to southern and southeastern Asia. It is also cultivated as en evergreen shade tree in Australia, parts of Africa and Central and South America.
(Based on an article in the March 8 issue of the Idaho Post Register.)

populations on overgrazed rangeland. Bradshaw's desert parsely (*Lomatium bradshawii*), the Willamette Valley's first federally protected endangered species, was once a plant of prairies and open savannah. Today it is a narrow endemic of fence-rows and occasional grassland remnants. Largely because of agricultural practices and rangeland grazing to support a few alien food organisms at the expense of a diversity of native species, anthropogenic endemics are common world wide.

Endemism is a fascinating phenomenon incorporating evolution, genetics, population biology, biogeography and politics. Not all endemics are rare, and not all forms of rarity constitue endemism, but the two subjects often converge. Today that convergence is acute, and will continue to intensify. Rarity and endemism become synonymous, then dissappear together, through extinction. Hopefully, with federal and state legislation, better conservation practices and communication, we can stave off this pernicious process.

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Justifying Existence

--by Gary Finstad. *This article was originally published in Aquilegia, a newsletter of the Colorado NPS.*

Natural resource conservation is not very glamorous, unless one is working with rain forests, whales or pandas. It's unlikely that the public's heart strings will ever be plucked by *Physaria bellii*. And I doubt that we'll be seeing appeals on MTV for the preservation of prairie chicken habitat or the Colorado squawfish anytime soon.

There are those among us who feel that all species should be accorded a basic "right to exist". While some species have more complex or interesting evolutionary histories than others, the fact that a species exists *now* should be regarded with at least a bit of reverence, if not amazement. It hasn't been easy to get to *now*.

Most Americans, unfortunately, are disconnected with the land. Few can read a landscape, and *Manifest Destiny* still makes perfect sense, especially in an oil pinch. So how do conservationists get ecologically important jobs done in the absence of public awareness and concern?

We normally must sell projects and programs using economic benefits (including tax advantages). That's often not an easy task. In many cases, there are no economic benefits-- or, at least, none discernable in the short term. Can a species without economic benefit have a *value*? The answer should be obvious; but most of us realize that the "bottomline mentality" usually prevails. Until *Homo sapiens* evolves a bit further (or disappears), an economic benefit argument must usually be won to safeguard a wild species or to get a conservation project funded.

Happily, there are some plants-- and, we hope, habitats-- which may survive because someone has discovered a characteristic which may economically justify their existence and perpetuation.

One such person is James Duke, a scientist with the U.S. Department of Agriculture's Agricultural Research Service (ARS). He's an economic botanist working at the ARS National Germplasm Resources Laboratory in Beltsville, Maryland. Some of Duke's associates collect wild relatives of existing crops-- wheat, corn, potatoes, soybeans-- which may be useful in improving our overly manipulated crop varieties. But Duke is most concerned with the "odd crops". He works at finding and salvaging germplasm from species which have some potential to be grown commercially, at least on a limited basis.

Duke has files on nearly 1,000 different plants which could be profitably grown as crops. Alternative crops are becoming attractive to farmers mired in monocultures of wheat or corn, whose productivity only adds to an already glutted market. For example, he suggests that every major city could support a basil grower, although probably only one. Some day there might even be farmers profitably raising a plant that is now considered a weed, St. Johnswort (*Hypericum* spp.). This may compel us

to question the wisdom of eradication campaigns against any species.

About two years ago, the National Cancer Institute came to Duke for assistance because it was interest in St. Johnswort (also called Klamathweed), which has a long history in folk medicine as an antidepressant and for treating nervous disorders, burns and urinary infections. Two compounds in the weed have been found to strongly inhibit the AIDS virus. Although species are native to Europe, West Asia and North Africa, and naturalized in North America and Australia, no germplasm had ever been systematically collected for inclusion in the germplasm bank. Since then, Duke has collected five different species growing along a highway near his Maryland home. The species appear to vary in the concentrations of the active chemicals, so collecting them is important to improving its potential as a pharmaceutical crop.

Another potential AIDS fighter is the Moreton Bay chestnut, an evergreen legume that grows in the rain forests and along streambanks in northeastern Australia. It's one of the best sources of castanospermine, a compound that appears to halt reproduction of the AIDS virus. If the compound proves useful against AIDS, the plant could be a lucrative alternative crop, possible suited to Texas, Arizona, Florida, California and Hawaii. In 1987, before its potential anti-AIDS activity was announced, castanospermine was priced at $23 per milligram ($9 million per pound!). The seeds yield 0.2-0.3% of the compound.

Duke has been collecting varieties of evening-primrose for use as an alternative to tobacco production in North Carolina. Oil from the flower is a major source of gammalinolenic acid -- a fatty acid which is the precursor of prostaglandin E1 and is thought to abate symptoms of several illnesses. It is best known as a treatment for atopic eczema. Evening primrose oil is sold in health food stores. The plant is grown commercially in 15 countries, but the U.S. and Canada account for only a small share of total production. With a sales price of $22 per ounce of oil, evening primrose could be a profitable alternative crop. Currently about 400 acres is devoted to evening primrose production in North Carolina.

Recently Duke submitted wild-harvested *Huperzia lucidula* (=*Lycopodium lucidulum)* for alkaloid analysis as a possible treatment for Alzheimer's disease. Plants in the clubmoss family have been used as medicine in China for centuries for such diverse ailments as muscle cramps, hemerrhoids and pneumonia.

A wild mountain mint he's collected may be the best source of pulegone, the major ingredient in pennyroyal oil. This highly pungent compound has been found to repel fleas and birds and is being evaluated as a tick repellent.

Duke also has files on fast-growing tree species which may be grown for firewood in Third World countries and a plant that has a resin which may be used as a fuel in diesel engines.

Economic justification will save relatively few species, of course; but *the process* may help foster more thoughtful and sustainable approaches to managing land and natural resources. Until we produce a video featuring the *"Physaria bellii* rap", what else are we to do?

(Those interested in more information may write to Dr. Duke at: USDA-ARS Germplasm Resources Laboratory, Room 133, Bldg 001, Beltsville Agricultural Research Center; Beltsvill, MD 20705.)

From the Challis Messenger, 1916:

"Two botanists were in town last week on their way to the upper country for the purpose of conducting a search for interesting specimens for the Smithsonian Institute."

Who were they??? Send your guesses to **SageNotes.**

Ancient Forest Action in Congress

Susan Wood-McKean *Ancient Forest Alliance*

The stage is set for the U.S. Congress to protect the Northwest's ancient forest ecosystems and Idaho's congressional delegation has a key role to play.

House Interior Committee chairman George Miller is now finishing legislation that will protect the ancient forest ecosystem based on scientific criteria. Idaho's first district representative Larry LaRocco will be a key vote in the Interior Committee. Please write LaRocco and ask him to support Miller's package.

This legislation will also be referred to the House Agricultural Committee where Idaho's second district Congressman Richard Stallings will be a key vote. Please write Stallings and ask him to support strong ancient forest protection.

We are closer than ever to congressional action on ancient forest ecosystem protection. Your can make it happen by writing a letter now. Fore more information, or to sign up as an activist on this issue please contact Susan in Boise at the Wilderness Society office, phone # 343-8153 or fax number 343-8184.

Group Works to Preserve Natural Heritage

Dr. Ross Watson, Moscow

(Reprinted from Mariposa, newsletter of the Calochortus Society; Volume III, #3; January 1991)

The objective of the Mariposa Foundation is to develop educational programs which foster realistic and achievable concepts of conservation and utilize and develop human resources, especially retired persons.

The preservation of our natural heritage through native plant resources development is the concern of all nature lovers and requires various forms of conservation to identify the ecologically valuable plants and to preserve them through all available means. Our group will focus on developing

permanent "gene bank" plantings where annual harvest of seed can be made for a sustained planting program without damage to the wild stands or their natural increase.

The group will initiate a pilot conservation program using wild lilies *Calochortus* and *Camassia* (sego and camas). These important genera were once widespread and a part of the native ecosystem. They formed an important part of the food supply for the native Americans and later the trappers and pioneers. They are also used by animals.

These species have been greatly restricted in their range and some area strains are presumed to be lost. Many more strains are endangered, with only remnants now existing. If lost, the wide genetic variability may be reduced, thus limiting the adaptability and hence the chances for survival.

Procedures for the pilot project are:

1) Locate native sites of the lilies in as many diverse locations as possible for each species, and mark these locations for future research, reference and for site improvement.

2) Collect seed from as many species and/or strains within each genus and from as wide a variety of sites as possible to assure a broad genetic base which will improve the chances of their ultimate survival.

3) Develop methods for improving existing sites to prevent further reduction of native stands.

4) Develop effective seed treatment procedures that will enable the lilies to produce bulbs that are "disease free" for planting.

5) Establish permanent seed producing areas to conserve native seed sources for natural increase on the site.

6) Establish new stands of each species and/or strain through planting of seeds or bulbs in acceptable locations.

7) Conduct a basic taxonomic study of the wild strains of a species that occur naturally on widely differing sites. Compare these by growing them under the same conditions to determine if there are significant differences among them.

(For more information contact Dr. Watson, Mariposa Foundation for Conservation, Inc; 415 Residence St.; Moscow, Idaho; 83843.)

Species Profile: Calochortus nuttallii (Sego Lily)

--By Pam Gontz. *Originally published in **The Calypso Companion**, the newsletter of the Calypso Chapter.*

The name *Calochortus* comes from kalo, meaning beautiful and chortos for grass. The species *nuttallii* was named for Thomas Nuttall, a self-taught naturalist. The Sego Lily is the state flower of Utah.

The flower is white and somewhat tuliplike, with a triangular cup-shaped appearance. It has three sepals, three petals and six stamens, which is a characteristic composition for members of the Lily family. The base of the petals are yellow and are marked with a crescent-shaped purple band or spot. Its stems can be 8 to 20 inches high, have a few grasslike leaves. Underground is a thin coated bulb. The plant blooms in late spring and early summer.

The Sego Lily ranges from New Mexico and Colorado to the Dakotas, west to Idaho and California. This species grows on hillsides at low elevations and on well-drained plains. It may be found among sagebrush, or on gravel slopes and terraces. The genus *Calochortus*, consisting of 57 species, is found in western U.S., Canada and as far south as Guatemala. Nine species occur in the Rockies, some in mountainous habitats and others in valleys and plains.

The bulbous root of the sego lily was used by Indians who frequently ground it and made a bread from the starchy meal. The bulb is sweet and nutritious and is the size of a walnut. It can be eaten raw or cooked as an emergency food. It tastes like a potatoe when boiled. The Mormon pioneers made much use of this plant as a source of food. Bears and rodents also consume the bulbs.

Chapter News

White Pine Chapter

April 11. We'll venture to Palouse Falls and lower Snake River. Meet at Reaney Park in Pullman at 9:30a. To get to the park, take the Pullman Highway from Moscow into Pullman, passing the WSU campus entrance and continuing across the bridge. The park is on the right. The falls and channelled scablands are spectacular, so bring your camera.

June 6. Field trip to Elk Creek Falls and Big Tree Cedar Grove. Meet at the Moscow Mall parking lot at 9:00a. In the morning we will walk the well-maintained trails and view several of the Elk Creek waterfalls. In the afternoon we will visit some of Idaho's largest western redcedars. The largest *Thuja plicata* in the state is in this grove.

Pahove Chapter

March 19. Presentation by Roger Rosentreter, BLM State Botanist, on "Forest Structure and Diversity and How to Measure It".

April 16. Dr. Dottie Douglas will show slides of the flora of the Soviet Union. Dottie visited the Soviet Union last fall.

May 21. Nancy Cole will talk about the wetlands along the Snake River.

July 18. Joe Duft will lead a field trip to Railroad Ridge.

Tentative upcoming field trips have been planned for May to the Craters of the Moon with Wood River Chapter. In June, Kathy Geier-Hayes plans to lead a trip to the wildfire area near Lowman, and in August, Dr. Pat Packard plans to lead a trip to some of the interesting spots in Caldwell. For more information on Pahove activities, call Gale Green, 384-3407.

Calypso Chapter

April 18. Meet at Tubb's Hill Nature Preserve in downtown Coeur d'Alene at 9:00a. The buttercups are in bloom and the ballhead waterleaf leaves are up so there should be a good variety by mid-April.

May 16. National Wildflower Week. Meet at 10:00a at Quemlin Trails in Post Falls for a field trip led by Jill Blake.

June 27. Field trip led by Rick Barth. Meet at Berlin Flats Campground up the Coeur d'Alene River by 9:00a. The trip will cover elevational zones between 2500 and 6000 feet.

July 18 and 19. Part of our field activity for 1992 will be working with the Idaho Panhandle National Forest doing rare plant survey work. This effort, led by IPNF botanist Jill Blake and Conservation Data Center botanist Rob Bursik, will provide information for future Botanical Area designation of some unique bog areas. This is a joint project with the North Idaho Audubon group in Bonner's Ferry.

Good Stuff

WRITTEN MATERIAL

The Gardener's Source Guide lists over 510 nursery and seed mail order catalogs. The best thing is that each of the offered catalogs is free. Each listing provides a full address, the number of pages, color or black and white, and a note on the company's main product. Catalogs are listed in four groups: veggies and flowers; berries and woodies; flower plants and bulbs; bamboo, cacti and herbs. See add, this issue, for more information.

The Xeriscape Flower Gardener, by Jim Knopf, describes methods of landscaping with water conservation in mind. Plant species are described in detail and include recommendations for growing conditions and maintanence. Available from Johnson Publishing Company, 1880 S. 57th Court; Boulder, CO 80301. Soft cover, 187 page book is $14.95.

Landscape Linkages and Biodiversity by W.E. Hudson is an edited volume that presents the recent controversies and theories about landscape corridors, linkages and biodiveristy. Authors include J. Michael Scott, Michael Soule, Reed F. Noss, Allen Cooperider and Hal Salwasser. Softcover copies are available from Island Press, Box 7; Covelo, CA 95428. $19.95.

Genetics and Conservation of Rare Plants, edited by D.A. Falk and K.E. Holsinger, summarizes current understanding of the genetics and population biology of rare plants. The book includes chapters on the significance of genetic variation, the implication of small population sizes, sampling design, and conservation and management strategies. Copies are available for $45.00 from Order Department, Oxford University Press, 2001 Evans Road, Cary, North Carolina 27513.

CONFERENCES

Management for Biotic Diversity Workshop will be held at Colorado State, July 13-17. The workshop will include sessions on viable population analysis, GIS applications and management of biodiversity in fragmented landscapes. For more information contact Luke George; Humbolt State University; Arcata, CA 95521.

EMPLOYMENT

The **Salmon District BLM** is hiring a seasonal botanist for this summer. The position will involve primarily rare plant surveys, report writing, plant collecting, herbarium curation and assisting the District Botanist. SF-171 applications are due by March 30. Send them to State of Idaho Job Service, 1301-1 Main Street, Salmon Idaho 83467. For more information, call Caryl Elzinga, 756-5441.

Housekeeping

The purpose of the Idaho Native Plant Society (INPS) is to promote interest in native plants and to collect and disseminate information on all phases of the botany of native plants in Idaho, including educating the public to the value of the native flora and its habitats.

Membership is open to anyone interested in our native flora. Contributions to our Society, are tax deductible. Send dues and all correspondence to I.N.P.S., Box 9451, Boise, ID 83707.

Please include me as an Idaho Native Plant Society member.

	Full Year Jan-Dec 31	Half Year July 1-Dec 31
__ Sustaining	$30	15
__ Individual	$ 8	4
__ Household*	$10	5
__ Student	$ 6	3
__ Senior Citizen	$ 6	3

Name: _____
Address: _____
City/State: _____
Zip Code: _____ Telephone: _____
Chapter affiliation?
__ Pahove (Boise)
__ White Pine (Moscow)
__ Calypso (Coeur d'Alene)
__ Sah-wah-be (SE Idaho)
__ Upper Valley Chapter (Idaho Falls)
__ Wood River (Ketchum-Sun Valley)
(include $7 chapter dues)
__ None. Those who do not live near a chapter center are especially encouraged to join. We can put you in touch with other members in your area, and can coordinate with you on any state level activities you may with to be involved in. New chapters may be forming in eastern and northern Idaho.

*Household memberships are allocated two votes.

SAGE NOTES is published bimonthly by the Idaho Native Plant Society, incorporated since 1977 under the laws of the State of Idaho. Newsletter ads are $2.00 for personal ads; Commercial advertisements: 1/8 page $5.00, 1/4 page $8.00, 1/2 page $15.00, and full page $25.00. Newsletter ads should be camera ready and accompanied by payment.

MATERIALS FOR PUBLICATION: Members and others are invited to submit material for publication in Sage Notes. Articles in any form, even hand-written (if legible!), are encouraged. Submissions on 5 1/4 or 3 1/2 inch floppy discs for an IBM computer in WordPerfect, Multimate or ascii file format are especially appreciated. Use a cheap disk- it will not be returned. Illustrations and even good quality photos may be reduced and incorporated into the newsletter. Provide a phone number in case the editors have questions on your materials. Send submissions directly to the newsletter editor: Caryl Elzinga; P.O. Box 182; Carmen, Idaho 83462. **Due date for material for the next newsletter is 15 April 1992.**

OFFICERS

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Big Wood Chapter, P.O. Box 4154, Ketchum, ID, 83340: President--Kristin Fletcher, Vice President--Frances Naser, Secretary/Treasurer--Carol Blackburn.

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Idaho Native Plant Society
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IT'S TIME TO RENEW YOUR MEMBERSHIP

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April/May 1992 ** SAGE NOTES ** A Publication of the Idaho Native Plant Society ** Vol 15(2)

Chapter News

For information about field trips, contact one of the chapter officers listed on the last page.

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May 21. Nancy Cole will talk about the wetlands along the Snake River.

July 18. Joe Duft will lead a field trip to Railroad Ridge. See Wood River entry.

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Wood River Chapter

May 30. "The Camas Prairie". John Shelly, a resource assistant with the USFS, Fairfield District, will lead us into the beautiful and historic Camas Prairie near Fairfield. We will journey to Centennial Marsh to catch the camas blooming and to watch for waterfowl. Last stop on the trip is Cat Creek Summit, where we will explore the lovely blue-eyed grass meadows.

June 6-7. "Craters of the Moon/Brass Cap Kapuka". This special 2-day field trip will feature the incredible spring bloom of the Cave. Park Interpreter David Clark will introduce us to the Crater's unique ecology and the plant species which thrive in this seemingly barren environment. The night of the 6th we will camp at Sunset Cone Group Campground along the Oregon Trail. The next day Mike Mancuso, research biologist with the Conservation Data Center, will lead us on a rather rough, one hour walk to Brass Cap Kapuka, a proposed research natural area. This fascinating area features an older lave flow now covered with vegetation, surrounded by a newer, more rugged flow. Cattle grazing has been limited on the older flow by the rough terrain of the newer flow, leaving it in nearly pristine condition.

June 23 and 30. Lisa Clark, botanist and baker extraordinaire, will again teach this helpful plant identification class for beginners on two successive Tuesday evenings. On the 23rd, Lisa will show slides and discuss basic plant anatomy. Then on the 30th, she will bring plants in for identification and introduce us to the art of using a plant key. Please bring a hand lens or magnifying glass to each class.

July 18. Joe Duft, alpine plant specialist and co-author of the beautiful book **Alpine Wildflowers of the Rocky Mountains**, will once again lead us to this spectacular, 10,000 foot ridge in the White Cloud Mountains. Meet at Ketchum Park and Ride (Warm Springs Road) at 8:30a for carpooling. We will then head to the Sawtooth NRA office near Stanley to regroup prior to the final 1.5 hour drive (accessible by high-clearance vehicle). Be sure to bring lunch, water and clothing suitable for rapidly changing weather conditions. Cosponsored with the Sawtooth Wildlife Council and the Pahove Chapter.

August 8. "The Ethnobotany of Silver Creek". Paul Todd, botanist and assistant manager of Siver Creek Preserve, will introduce us to ethnobotany, the study of the use of native plants. We will learn how to make rope from bark, weave reeds for baskets, gather plants and prepare them for lunch and more! If you'd like to linger into the late afternoon and stay for a potluck dinner at Paul's house, bring a dish to share.

Sah-wah-be Chapter

June 19-21. Camp at USFS Riverside campground just south of Harriman State Park (Island Park, Fremont County), and venture up Sawtelle Peak. Sunday will offer trips to Mesa Falls, Cave Falls, and/or Big Springs. Call Dave Burrup (397-4606) for details; you may wish to reserve camping space early. Good birding here too; the Portneuf Valley Audubon group has been alerted to this trip.

July 25. 7:00a, ISU Biology parking lot. Jensen Creek drainage (Palisades Reservoir, Bonneville County) tour, another of Karl's annual favorites, and another all-day escapade. Call Ruth Moorhead, 233-5011, to carpool or for overview of the trip.

August 6. 6:00p, USFS Cherry Springs recreation area (by the poison ivy table). Bring your own picnic dinner.

August 22. 10:00a, ISU Oboler Library parking lot, 10th and Carter streets. Silver Creek Nature Conservancy preserve, west of Picabo (Blaine County). Bring a lunch and look for early fall color. Call Ruth Moorhead, 233-5011, to carpool.

Conservation of Idaho's Pacific Dogwood

-by Juanita Lichthardt, Conservation Data Center

The creamy white blossoms of the graceful Pacific dogwood (*Cornus nuttallii*) are a familiar sight to those living on the west side of the Cascade Mountains. However, as many Idahoans are aware, the Pacific dogwood occurs naturally in one location far to the east of the Cascades--along the lower Lochsa and Selway Rivers, where they meet to form the Middle Fork Clearwater River (Figure 1). In years past, the early-spring flowering of these trees was a much-anticipated event that was announced in local newspapers. Many people took yearly pilgrimages to behold the spectacle produced by hillsides of blooming dogwood trees.

The isolation of Idaho's dogwood trees is extremely interesting from a biogeographical standpoint. It reinforces the existence, within the Clearwater Basin, of coastal refugia--areas where the vegetation is indicative of a warmer, wetter climate than now prevails. Floristically these areas have many similarities to the northwest Pacific coast. The disjunct range of Pacific dogwood defines one of the best examples of a coastal refugium. Pacific dogwood is classified as a Sensitive Species by the Forest Service because of its rarity in Idaho, declining abundance, and biogeographic significance.

Pacific dogwood is closely related to the eastern flowering dogwood (*Cornus florida*), which is native to the eastern US and is a highly valued ornamental wherever it can be grown. These two species are quite similar in appearance and likely diverged from a common ancestor in response to geographic isolation.

The flowers of Pacific dogwood are rather inconspicuous. What appear to be 4-7 large, white petals are actually bracts that subtend a globose cluster of tiny flowers. In fall these flowers produce shiny, red berries, and foliage becomes a striking, deep red.

Pacific dogwood trees are usually multi-stemmed and our inland trees usually do not exceed 30 ft in height. Although trees growing in deep shade tend to have a single main trunk,

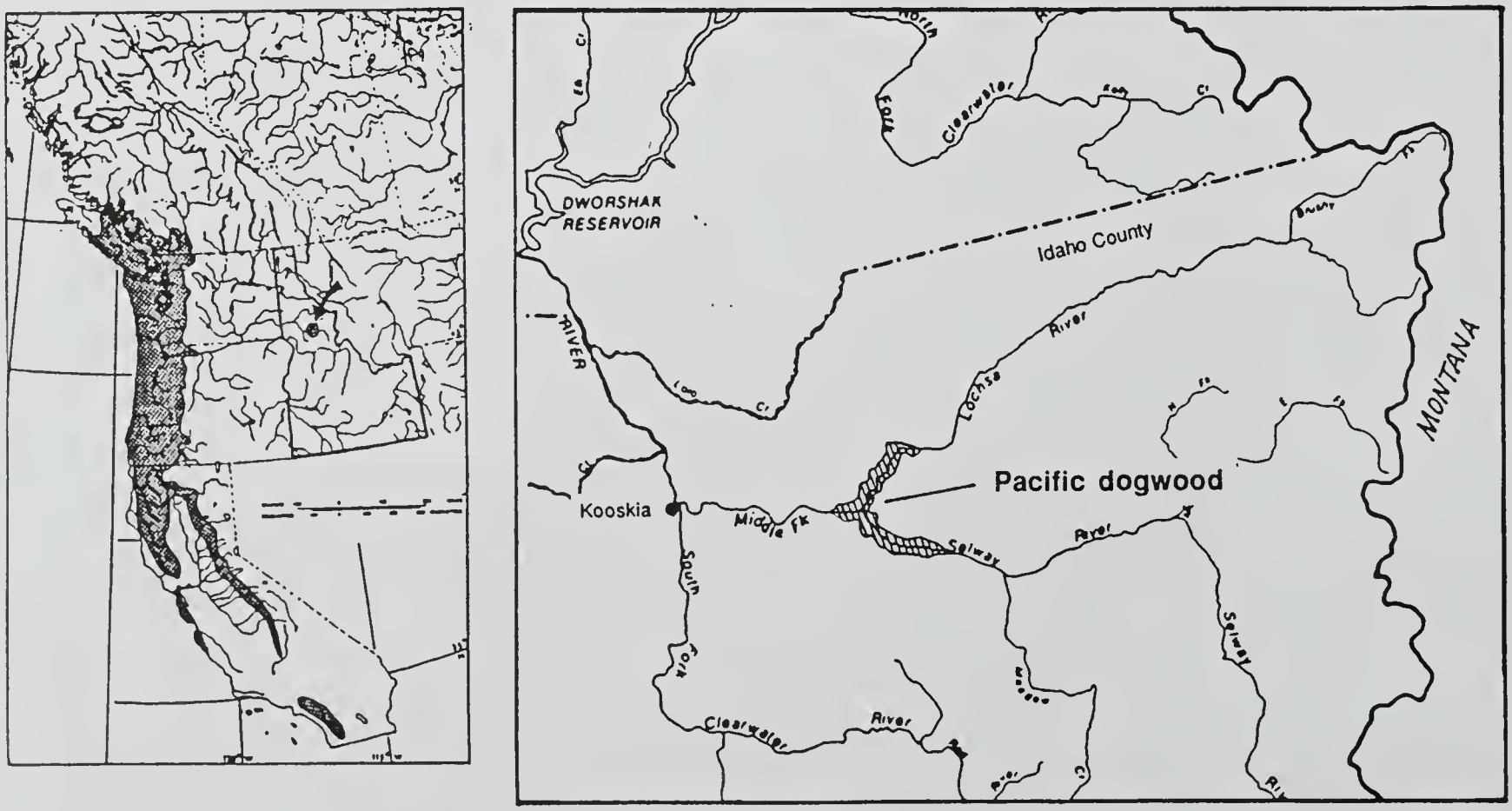

Figure 1. Distribution of Pacific Dogwood. The population at the confluence of the Lochsa and Selway Rivers represents the only occurrence of this species east of the Sierra/Cascade crest.

they frequently have a few smaller stems arising from the base. In open shrubfield habitats along the Lochsa River, the species takes on a very shrubby habit, with numerous basal stems. Production of new stems is stimulated by death of, or damage to, the main stem, such as from fire. Old trees, especially those growing in openings in young conifer stands, can have as many as 10 main stems.

Habitat and Ecology

In Idaho, Pacific dogwood is found between 1600 and 2800 ft. in the *Thuja plicata* (western redcedar) zone. It inhabits a variety of communities including brushfields dominated by tall shrubs, mature redcedar forest, young conifer stands, and streamsides, but is mostly restricted to lower slopes near the valley bottom. A distribution map by Roper (1970) showed that dogwood trees occupied all aspects. It is most common on south aspects, on slopes varying from flat to over 60%.

Although Pacific dogwood is shade-tolerant and can grow in climax communities, it appears to be better adapted to mid-successional seral habitats and is strongly associated with the margins or openings of forest canopy. Fire appears to have played a key role in the distribution and density of Pacific dogwood in the Lochsa/Selway area (Roper 1970). Open or lightly shaded habitats, such as those induced by fire, support the greatest concentration of plants and produce more consistent flowering than closed stands. Seedling establishment, however, appears to require moderate shade of overstory conifers (Johnson 1988). The possibility has been raised that natural, successional changes could reduce or eliminate suitable habitat.

Declining Numbers Confirmed

It was apparently sometime after 1970 that our dogwoods became afflicted by a serious malady that killed scores of trees. In 1987, Steven Brunsfeld and Fred Johnson (Forest Resources, University of Idaho) confirmed that a high rate of mortality had occurred and that remaining trees were unhealthy. In subsequent research by Johnson (1988), he estimated greater than 50% mortality throughout the Idaho populations and noted that all trees taller than 4 ft showed symptoms of a yet-unidentified ailment.

Subsequent pathological work identified several root fungi as possible causes of the observed mortality (Bertagnolli and Partridge 1990). It is possible that the trees' resistance to pathogens was weakened by any number of factors including the long-term drought experienced by the region or competition from other plants brought about by successional changes in the vegetation.

Populations of Pacific dogwood in the Lochsa/Selway area are recovering slowly, if at all, and there is little evidence of seedling establishment, leaving little hope that the species can regain its previous abundance. In response, the Forest Service has developed a Conservation Plan outlining research needs and providing for off-site preservation of the gene pool through long-term seed storage (Lorain 1991).

Off-site Preservation

Profuse flowering occurred in 1990 even though plants were in a weakened state with many dead branches and trunks. The following fall, Chris Lorain, working with the Conservation Data Center, systematically collected fruits from throughout the disjunct range of the species. Seeds were extracted and placed in long-term storage at the Berry Botanical Garden in Portland, Oregon, thus preserving a representative sample of the gene pool and providing the potential for increase by growing-out trees to maturity. Seedlings produced from this seed were doing well after five months in pots.

Although seed of Pacific dogwood germinates fairly easily, the species can be difficult to cultivate. John Edson, a researcher at the University of Idaho, is successfully raising seedlings in the greenhouse that can be used for his research in tissue culture for possible reintroduction of the species, should that ever be attempted. Due to the cost and uncertainty of growing a tree to reproductive maturity, and the time involved, tissue culture could offer a more dependable method of increasing the species off-site.

On-Site Preservation

In 1991 the Conservation Data Center, in cooperation with the Forest Service, initiated long-term demographic monitoring of Pacific dogwood. Demography is the study of changes in population size over time and their causes. Rates of birth, death, growth and reproduction are some of the variables measured. To obtain these data, permanent, tenth-acre plots were established in Pacific dogwood stands along both the Selway and Lochsa Rivers. Dogwood trees within the plots were mapped and individual stems marked and measured so that they can be followed over time. The plant community at each site was quantitatively described.

Goals of this study are to determine the best management for recovery of the species on site, determine the effect of site on tree survival, and measure demographic variables which will ultimately determine the fate of the species in its inland range.

The ability of Pacific dogwood to resprout following fire or other damage means that an individual tree cannot necessarily be aged by the diameter of the largest stem. Stem size does,

however, give an estimate of the relative age of individual stems and can give us an idea about the dynamics of stem production, growth, and death.

Figure 2 is the size distribution (diameter at base) of all live, Pacific dogwood stems measured in the first year of the study. Note that many stems frequently make up an individual tree. The distribution is strongly skewed toward the smaller sizes, reflecting the fact that virtually all large stems (i.e. >4 inches) are either dead or near death. Most of the smallest stems die before they grow large enough to be included in a larger size class. The largest stems are often alive only near the base where they support a younger stem. Standing dead stems as large as eight inches in diameter were observed.

Since fire appears to have played a major role in the occurrence of Pacific dogwood within the canyons, succession on these sites may pose an additional threat to our populations. The Forest Service may choose to conduct habitat manipulations such as thinning or burning on an experimental basis to explore the possibility of using such practices as management tools.

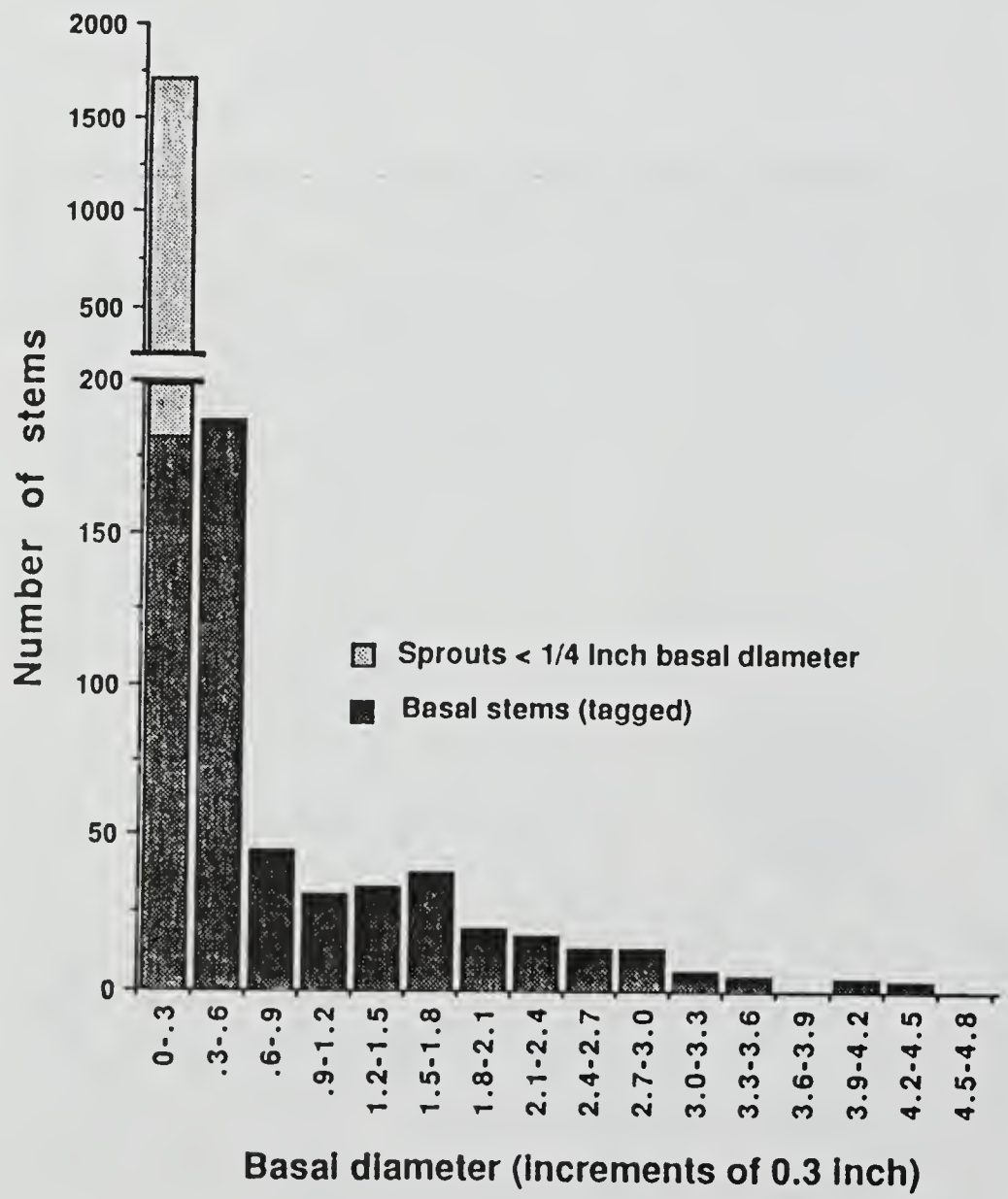

Figure 2. Stem size distribution of Pacific Dogwood.

Genetics Reinforces Uniqueness of Idaho Populations

New genetic studies being carried out by Steven Brunsfeld at the University of Idaho will compare the genetic make-up of Idaho populations to that of west-coast trees to determine whether there has been divergence within the isolated range. Comparisons of the genetic variation present in Lochsa and Selway populations show a distinct difference. There is little variation present among Lochsa trees, while those on the Selway have a large amount. This indicates that Lochsa populations experienced a crash in numbers, a genetic bottleneck, sometime in the past, while those on the Selway have not.

The underlying goal of all of this research is preservation of the genotype of Idaho's dogwoods, which appears to be distinct from that of Pacific-coastal populations. In the best case the dogwoods will eventually recover and persist on-site where they can once again be enjoyed for their beauty and as a symbol of Idaho's unique botanical heritage. Since their survival, however, may be out of our control, such off-site methods as long-term seed storage and tissue culture can help assure that the range of genetic variation now present within inland populations will not be lost.

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Lorain, C.C. 1991a. Conservation Plan for *Cornus nuttallii* (Pacific dogwood), in Idaho. Unpublished report by Idaho Dept of Fish and Game, Conservation Data Center for the US Forest Service. 15 pp plus appendices.

Roper, L.A. 1970. Some aspects of the synecology of *Cornus nuttallii* in Northern Idaho. MS Thesis, Univ. of Idaho, Moscow.

What do you want to see in your newsletter? Do you enjoy the more technical articles? Would you like to see more Chapter News? Do you have an idea for a regular column? Do you have an interest in certain subjects?

Biological Diversity in Idaho's Future

- by Keith E. Evans

The author is the Assistant Station Director, Intermountain Research Station, USFS, at Ogden, and co-chair of the Research Natural Area committee of Region 4. This article is adapted from a speech presented at the Idaho Natural Areas Conference, Boise Idaho, 29 October, 1991.

I hear a lot of conflicting attitudes concerning the subject of biological diversity--or the term I prefer--biodiversity. Some say we can't manage what we can't define. Some say biodiversity is complex and any attempt to simplify this complexity will "misrepresent the concept." Some say there is nothing new and we should continue "business as usual"--after all, we are the greatest country in the world and we got here by "harnessing" the powers of nature.

Well, my fellow earthlings, we cannot continue to "control" and "exploit" our natural surroundings in the way our forefathers thought necessary to survive, prosper, and be comfortable. We are now in a high-tech society. This technology will assist us in what we comfortably refer to as "the easy life," but without our cooperation, the technology will not provide a sustainable Earth ecosystem that will assure the survival of our grandchildren, great-grandchildren, and great-great-grandchildren. Be fully aware that children, infants, and future generations cannot currently vote or promote change, but when they become adults, they will either praise our successes or pay for our failures.

You are now free to ask--what is this thing called biodiversity and how does "it" affect me in Idaho? Biological diversity is one topic where the concept is easy to define, but there will continue to be a flurry of research, technology development, computer modeling, and discussion before we have concise, nonambiguous land management prescriptions that adequately deal with the implications of the biodiversity concept.

The "concept" is defined as follows: BIODIVERSITY IS THE VARIETY OF LIFE AND ITS PROCESSES. Therefore, biodiversity refers to the conservation of the full variety of life, from genetic variation within species to the "richness" of ecosystems in the biosphere. The easiest segment of this spectrum to understand is the "species" level where we can get a reasonably good count of plant and animal species in an area and use this information as a standard for management actions. Species management is a start but is not the complete and correct answer to the biodiversity question.

Aldo Leopold's land ethic, which included "saving the pieces," offers many thoughts to contemplate. In my view, we need to define the "pieces" as genetic diversity, community richness, and ecosystem complexity, as well as the number of species. It is also important to assess the risk of losing a "piece" and prioritize our efforts on components with high risk (wetlands, riparian values, endangered species, etc.).

Biodiversity is not an isolated cause dreamed up by some radical environmentalists. Biodiversity has a lot of commonality with the foundations in which Aldo Leopold based his land ethic, in which the academic field of conservation biology is based, and in which the concepts of ecosystem integrity and long-term sustainability are built. In simpler terms, biodiversity is the foundation for healthy ecosystems and therefore the sustainability of natural resources and life as we would like to know it. A sustainable society is one that satisfies its needs without jeopardizing the prospects of future generations.

Why should we be concerned with the preservation of biodiversity? Here are just three reasons--(1) for ethical and esthetic reasons; (2) because humanity has already obtained enormous direct economic benefits from biodiversity in the form of food, medicine, and industrial products, and has the potential for gaining much more; and (3) for necessity, as the array of services provided by diverse functioning ecosystems are essential to our survival. This last item is poorly understood and inadequately evaluated; therefore, we are at great risk when we continue to lose or simplify our diverse ecosystems.

Believe it or not, the greatest challenge for Idaho Native Plant Society members is not how to preserve what Idaho has. A far greater challenge is to change land management practices to consider ecosystem-level management. This will require new approaches in planning, monitoring, coordinating, and administering. Yes, "saving the species" is still an important first step. However, we need to develop and implement land use strategies that provide an acceptable mix of commodity production, amenity use, protection of environmental and ecological values, biodiversity, and sustainability.

The direction of Idaho's wildlands management, and therefore conservation of biodiversity, can be changed if new ideas and approaches are incorporated into management frameworks. To succeed, we must be persistent in our demands. Perception becomes reality, and currently "harbingers of change" will be challenged with perceptions such as:

- Forest management must be done at the stand level, because land managers cannot control a significant number of the variables in a landscape setting.
- Planning and budgeting horizons are short term. Therefore, time scales appropriate to ecosystem functions cannot be addressed.
- Monitoring technology does not exist for judging successes in conserving biological diversity. Without targets we cannot hold our managers accountable.
- Not enough is known about the structure and functioning of an ecosystem to formulate management practices.

We must all insist that "caring for the land" is based on what is known, and not compromised by what is yet to be learned. Promoting an adaptive management philosophy should be a way of life. I don't have "standardized" responses for the above-listed factors that seem to limit the speed of change. My recommendation is that you study the aspects of biodiversity and be innovative and insistent in demanding changes.

In concept, think of biodiversity in terms of (1) genetic

diversity, (2) species sustainability/viability, (3) community composition/function, and (4) landscape resiliency/integrity. In practice, I suggest the following actions:

- o Temper your demands based on ecological, economical, and political potentials and realities. The concept of sustainability is somewhere between preservation and exploitation. Our challenge is to define this space and progress toward a goal of sustainability.
- o Think and act in terms of "new perspectives" that promote integrated management plans and practice adaptive management. With the concept of ecosystem management, we should not expect changes to be instantaneous. We can expect progress towards a desired future condition.
- o Consider the "context" as well as the "content" of the area to be managed. What our "neighbors" are doing with their land influences the options left open to Federal land managers.
- o Demand additional research and technology, but make today's decisions on what we have--Leopold's land ethic, principles of landscape ecology, species recovery plans, wildlife habitat relationships models, seed ecology, regeneration technology, and much more.
- o Don't plan on the luxury of following a totally logical sequence of events. We must simultaneously operate thinktanks to generate the questions, conduct research to generate answers, and promote skunkworks to develop prototypes. At times, this may confuse the issue, but don't let confusion deter needed actions.
- o Serve as teachers and providers of knowledge.
- o The time is NOW--put on your running shoes, radiate enthusiasm, and try to stay ahead of the pack.

The public lands in Idaho hold the key to conserving biodiversity. YOU have three points of opportunity/responsibility to contribute to the management of your public lands. First, work hard to develop information that can be used in planning processes. Second, insist that the full complement of appropriate knowledge is incorporated into management plans. Third, demand that the concepts of best management practices (BMP's) and desired future conditions (DFC's) outlined in the plans are properly implemented.

My perception: Idaho has not yet entered into the arena of massive extinction rates that are of great concern for some parts of the planet. Your responsibility: assure that Idaho sets an example that the entire nation can admire for a high standard of ecosystem function and sustainability.

Good luck!

Don't forget to pay your membership dues! Check your lable.

The next issue of SageNotes will feature "great places" in Idaho. Write about your favorite place to botanize.

Sedges Don't Always Have Edges and Other Stuff About The Genus Carex.

-by Michael Mancuso, Conservation Data Center

Members of the genus *Carex* (sedge) are conspicuous in many riparian communities, in some cases being the vegetational dominant. No discussion of riparian wetlands would be complete without at least a few words of homage about this interesting and important group of plants.

Carex is a part of the Cyperaceae (sedge) family, which also includes the genera *Cyperus* (flatsedge), *Eleocharis* (spikerush), *Eriophorum* (cotton-grass), and *Scirpus* (bulrush), to name just a few. Estimates of the number of *Carex* species varies from around 1100 to nearly 2000, making it one of the largest genera in the plant kingdom. Hermann (1974) estimated Carex to be the largest genus in North America, with approximately 600 species. It takes Hitchcock and Cronquist (1973) 18 pages to complete their key to the identification of all 134 sedge species listed in their **Flora of the Pacific Northwest**! The sedges are distributed worldwide and can occur in a wide array of habitats, from tropical to high arctic areas, but they are most common in the north temperate to arctic areas. Many, but by no means all species, are restricted to wet or at least moist habitats.

All Carices are herbaceous perennials. Flowers are unisexual, the plants mostly monoecious, but occasionally dioecious. Individually, the flowers are typically inconspicuous. The inflorescence, however, can be quite impressive, even attractive, even if the group is often excluded or mentioned only in passing in many wildflower books. A distinctive feature in *Carex* is the closed perigynium, a highly modified bract which encloses the pistillate flower. Features of the perigynium are important to help distinguish and identify the many sedge species.

Besides reproducing by seed, sedges reproduce vegetatively by rhizomes or occasionally some other means. Vegetative reproduction can be extensive, with some species forming very long-lived clones, or tufts, clumps, or tussocks of various size. Most temperate and arctic species form shoots during the previous year, some emerging in the fall, other species with these shoots remaining underground until spring. Most temperate species also develop flower initials during the fall. A shoot will probably not flower the next summer if such development does not occur the previous fall (Bernard 1990).

Sedges are typically thought of as grass-like plants, and indeed, they are taxonomically closely related to grasses (Poaceae). In fact, it can sometimes be difficult to tell if a particular plant is a sedge or a grass, especially if only vegetative material is available. The following field characteristics are useful to differentiate between the two groups when flowers are not present: 1) sedges have solid stems, whereas grass stems are usually hollow; 2) sedge leaves are 3-ranked, versus 2-ranked for the grasses; 3) the stems of sedges are often angled ("sedges have edges", but remember - not always), whereas grass stems are round in cross section.

Sedges are an important riparian component for many reasons.

As part of the riparian vegetation they play a role in streambank stabilization and other riparian dynamics, such as bank morphology, sediment load and flood control. They are important as wildlife habitat and forage, and from a general biodiversity perspective as well.

Some of the more widespread and common wetland sedges in Idaho include *Carex aquatilis* (water sedge), *C. interior* (inland sedge), *C. lanuginosa* (wooly sedge), *C. lasiocarpa* (slender sedge), *C. lenticularis*, *C. luzulina* (woodrush sedge), *C. muricata* (muricate sedge), *C. nebrascensis* (Nebraska sedge), and *C. rostrata* (beaked sedge). Luckily, with a bit of practice, most of these are pretty readily distinguishable sedges.

In Idaho, fourteen *Carex* species are currently recognized worthy of conservation concern by the Idaho Native Plant Society, either as State Priority 1, State Priority 2, State Sensitive, or State Monitor species. An additional five sedges are on the State Review list. Nearly all of these sedges are more common elsewhere in their range, but to varying degrees are rare in Idaho. Of special note is *Carex aboriginum* (Indian Valley sedge), known from one historical population. This species was collected by Marcus E. Jones in 1899, in what is now Adams County, Idaho. Apparently, Indian Valley sedge has never been collected or seen since Jones' original collection. This original population is now considered extinct due to unknown causes (Moseley 1990). Indian Valley sedge is considered possibly extinct, and is the only Idaho endemic documented to have met this dubious fate.

Hopefully, you now have a little better appreciation for the often conveniently overlooked sedges. So the next time you are out and about in one of Idaho's wetlands, look around, there is a good chance you are stepping on a sedge.

To help identify sedges, the book **How to Identify Grasses and Grasslike Plants**, by H.D. Harrington, is recommended. It is published by Swallow Press, Chicago. Volume 1 of the **Vascular Plants of the Pacific Northwest**, by Hitchcock, et al. provides excellent descriptions and line drawings of the regions sedges. Other publications with useful descriptions and line drawings are: **Manual of the Carices of the Rocky Mountains and Colorado Basin**, by F.J. Hermann (see literature cited); **A Field Guide to the Sedges of the Cariboo Forest Region, British Columbia**, available from the British Columbia Ministry of Forests; and **Riparian Dominance Types of Montana**, by Hansen, *et al.*, and available from the School of Forestry, University of Montana, Missoula, Montana (Misc. Publication No. 49).

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Hermann, F.J. 1970. **Manual of the Carices of the Rocky Mountains and Colorado Basin**. Agriculture Handbook No. 374. U.S. Dept. of Agriculture, Forest Service. 397 pp.

Hitchcock, C.L., and A. Cronquist. 1973. **Flora of the Pacific Northwest**. University of Washington Press, Seattle. 730 pp.

Moseley, R.K. 1990. Report on the conservation status of *Carex aboriginum*, in Idaho. Unpublished report on file at the Idaho Department of Fish and Game, Conservation Data Center, Boise, ID. 17 pp., plus appendices.

Good Stuff

WRITTEN MATERIAL

Dictionary of Gardening, the New Royal Horticultural Society. This four volume set covers over 50,000 plants, including every plant cultivated in North America, each with scientific and popular names, description, native distribution, natural habitat, line drawings, known cultivars and detailed cultivation notes. The set also contains over 350 articles on various aspects of gardening: soil husbandry, genetics, specialty gardens, and plant families. The line drawings shown in the flyer are excellent, and at 3,000 pages, it is likley to be a fairly complete reference. Pricey. The four volumes are available for $725 from Stockton Press; 257 Park Ave. South; 18th Floor; New York, NY 10010.

WORKSHOPS AND CONFERENCES

Biodiversity and Climate Challenge will be held at Grand Teton National Park, August 3-7. The workshop, designed especially for those interested in environmental education, offers graduate credit from the University of Wyoming. A major emphasis will be given to field study, and to the development of materials by teachers for use in their own teaching. Contact Donn Kesselheim; Wyoming Outdoor Council; 201 Main St.; Lander, WY 82520.

The **Greater Yellowstone Coalition** will be holding their annual conference May 29-30. Keynote speaker is Lorraine Mintzmyer, former National Park Service Rocky Mountain regional directer. Mintzmyer was moved from that position after supporting the original "vision" planning document for the greater Yellowstone area, which the natural values of the area over its commodity values. Idaho state auditor J.D. Williams will also speak on "Doing it Right in Greater Yellowstone". Contact GYC, P.O. Box 1874, Bozeman, MT 59771.

COURSES

Malhuer Field Station. Dr. Karl Holte, INPS member, will be teaching two courses at MFS. Students who take the course, **Hart Mountain Antelope Refuge Botanical Studies**, June 14-July 4, will learn to key plants in the field using hand lenses, learn community sampling techniques, and compare grazed and ungrazed communities using established exclosures. Students will camp out at Hart Mountain Monday through Friday. The course is available for 1-4 credits. Karl will instruct **Riparian Plants of Malheur Refuge**, from July 5 to 11. The course will

emphasize field keying, with some use of dissecting scopes for difficult grasses and sedges.

Botany of Steens Mountain (July 26-August 1), is taught by another Idaho botanist, Don Mansfield of College of Idaho. The course will introduce students to the botany of Steens Mountain. Advanced students will study the botanically unexplored areas of Steens Mountain, while beginning students will learn the more common plants while learning how to identify plants through the use of keys.

Other MFS courses may also be of interest. **Xeriscape Plant Workshop**, June 12-14, will provide hands-on instruction as students plan and plant a drought resistent garden. **Plant Ecology Field Techniques**, June 21-July 11, will explore the relationships of vegetation distribution and physical environment, disturbance regime and history. Students will work with researchers on long term projects to learn sampling techniques.

Additional courses in **Environmental Photography, Field Ethnobotany, Natural History of Southeastern Oregon, Natural Science Illustration: Plants in Pen and Ink or Watercolor**, sound interesting. Call (503) 493-2629, or write Malheur Field Station; HC 72 Box 260; Princeton, OR 97721, for details.

National Audubon Society offers ecology courses in the Wind River Mountains in Wyoming. University credit available for the week long sessions. Sessions cost $650 per week, includes meals. Contact Registrar; National Audubon Society; 613 Riversville Rd.; Greenwich, CT 06831.

SAGE NOTES is published bimonthly by the Idaho Native Plant Society, incorporated since 1977 under the laws of the State of Idaho. Newsletter ads are $2.00 for personal ads; Commercial advertisements: 1/8 page $5.00, 1/4 page $8.00, 1/2 page $15.00, and full page $25.00. Newsletter ads should be camera ready and accompanied by payment. Members and others are invited to submit material for publication in Sage Notes. Articles in any form, even hand-written (if legible!), are encouraged. Submissions on 5 1/4 or 3 1/2 inch floppy discs for an IBM computer in WordPerfect, Multimate or ascii file format are especially appreciated. Illustrations and even good quality photos may be reduced and incorporated into the newsletter. Provide a phone number in case the editors have questions on your materials. Send submissions directly to the newsletter editor: Caryl Elzinga; P.O. Box 182; Carmen, Idaho 83462. **Due date for material for the next newsletter is 15 June 1992.**

The purpose of the Idaho Native Plant Society (INPS) is to promote interest in native plants and to collect and disseminate information on all phases of the botany of native plants in Idaho, including educating the public to the value of the native flora and its habitats.

Membership is open to anyone interested in our native flora. Contributions to our Society, are tax deductible. Send dues and all correspondence to I.N.P.S., Box 9451, Boise, ID 83707.

Please include me as an Idaho Native Plant Society member.

	Full Year Jan-Dec 31	Half Year July 1-Dec 31
__ Sustaining	$30	15
__ Individual	$ 8	4
__ Household*	$10	5
__ Student	$ 6	3
__ Senior Citizen	$ 6	3

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Chapter affiliation?
__ Pahove (Boise)
__ White Pine (Moscow)
__ Calypso (Coeur d'Alene)
__ Sah-wah-be (SE Idaho)
__ Upper Valley Chapter (Idaho Falls)
__ Wood River (Ketchum-Sun Valley)
(include $7 chapter dues)
__ None. Those who do not live near a chapter center are especially encouraged to join. We can put you in touch with other members in your area, and can coordinate with you on any state level activities you may with to be involved in. New chapters may be forming in eastern and northern Idaho.

*Household memberships are allocated two votes.

Idaho Native Plant Society
P.O. Box 9451
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Don't forget to pay your membership dues!

June/July 1992 ** SAGE NOTES ** A Publication of the Idaho Native Plant Society ** Vol 15(3)

Endangered Species Act Funding Reauthorization

(reprinted from The Native Plant Society of Oregon Bulletin; Volume 25(6), June 1992)

Every few years the Endangered Species Act (ESA) must have its funding authority renewed by Congress. This opens the door to amendments to the Act. In the past this has resulted in a net benefit for endangered wildlife and plants. This time around more than one attempt is being made to weaken the ESA.

Last summer a group of fourteen western Republican congressmen submitted HR 3092, nicknamed the "Human Protection Act", which would require "potential economic benefits under the ESA outweigh potential economic costs". A group of anti-ESA lobbyists reportedly is preparing a comprehensive revamping of the Act to limit its power to protect endangered species.

On the other hand, Congressman Gerry Studds (D-MA), chair of the Fish and Wildlife Subcommittee, has introduced HR 4045, which embodies concerns of the environmental community. This would streamline the listing of species, improve critical habitat designation, strengthen enforcement of the act and insure adequate funding for conservation work.

The Nature Conservancy has stated its view that the "battle to halt destruction of habitat and consequent loss of species will be won or lost by the turn of the century". The upcoming tough fight over the ESA is a crucial part of this battle. You can help in this by writing your representative to support the Studds Endangered Species Act amendments (HR 4045) and oppose HR 3092 and other attempts to gut the ESA.

Remember that most politicians as well as governmental agencies do listen to public comments, and in fact, agencies are often happy to get support in carrying out their legally mandated responsibilities. Only a small percent of citizens ever contact their representatives or agencies (1-2%), so each voice heard really represents 50 to 100 who never speak up. It is possible to make a difference, as past efforts by environmentalists have demonstrated. A few more voices heard may help our vanishing species hold on into the next century and longer.

Mirabilis macfarlenei

MacFarlane's Four O'Clock, Idaho's only listed species. Is there an economic value??

Native Bees: the Other Native Plant Enthusiasts

-by Vince Tepedino and Susan Geer. Reprinted from the newsletter of the Utah Native Plant Society, ***Sego Lily****, 15(2), 1992.*

Eccentric humans roaming the hinterlands in scruffy hiking boots, hand-lenses and plant presses at the ready are not alone in their enthusiasm for native plants. Other enthusiasts are about, bootless but winged, noisily investigating flowers with organic "hand lenses" and other sensory equipment. In place of plant presses they carry built-in "pollen baskets' and "nectar buckets" into which they pack their booty. These other enthusiasts are our native bees, and they were active in the flower trade long before men could point to flowers and give them names. Indeed, if native plant societies are composed of beings that foster plant abundance and diversity, then charter membership belongs to bees.

These six-legged soul mates of UNPS'ers are members of the *Hymenoptera*, the large insect order which also includes wasps and ants. The bees are 3000+ species strong nationwide, with more than 800 species in Utah alone. Native species range in size from 2-3mm to about 20mm, and in color from drab brown or black through red, yellow and orange, to bright metallic blue and green. Some are slight in shape while the robust dimensions of others bring burly football players to mind.

Millions of species that biologists believe inhabit the Earth: 5-30

Millions of species with scientific names: 1.4

Despite their wide range in aspect, several attributes render them immediately recognizable: a Dolly Parton-like "wasp waist" (albeit without exaggerated anterioventral prominence); four wings, two more than flies, which also visit flowers with great frequency; a sting (most noticeable if you attempt to pat them on the back or butt); and general hairiness - if bees were the size of beavers they would be prized for their fur. They are most easily confused with the stinging wasps, their close, but much less hairy, and frequently less friendly, relatives. Indeed, they are commonly (and erroneously) blamed for the sting more freely given by wasps. But unlike their more pugnaceous relatives, these strict vegetarians are uninterested in meals of flesh and do not sting offensively.

Most of our native bees share a number of other, poorly appreciated characteristics. The term "poorly appreciated" is apt because the impressions that most people have of bee life are formed from the notoriety of the ubiquitous honeybee which is neither native nor typical. For example, unlike the honeybee, most bees are not social: there is no hive, no honey, no workers, no caste system. There are queens, in a manner of speaking, but in contrast to the honeybee queen whose wish is the worker's command, the solitary bee queen reigns over a subjectless realm. They can expect no help in foraging, or in nest construction and upkeep. No kamikaze viragos take to the air in defense of the nest. Nor is support forthcoming from the rakish consort of the queen, who, free of quilt and the threat of a garnished salary, supplies only a brief moment of passion and then moves on to try to impassion others. In bees (and most other *Hymenoptera*) even this male "contribution" can be dispensed with because females that do not mate still produce male (but not female) offspring.

These "queens" toil alone: they excavate, construct or select a nest (apartment), supply the requisite furnishings and food, and rear their several offspring in separate rooms termed cells. Furnishings may be a lining of leaves that cover the cell walls, or a coat of glandular material applied by the female's mouthparts to waterproof the cell. Food is nectar and pollen collected during frequent foraging trips. Nectar is carried internally in the crop, pollen is carried on hairy pollen baskets on the hind legs or on the underside of the abdomen. The female molds a provision loaf from the food accumulated over several collecting trips, and lays an egg upon it when it is of sufficient size to support the maturation of a single offspring. Immediately after egg-laying, she seals the cell with a wall of silk, leaves or other material, and starts another cell in the same nest. Mother and offspring never meet; by the time baby's development is completed to the adult stage, mom is long since dead.

Our solitary "queens" construct or select nests of three broad types. Some species excavate tunnels in soil or wood. In soil, side branches usually emanate from the main tunnel and end in one or more cells, but the variety of nest floor plans is endless. Hard bare ground like that of infrequently used dirt roadways is preferred by some excavators; others are enamored of ground in sparsely to heavily vegetated areas. Characteristics such as soil texture, temperature, slope and aspect may also be important in determining whether a site is attractive. The alkali bee (*Nomia melanderi*), a species sometimes used for the commercial pollination of alfalfa, prefers bare but moist alkali flats in which to nest. These bees use the same site from year-to-year and huge aggregations of independently nesting females may build up. There is so much noise from the activity at such

Number of known species that are flowering plants: 250,000

sites that they are usually heard before they are seen.

A second type is comprised by those species that seek out vacant holes (frequently made by beetles) in dead twigs, branches or stumps. These species typically produce linear unbranched nests in which one cell is directly behind another. Two commonly used commercial pollinators, *Megachile rotundata*, the alfalfa leafcutting bee, and the blue orchard bee (*Osmia lignaria*), a pollinator of apples, use exiting holes. Such beneficial species are easily persuaded to use artificial nesting blocks in backyards or agricultural fields.

A final group of species are the mason bees. These aptly named artisans construct hard heavy nests of mud. In areas with moist clayey soil, they can be seen rolling little balls of mud with their mandibles and feet and tucking them up under their chin for transport back to the nesting site. Nest may be attached to rock, twigs or branches, or to the walls, eaves or roofs of houses. They are sometimes a problem in rural areas of southern Europe where accumulations of nest material over many years may be heavy enough to collapse less sturdy roofs.

Bees are enthusiasts of flowers for compelling reasons: over the last 100 million or so years, their very existence has come to depend almost exclusively upon the nourishment offered by pollen and nectar. Not unexpectedly then, they are admirably attuned, morphologically, physiologically and behaviorly to manipulating flowers. But the bees that have rapidly expanded into these new niches eons ago have not remained simple exploiters. Instead, they have become winged appendages of flowering plants. Indeed, it was really the plants that started the whole business, probably because attracting insects was an effective way of trading gametes with another member of the species, *i.e.* reproducing sexually. After all, plants can't just retract their roots and boogie down to the nearest gathering place for some radical socializing. To get their genes next to some fresh (not to mention cute) genetic material, they need a go-between, a matchmaker. If flowering plants are the organic world's Miles Standishes, then bees are the flowering plant's John Aldens. Remember that next time you want to swat one.

BOTANICAL NAMES

-Margaret Williams. From the Northern Nevada Native Plant Society Newsletter, 16(4), 1990.

The suffix *cephala* used with an adjective describes the kind of heads a flower has:

megalocephala, macrocephala large heads
eriocephalum wooly heads
microcephala, microcephalum little head
sphaerocephalus round head
ochrocephalum yellow head
polycephalus many heads
chlorocephalus green heads
phaeocephala dark colored head

The suffix *-philus* means loving:

namophilum spring loving
petriphilus rock loving
anemophilus wind loving
oreophilus mountain loving

Russian Imports Include Devastating Pest

*From the **Bulletin** of the Native Plant Society of Oregon, March, 1992, Volume 25(3).*

With the end of the Cold War and the great improvements in relations with the former Soviet empire, it has been hoped that trade with Siberia would bring economic benefits to our region. Our loggers are at a cost disadvantage in competition with the Canadian and Southern timber regions, and historically have survived by offering higher quality old growth lumber at higher prices. Attempts are being made to import Siberian old growth to fill in at the mills. Many other goods are being imported also.

Whenever two geographical areas are linked by trade, the possibility exists for accidental introduction of disease or insect problems. In the case of Siberian trade, it is already to late to say "oops". Trappings indicate that the Asian gypsy moth has arrived in Oregon, Washington and British Columbia. At this time it appears numbers are small. Though technically the same species (*Lymantria dispar*) as the European race already present in this country, there are some important differences between the two races. The Asian race feeds on an even wider range of plant species than the European (which chooses from a list only 500 species long), and it grows faster. They are more cold hardy and could migrate farther north. A more threatening difference is that the female Asian gypsy moth can actually fly long distances before laying eggs. The European version can only glide a short distance. Hence

an infestation by Asian moths can spread very rapidly compared to one of the European strains. Russian officials state that the egg laying flights in Siberia can be so massive that the branches of birches are snapped off, as if covered by ice.

Regulatory agencies in both the US and Canada are looking into their options for control of this pest. The USDA Animal and Plant Health Inspection Service is coordinating efforts with Washington, Oregon, Idaho and California to pool resources and strategies in a regional project team. A detection and eradication plan is to be implemented by early spring. Estimates of economic damages possible from the Asian gypsy moth, including lost forests, start at 35 billion and go up from there.

Saving Endangered Plants While Stopping Grasshoppers

*-by Kurt W. Gutknecht, Editor of **Utah Science**, Agricultural Experiment Station, Utah State University. Reprinted from the March 1992 issue of **Sego Lily**, 15(2), a newsletter of the Utah Native Plant Society.*

When grasshoppers pillage rangelands, the fate of the dwarf bearclaw poppy and the silver pincushion cactus might hang in the balance.

Insecticides used to control grasshoppers may be the problem. The poppy, the cactus and dozens of other plants in Utah such as toad-flax cress and Jones cycladenia are on the brink of extinction. Insecticides that decimate pollinators along with grasshoppers could mean the irretrievable loss of these species.

Researchers are trying to determine which of these threatened and endangered plants depend on insects for pollination. If so, it may be necessary to protect them when insecticides are applied to control grasshoppers, perhaps by creating a "buffer zone" around known plant populations.

The problem is that no one knows how many of these species rely on pollination to reproduce, and, if they are pollinated, how they are pollinated, says Vince Tepedino, research entomologist with the Bee Biology and Systematics Laboratory (Agricultural Research Service) at USU. And it isn't easy to find out.

Simply getting to the plants can be difficult. Some isolated populations are reached only by backpacking to a remote site and camping there for several weeks. Once there, researchers spend hours on end hunkering over plants, mimicking natural pollination and snagging and identifying every insect that visits the flowers.

Since 1988, researchers have been scrutinizing about 20 of the 40 plant species in Nebraska, Colorado, Utah, Arizona and New Mexico that are listed as threatened or endangered. Many of these species are found on federally owned land where insecticides are occasionally applied to control severe grasshopper infestations. (In Utah, where the Bureau of Land Management and the Forest Service administer almost 60 percent of the land, 17 plant species are listed as threatened or endangered.)

Each species must be studied for 2 to 4 weeks to determine the type of pollination involved (plants can be self pollinated, cross pollinated or a combination of the two methods) and, if cross pollinated, which insects or other organisms are responsible.

It's painstaking, tedious work. Determining the type of pollination involves four or five treatments, each of which must be repeated 15 to 20 times, in which flowers are caged to exclude pollinators and grains of pollen are transferred by hand from the anthers to stigmatic surfaces. Some plants have such tiny reproductive parts that they must be pollinated under a microscope, no mean feat while hunched over a small plant in the middle of rangeland, forest or desert.

Plant may present nectar or pollen several times a day, so the insect visitors that are lured to these plants must also be sampled several times a day. "The only way to be sure that all potential pollinators have been collected is to sample when all insects are active, which is usually from sunrise to sundown," Tepedino says. Night collection may be required for a few night blooming plants.

"Surprisingly, almost all of the 20 species that we have studied so far are pollinated by insects or other organisms such as hummingbirds," Tepedino says. That was unexpected because insect visitation is generally considered to be density dependent; that is, the greater the number of plants of a species, the more insects they should attract.

Theoretically, as the number of these plants dwindled, there should have been a decline in the number of insects that pollinated these plants, thus creating selection pressure for self-pollination. Plants might also become less showy as their ability to attract insects becomes less important.

"This doesn't seem to be happening," Tepedino says.

What will happen if fewer pollinators visit plants? No one knows for certain, but it probably won't auger well for the plants. The detrimental effects depend on several factors, including the proportion of pollinators removed, the effectiveness of pollination, the seed bank in the soil, and the life span of a plant.

"We're not talking about a sudden elimination but a gradual decrease in recruitment. Short-lived perennials might hang on for decades, while long-lived perennials

might not be affected for hundreds of years. The situation would be much more critical for annuals and biennials, such as the few remaining clay phacelia found near Spanish Fork," Tepedino says.

The study is part of a larger integrated pest management project to find better and safer ways to control grasshoppers. The project involves several federal agencies and departments, and universities in several states.

Phase II of Bulb Labeling Agreement

(By Nina Marshall. Reprinted from the ***Berry Botanic Garden*** *Newsletter; Volume 5(2); Spring, 1992)*

Over the past decade concern has grown over the plight of bulbs and wildflowers collected for sale on the U.S. horticultural market. For years, gardeners have been buying plants such as the pink ladyslipper, the trillium, the winter daffodil (*Sternbergia* spp.) and the snowdrop (*Galanthus* spp.), without giving a thought to origin. Although many of these plants are thought to be propagated, in fact a significant proportion are collected from the wild. In some ares populations of wild plants are decreasing substantially because of collection pressures. Fortunately, awareness about wild plant conservation issues has increased in recent years. Progress has been made towards getting better information about the sources of plants in trade; gardeners are now better able to make informed choices about the plants they want to purchase for their gardens.

Much of the recent progress has been with the Dutch bulb industry, which is the largest in the world. In 1990, TRAFFIC (USA), the Natural Resources Defense Council, and the Fauna and Flora Preservation Society worked with industry representatives to develop a labeling system for bulbs in trade. Largely the result of pressure from the conservation community, this labeling agreement requires all Dutch bulbs to be labeled as to source by the year 1995.

The agreement is being implemented in three phases. The first phase which requires labeling of certain minor bulb species has already been implemented. Phase two, which requires labels for <u>all</u> minor bulbs, will came into affect July 1, 1992. Specifically, all minor bulbs exported from The Netherlands will be labeled either "Bulbs from wild source" or "Grown from cultivated stock". In the final phase, which will be implemented in 1995, all Dutch bulbs, including hybrids and cultivars, will bear labels indicating source.

The significance of this agreement is that the consumer now has information about whether the plants are of wild or propagated origin. For certain species which are rare or threatened, or for which information is lacking, this is a significant development that will allow the consumer to play a role in the conservation of wild plants. Consumers can send a message to vendors by restricting purchases to propagated plants or wild plants with a management plan.

It is important to note that this labeling agreement only pertains to the Dutch bulb industry. Although the Dutch dominate the world bulb industry, brokers from the U.S. and other countries buy bulbs and repackage them. Since these brokers are not a party to the labeling agreement, they are not obligated to comply with the labeling requirements. Consequently there are still numerous inconsistencies in the system that may confuse the consumer. Dutch packages will bear labels, but American packages containing the same species are likely not to. For this reason it is up to the gardeners not only to request source data from the vendor, but also to encourage American brokers to adopt the labeling system discussed above.

Percentage of all species (excluding plants) larger than a bumblebee: 1

Boise's Historical and Rare Tree Program

By Harold Robinson, Nursery Specialist, City of Boise/Urban Forestry Unit. Reprinted from ***Taproot,*** *March 1992.*

Trees have a popular appeal to almost everyone, especially those trees with historical, aesthetic or unusual qualities. The history of the United States abounds with references to trees.

The intent of Boise's Historical and Rare Tree Program is to increase public awareness of Boise's great tree resources, which will hopefully lead to a higher standard of appreciation and protection of trees throughout the city.

In August of 1987, the Urban Forestry Unit of the Boise Park System initiated a historical, rare tree search of Boise's trees. Boiseans were invited to nominate trees based on historical significance, rare botanical qualities or other unusual characteristics.

Since then, a total of 28 trees have been highlighted in a brochure, developed by the Urban Forestry Unit. We welcome any nominations of trees which you feel are worthy of special recognition. Together, we can work towards promoting the important role trees play in the City of Trees.

Examples of some of the types of trees found in this brochure are the Kentucky coffeetree (*Gymnocladus dioicus*), located in Julia Davis Park, northwest of the band shell. This tree was planted by W.E. Pierce in 1907. Pierce was Mayor of Boise from 1895-1897. It is the largest coffeetree known in our state. The name coffeetree originated from the efforts of early pioneers who tried to make coffee from the heavy, bitter seeds.

Another entry is a cucumbertree (*Magnolia acuminata*), located in Capitol Park across from the state capitol. This tree gets its name from the fleshy two to three inch long fruit which resembles a cucumber.

Still another entry is a giant sequoia (*Sequoiadendron giganteum*) located on the grounds of St. Luke's Regional Medical Center. This particular tree was brought from its native range in central California by Emil Grandjean, Idaho's first Regional Forester. It was a gift from Dr. Fred Pittender, a respected Boise physician. The tree has since grown to a height of more than 110 feet. Unfortunately, cold temperatures in the winter of 1990-1991 severely damaged this specimen tree, which was already under stress due to a poor rooting environment. Its survival is still in question.

If you would like a copy of Boise's brochure or a nomination form, you can contact the Boise Park System, located at 1104 Royal Boulevard., or call 384-4240.

According to a survey of botanists, the number of U.S. plant species that face "a real risk of extinction" within 5 years: 253.

Number of plant and animal species known to have become extinct on the North American continent since the arrival of European colonists at Plymouth Rock in 1620: at least 500.

Of the approximately 75,000 known edible plant species, the number that people have used for food: about 5000.

Annual value of medicinal drugs that contain active ingredients derived from plants: $40 billion.

Percentage of tropical plants that have been screened for potential medicinal drug use: <1%.

Portion of plant species that scientists believe contain compounds with ingredients active against cancer: 1 out of 10.

Cactus

-by Chris Davidson. Reprinted from the newsletter of the Idaho Botanical Garden; Fall 1991.

Contained in the cactus family (Cactaceae) are more than 2,000 species in 50 to 150 genera, depending on how finely one draws the distinctions. This is really a fascinating group of plants and has drawn a world-wide network of collectors, especially in Germany and Japan.

I once had a large collection of my own, assembled during field trips in California, Mexico and South America. I had to leave it in California when I moved back to Idaho because the climate here is too severe for most cacti. However, we do have a few native species and can coax some more from farther south to survive in the Intermountain region.

We are particularly pleased to have some of these on display in our cactus and succulent garden. Designed and installed by David Ballard, this garden was completed in the fall of 1990. By spring of 1991, we knew which ones were really hardy and which were not-- after the -25°F cold crunch, all but one of the species David had given to us lived. Joel Tannenholtz gave us several more valuable specimens this spring.

Because Idaho has only four or five native species of cacti, compared with the 1,000 or more found in Mexico, we are cactus-poor. Those who have experienced the cactus defence may rejoice at this -- but wait. They don't really mean to injure you. The spine, we presume, are a strong deterrent to browsers and only incidentally jump into the hands of zealous weeders (me) and careless wanderers (everyone else).

Our IBG cactus garden contains some very interesting natives. *Pediocactus simpsonii*, from Owyhee County, is found as single or clumped plants rising just above the ground surface. In the early spring, yellow flowers about 3/4 of an inch in diameter appear. A common name is "hedgehog cactus", but this could as easily apply to *Coryphantha*. We have two forms of *Coryphantha vivipara*: one has pink to reddish flowers, the other has yellowish-tinged flowers. The latter is sometimes separated as *C. missouriensis*.

Of the *Opuntias* or prickly pears, we have only two natives: *O. polycantha* and *O. fragilis*, both represented in the garden. The flowers are large and showy, but the

spininess is intimidating. I have seen hillsides covered with large clumps of the former species near Imnaha, Oregon, towards Hells Canyon. It must pull this kind of stunt in Idaho too, although when I floated the Lower Salmon and Snake rivers two years ago, I did not see any.

Once you get used to the idea of succulence, i.e. the fleshy water storage appearance of most catcti, it is irritating to learn that there are tropical and subtropical cacti with normal woody stems and typical broad green leaves, just like any other non-cactus. These (*Pereskia, Pereskiopsis, Maihuenia*) are indeed very spiney and have typical cactus flowers, but they are typically shrubby and not at all succulent. We assume for the time being that they are vestiges of the ancestral cacti from which the vast array of fat and spiny catus creatures have arisen.

There are also many tropical epiphytic cacti, typically succulent but not especially spiny, festooning tree branches throughout the moist and wet tropical forests of the New World. The habitat of the epiphyte, often high in the forest canopy, can be estremely hot and dry, thus the succulent habit of the cactus is well positioned for an invasion of this realm. Another interesting epiphytic cactus that is often available from greens dealers is *Rhipsalis*. Its slender stems, not much thicker than spaghetti in *R. capilliformis*, are gracefully pendant from their host branch and remind one more of a fountain than a cactus.

We can make a perfectly plausible argument that the cacti are the most interesting of all the flowering plants. That's really saying something because some other groups do have their champions. So I avoid this assertion and simply claim that the cacti are terrifically interesting and that they are oriented toward water conservation.

(Editor's Note: collecting of cacti from the wild is of concern to conservationists. Some species are threatened by collectors, and some local populations have been brought to extinction by overcollecting. Exercise care whenever you collect plants from the wild)

Favorite Places: North Fork of Hyndman Creek

-by Kristen Fletcher, Wood River Chapter

My favorite place to explore is the North Fork of Hyndman Creek in the Pioneer Mountains. It's a delightful, undulating moderate walk that offers a wide variety of environments to enjoy. The path follows a creek about 3 miles to a glaciated granite basin. On the way, it passes through old aspen groves with Basque arborglyphs from the turn of the century and through sagebrush meadows with volcanic buttes dotting the skyline which provides homes for a variety of raptors. Little springlets gurgle down the hills making soggy places for water-loving plants. Avalanche chutes are common, and bring down interesting debris for inspection. Heathers can be found on the dry hillsides under spruce. A little higher the limber pines begin and the views into the heart of the nearby Pioneers are breathtaking.

A connecting loop can be made by going up the steep switchbacks near the end of the canyon to Pioneer Cabin (maintained by the Forest Service), down into Corral Creek and on into Trail Creek, if a car has been left at this end. Another loop for compass and cross-country enthusiasts can be made by going through the basin and connecting to Hyndman Creek for the last decent to the parking area.

Learn the Gender of Your Genera

*- by Dr. Ken Chambers, Corvallis Chapter of the Oregon Native Plant Society. Reprinted from the newsletter of the Washington Native Plant Society, **Douglasia**, Spring 1992.*

The generic names of plants are derived from classical Greek and Latin, and in those languages there are three genders -- feminine, masculine and neuter. Nouns are the names of things; in Greek and Latin, every "thing" must be a "she," a "he," or an "it". To the ancient Romans, for example, each tree was a feminine "she" (*arbor*), each shrub a masculine "he" (*frutex*), and each stone a neuter "it" (*saxum*). Modern languages that are derived from or related to Greek or Latin usually retain masculine and feminine gender for a great many nouns which, in English, have become neuter. In German, for example, every plant has a feminine root (*die wurtzel*), masculine stem (*der stamm*), and neuter leaf (*das blatt*). French treats the stem as masculine (*le tronc*) and the root and leaf as feminine (*la racine, la feuille*).

Memorizing the genders of nouns is, to me, one of the

Number of taxa and distinct populations in U.S. on the official endangered and threatened list as of December 1, 1991: 617.

At current rate, the number of years it would take to officially list all U.S. species presently considered to be in danger of extinction: 50 years.

hardest chores when learning a foreign language. In English, we have done away with most of the gender-labeling of nouns, and nearly every object that is not evidently a male or female animal is considered to be of neuter gender (and hence an "it" -- the root, the stem, the leaf). Of course, a cow is still "she" and a bull "he," and sailors may affectionately refer to their ship as "she." Remember too that Jerome Kern wrote a song about "Old Man River, he just keeps rollin' along."

Because English has only the vestiges of gender-specific nouns, we may not realize how important gender is to the scientific naming of plants. Every plant has a two-word Latin name consisting of a "generic name" and a "specific epithet." As in the Latin language itself, each genus name has a particular gender, either feminine, masculine or neuter. When you learned the name *Rhododendron macrophyllum* for the common rhododendron, you may not realize that the final two letters of the species epithet, -um, are a clue to the gender of the generic name. The word *macrophyllum* is an adjective meaning "large leaved" in Latin, and the -um ending is a neuter suffix in the nominative case; therefore, *Rhododendron* must be a noun of neuter gender. The grammatical rule being followed here says that an adjective must agree in gender with the noun it modifies.

For species epithets that are adjectives, the most commonly seen suffixes are the feminine -a, the masculine -us, and the neuter -um. Also quite common is the suffix -is, indicating either feminine or masculine, versus -e indicating neuter. Generic names of trees offer good examples of the feminine gender; with few exceptions (*e.g., Acer*, neuter gender), all genera of trees are feminine, even if their names end with the seemingly masculine suffix -us. Note the feminine endings on the specific epithets of Pacific yew, *Taxus brevifolia*, red alder, *Alnus rubra*, and western larch, *Larix occidentalis*. Generic names of shrubs and herbs, however, can be masculine, feminine or neuter; no easy rules allow you to tell which is correct in a given case.

I might as well admit that my interest in this "problem" was stimulated by the discovery that I have consistently been using the wrong gender for two common plant genera in Oregon -- devil's club (*Oplopanax*) and woodland star (*Lithophragma*). For both genera, the spelling of the specific epithets is incorrect in nearly all the floras and reference books for Oregon! *Oplopanax*, which the "books" say has a neuter gender, is actually masculine; hence the plant's name must be spelled *Oplopanax horridus* (not "*horridum*"). *Lithophragma* has almost universally been considered to be feminine (standard references use feminine species epithets like *"parviflora," "tenella," "affinis"*, etc.), but it is actually a neuter name. This means that we must change the spellings of all its epithets to a neuter form. A complete list of *Lithophragma* species in Oregon therefore becomes: *L. affine, L. bulbiferum, L. campanulatum, L. glabrum, L. parviflorum, L. tennellum*. In 1963, the monographer of this genus, R.L. Taylor, pointed out that because of the Greek stem-word *phragma* (meaning fence or wall; compare "diaphragm") has neuter gender, the generic name *Lithophragma* (a compound word meaning "stone wall") must also be neuter, not feminine. The error goes back to 1840, when John Torrey and Asa Gray first published the genus name and assigned feminine gender to it. Their usage went against the classical (*i.e.*, ancient Greek) gender of the word, and therefore it must now be corrected. Dr. Taylor's discovery has unfortunately been overlooked in botanical works published since 1963.

A useful review of guidelines for assigning gender to generic names was published recently by Bruno Manara (Taxon 40:301-308, 1991). He echoed the advice given in the International Code of Botanical Nomenclature (1988, Article 76), that "a generic name retains the gender assigned by its author, unless this is contrary to botanical tradition." The "unless" is a very big exception, however, because "botanical tradition" is considered to extend back to the writings of the ancient Greeks and Romans! This is why *Lithophragma*, a compound name containing the Greek neuter stem-word *phragma*, cannot be feminine in gender as was previously thought.

Readers should be aware that not all specific epithets are adjectives agreeing in gender with the generic name. Some epithets based on personal names (*Dodecatheon*

Dispersal

Most conifer seeds are winged and are dispersed by the wind. Limber pine and white bark pine are not winged, but depend on stellar and pinyon jays and, most commonly, the clarks nutcracker.

The trees bear their cones turned up, with the tip of the cone easily accessible. The nutcracker carries seed up to several miles in a special pouch below its bill and buries them one to several at a time with its bill. The winter food supply for a single bird may consist of over 30,000 seeds. The seeds that the bird fails to recover may grow into new trees.

hendersonii, Penstemon barrettiae) have a suffix such as -i or -ae indicating possession (genitive case), irrespective of the gender of the genus. Other species epithets are nouns rather than adjectives and are called "substantive epithet". For these, the gender of the epithet is independent of the generic name. Examples in the Oregon flora include *Berberis aquifolium* (the epithet is an old out-of-use generic name, not an adjective; *Arctostaphylos uva-usi* (same origin as above); and *Sidalcea hirtipes* (the epithet is a noun meaning "hairy foot").

As an exercise in identifying genders, here are three examples of Oregon plant genera, with samples of specific epithets and their translations:

Amsinckia intermedia ("intermediate;" the -a ending shows that the genus name has feminine gender)

Amsinckia menziesii ("of menzies;" the -i ending is the genitive [possessive] case in Latin and is masculine because Dr. Archibald Menzies was himself of male gender)

Amsinckia lycopsoides ("resembling Lycopsis", a genus of Boraginaceae; the -oides ending shows that the epithet is a substantive which need not agree in gender with a genus)

Mimulus guttatus ("spotted;" the -us ending shows that the genus name has masculine gender)

Mimulus washingtonensis ("from the state of Washington"; the -ensis ending is masculine)

Delphinium trollifolium ("with leaves of Trollius," a genus of Ranunculaceae; the -um ending shows that the genus name has neuter gender)

Delphinium viridescens ("becoming green;" the -ens ending marks the epithet as a participle [a verb form], spelled the same regardless of gender)

Delphinium occidentale ("western;" the -e ending is neuter).

Due date for the next newsletter is September 15. The issue focus will be those less familiar "plants": mosses, fungi and lichens. Summaries of summer activities and field trips are encouraged. Early submissions will help get the newsletter back on schedule. Submission deadlines for the next three issues are as follows:

Issue	Submission Date	Subject
Aug/Sept	15 September	Mosses, Fungi, Lichens
Oct/Nov	20 October	Agency Programs
Nov/Dec	20 November	suggestions??

Field Trip Highlights: Saw-wah-be Chapter

-by Dave Burrup

Seven members of the Sah-wah-be chapter met at Riverside Campground on June 19 to look at the flora and fauna of Sawtell Peak. Sawtell Peak, south of Henry's Lake and west of Yellowstone National Park, rises to 9866 feet. The lower slopes are covered with a logged and unlogged lodge pole pine (*Pinus contorta*) community. Major components are common juniper (*Juniperus communis*), common snowberry (*Symphoricarpos albus*), ballhead sandwort (*Arenaria congesta*), sticky geranium (*Geranium viscosissimum*), valley cinquefoil (*Potentilla arguta*), silvery lupine (*Lupinus argenteus*), fireweed (*Epilobium angustifolium*), *Penstemon* sp., elk sedge (*Carex geyeri*), pinegrass (*Calamagrostis rubescens*), and Idaho fescue (*Festuca idahoensis*). Drier mid-slopes are covered with Douglas fir (*Pseudotsuga menziesii*) communities with understories of russet buffalo berry (*Sheperdia canadensis*), snowbrush (*Ceanothus velutinus*), birchleaf spiraea (*Spiraea betulifolia*), grouse huckleberry (*Vaccinium scoparium*), sweetroot (*Osmorhiza* sp.), silver lupine (*Lupinus argenteus*), *Penstemon* sp., heartleaf arnica (*Arnica cordifolia*), elk sedge (*Carex geyeri*), and pinegrass (*Calamagrostis rubescens*). Cooler wetter sites have subalpine fir (*Abies lasiocarpa*), Englemann spruce (*Picea engelmanii*), red elderberry (*Sambucus racemosa*), snowberry (*Symphoricarpos* sp.), stickseed (*Hackelia micrantha*), slim larkspur (*Delphinium depauperatum*), valerian (*Valeriana dioeca*), bracted lousewort (*Pedicularis bracteosa*), cinquefoil (*Potentilla* sp.), *Penstemon* sp., sickletop lousewort (*Pedicularis racemosa*), and sheep fescue (*Festuca ovina*). Near the tree line the forest community changes to whitebark pine (*Pinus albicaulis*), alpine prickly currant (*Ribes montigenum*), sickletop lousewort (*Pedicularis racemosa*), dogtoothed violet (*Erythronium grandiflorum*), spring beauty (*Claytonia lanceolata*), and sheep fescue (*Festuca ovina*). The summit of the mountain, nearly devoid of woody species, is composed of flowery phlox (*Phlox multiflora*), groundsel (*Senecio dimorphophylus*), moss campion (*Silene acaulis*), varileaf cinquefoil (*Potentilla diversifolia*), alpine smelowskia (*Smelowskia calycina*), alpine dusky maiden (*Chaenactis alpina*), Wyoming kittentails (*Besseya wyomingensis*), silky phacelia (*Phacelia sericia*), Parrys townsendia (*Townsendia parryi*), *Erigeron* sp., and diamondleaf saxifrage (*Saxifraga rhomboidia*).

We also saw deer, elk, moose, and 81 species of birds, the highlight being red-necked greebes on Silver Lake and great grey owls at Ponds Lodge.

SAGE NOTES is published bimonthly by the Idaho Native Plant Society, incorporated since 1977 under the laws of the State of Idaho. Newsletter ads are $2.00 for personal ads; Commercial advertisements: 1/8 page $5.00, 1/4 page $8.00, 1/2 page $15.00, and full page $25.00. Newsletter ads should be camera ready and accompanied by payment. Members and others are invited to submit material for publication in Sage Notes. Articles in any form, even hand-written (if legible!), are encouraged. Submissions on 5 1/4 or 3 1/2 inch floppy discs for an IBM computer in WordPerfect, Multimate or ascii file format are especially appreciated. Illustrations and even good quality photos may be reduced and incorporated into the newsletter. Computer disks, photos and illustrations will not be returned unless specifically requested. Provide a phone number in case the editors have questions on your materials. Send submissions directly to the newsletter editor: Caryl Elzinga; P.O. Box 182; Carmen, Idaho 83462. **Due date for material for the next newsletter is 15 September 1992.**

The purpose of the Idaho Native Plant Society (INPS) is to promote interest in native plants and to collect and disseminate information on all phases of the botany of native plants in Idaho, including educating the public to the value of the native flora and its habitats.

Membership is open to anyone interested in our native flora. Contributions to our Society, are tax deductible. Send dues and all correspondence to I.N.P.S., Box 9451, Boise, ID 83707.

Please include me as an Idaho Native Plant Society member.

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__ Pahove (Boise)

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__ Sah-wah-be (SE Idaho)

__ Upper Valley Chapter (Idaho Falls)

__ Wood River (Ketchum-Sun Valley) *Include $7 chapter dues*

__ None. Those who do not live near a chapter center are especially encouraged to join. We can put you in touch with other members in your area, and can coordinate with you on any state level activities you may with to be involved in. New chapters may be forming in eastern and northern Idaho.

*Household memberships are allocated two votes.

Idaho Native Plant Society
P.O. Box 9451
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Don't forget to pay your membership dues!

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Chapter News

PAHOVE

During the weekend of September 19 and 20, the Pahove Chapter had a booth at the Hyde Park Street Fair in Boise. We had a native plant seed display and also gave away several hundred native seed packets. Some people could not believe how small individual sagebrush or sand dropseed seeds are, and children enjoyed comparing and feeling the various seeds between their fingers. We also gave away lots of information on xeriscaping, rare plants in the Boise foothills, and membership brochures for the Society. The public's response at the street fair was positive, with landscaping and gardening with native plants probably generating the greatest interest.

Thanks to Pam Conley, Nancy Cole, Walter Hankins, Helen May, Agnes Miller, Paul Shaffer, Helen Ulmschneider and Linda Williams for their volunteer efforts to make the weekend a success. Special thanks to Ann DeBolt and Roger Rosentreter for donating the seeds.

October 15. Susan Borchers, plant ecologist for the Payette National Forest, presented "Flora and Ecosystems of Prince William Sound, Alaska".

November 19. Dr. Tim Smith, new botany professor at BSU will present a gentle initiation into the field of plant systematics. Take advantage of this introduction to a sometimes bewildering field, and meet the new botanist in town. BSU Science Building, Room 218, 7:30p.

SAH-WAH-BE

The Sah-Wah-Be chapter visited the Idaho Nature Conservancy's Silver Creek Preserve west of Picabo. Ruth Moorhead, interim president, led the day's activities for 16 members and guests from Pocatello, Blackfoot, Inkom and Denver.

They observed an intensive stream habitat restoration effort and the completion of the preserve's first year of water quality monitoring. A half-mile long self-guided nature trail has been developed, beginning and ending at the visitor's center.

A trail guide for the nature trail explains seven stops that include information on the area's geology, hydrology, vegetation (upland and riparian/wetland), native species, fisheries and water quality.

Members discovered numerous dried pale Solomon's seal with their dark berries. Fruits of other species were also observed. Highlights included blooming individuals of gentian, scarlet gilia, aster and evening primrose. There was a variety of aquatic plants seen.

Silver Creek Preserve is one of the last remaining examples of a high desert cold-spring ecosystem. The hundreds of springs that form Silver Creek emanate from huge underground aquifers. The chapter hiked to the headwaters to watch the springs bubble up and see the fish in the clear water.

-Lois Bates

BLM Joins Center for Plant Conservation to Protect Rare Plants

-by Leslie Robinette

To safeguard against the extinction of plants native to the Northwest, the U.S. Bureau of Land Management has joined efforts to sponsor rare plant species through the national Center for Plant Conservation (CPC). The Center maintains a comprehensive program of plant conservation, research, and education through cooperating regional centers.

In a June 9 ceremony, the Center presented BLM with a pair of original watercolors in recognition of the Vale District's sponsorship of two endangered eastern Oregon plant species.

Don Falk, Director for the Center for Plant Conservation, presented the paintings to BLM's Oregon/Washington State Director D. Dean Bibles, and to Vale's Associate District Manager Geoffrey Middaugh and district botanist Jean Findley.

The event took place in Portland at the Berry Botanic Garden, responsible for CPC's regional seed bank. The seed bank now contains more than 200 species, subspecies, and varieties of the region's rarest plants.

The efforts of dedicated botanists like Jean set a good example for other districts and other agencies to get involved in protecting and preserving rare plants throughout the region, said

Bibles. Only by ensuring their survival can we maintain the full variety within native ecosystems.

The watercolors, created by botanical artist Bobbi Angell, depict smooth blazing star and Biddle's lupine, both species sponsored by BLM. The agency is also a sponsor of Mulford's milk-vetch and Malheur wire-lettuce.

These paintings take the plants out of the background and focus on their beauty and uniqueness, said Dr. Linda McMahon, Executive Director of the Berry Botanic Garden.

Smooth blazing star, a small annual with yellow flowers, grows only on fragile ash outcrops in the desert of southeastern Oregon, northern Nevada and southwestern Idaho. The plant was petitioned as a threatened species in 1991 because of its extreme rarity, its narrow range and specific habitat, and its vulnerability to disturbance.

Biddle's lupine, which grows primarily on the border of Malheur and Harney counties, is a perennial lupine with light yellow flowers that bloom in early spring. The species, vulnerable to both rodents and human activities, grows only in Oregon.

BLM's Vale District became a sponsor of the rare plants in 1990 by contributing $5,000 per plant, an amount matched by the Mellon Foundation. Sponsorship contributions are used to maintain permanent seed banks kept at sub zero temperatures, as well as a living collection of endangered flora under protective cultivation. This strategy will prevent the total extinction of rare species and provide plants for reintroduction or studies as necessary.

The willingness of the BLM and others to sponsor rare plants provides continuing opportunities for scientists and biotechnicians to study them, explained McMahon. From the core collection, plants can be propagated for research that the wild populations are too fragile to endure. Conservationists managing these species in the wild can learn from horticultural experiments how to strengthen and increase those populations, helping them persist.

An Introduction to The "Weird" Plants

-by Caryl Elzinga, PhD.

Lichens, mosses, fungi, algae. This issue of SageNotes contains articles on some of these unfamiliar groups. Many folks who love botany are also interested in these organisms. What are they anyway? Are they plants?

Actually all have been or are plants, that is, classified with the more typical green vascular plants in the kingdom Plantae.

Fungi have been, and are still by some authors, considered plants but because there are some fundamental differences most taxonomists place fungi in a separate kingdom. First, fungi lack photosynthetic capabilities, although there are plants that are saprophytic also, relying on dead material for carbohydrates. Second, the cell walls of fungi are composed primarily of chitin (also found in the shells of arthropods-- spiders, insects, ticks, crayfish, lobsters), differing from the cellulose walls of plants. Last, fungi are not multicellular like plants and animals. The cell walls, if present at all, tend to be incomplete and the cell liquids thus tend to be continuous.

Fungi reproduce by spores, which are single cells containing one set of chromosomes, a condition termed "haploid" (most cells in your body and in plants contain two sets ["diploid"], except for eggs and sperm). These single cells can multiply and grow and spread through the soil or through dead material, forming hairlike "mycelia". When two mating types of mycelia meet, they can form fruiting bodies -- the visible mushroom -- containing diploid cells. These divide into haploid spores, which you see as the powder released from mature mushrooms.

Species of fungi come in a diversity of forms, many of which are not easily seen. The most familiar are the mushrooms bought at the supermarket, but a variety of shapes and colors occur in the wild.

Algae are usually classified as plants, since they are photosynthetic. Algae can be unicellular or multicellular, thus some authors classify the unicellular algae as part of the kingdom Protista, along with unicellular animals. Multicellular algae are often differentiated into structures that serve similar functions to roots, leaves and stems. Seaweeds, for example, are multicellular algae with holdfasts to attach to a surface, flattened structures that look like leaves, and gas bladders that function as floats. Most have no structures, however, that are similar to the internal transportation system of vascular plants. Movement of nutrients, water, oxygen, and metabolic wastes is dependent on cell to cell movement, although some algae have tissue similar to the phloem (sugar highway) of vascular plants.

Mosses, or bryophytes (which includes hornworts and liverworts) are universally considered plants. They live on land, but lack the vascular system of the more familiar land plants.

Lichens look like plants, since they are often green. In reality, lichens are the happy union of two kingdoms, Plants and Fungi. Lichens are usually comprised of an algae and a fungus, or sometimes a photosynthetic bacteria (cyanobacteria) and a fungus.

Many of the differences between vascular plants, algae, mosses and lichens can be understood in terms of adaptations to their habitat. Algae and mosses both require moist to aquatic habitats. To live in a terrestrial world, plants need to be able to move water from the moist part of their environments (soil) to the dry aerial parts. Xylem performs that function. Algae and mosses lack xylem. Thus they must live in water, like the large seaweed, or be small enough that transportion is relatively easy, like mosses. Moving photosynthetic products from the top (leaves) down (roots) also requires a highway system in vascular plants (phloem). Multicellular algae solve this problem by being all green-- most of their biomass is photosynthetic. Terrestrial plants also must have some means of support since they are no longer supported by water. That means specialized

tissue and structures to hold the plant up. Algae depend on the water for support, mosses remain small enough to avoid the problem.

The main problem, however, that land plants need to overcome is to carry out reproduction without water through which a flagellated sperm can swim, and to protect the early embryo from dessication. As you might guess the sex life and the life cycle of vascular plants differ radically from that of mosses and algae.

> Hair lichens are most abundant in old moist forests, where they may produce up to 1.3 tons per acre.

The life cycle of most multicellular algae follows this sequence: The plants develop spores which are haploid (half the number of regular chromosomes). These "plants" are one-celled and have a flagella, a little tail, that enables them to swim happily about for awhile until they settle down and grow into a visable "plant", sometimes larger than the original diploid plant, but usually smaller. Some cells in this haploid plant will specialize to form gametes (eggs and sperm are gametes, but in algae there is no real male or female). Gametes from different plants can fuse in fertilization and form a single-celled, flagellated embryonic "plant". Again the plant can swim around until it eventually settles down and grows into a more plantlike multicellular diploid plant, which can form haploid spores.

> Since to a hair lichen, prolonged snow cover means death, the lower limit on trees provides a rough estimate of winter snow depth.

Mosses still need to swim for sex, but they have developed some special structures to help. The life cycle is easiest to explain starting with the haploid plant. This is the leafy green part that is most familiar, but remember, this structure has only half the chromosomes. This plant developes two types of reproductive structures. Some will form flagellated gametes, others non-motile gametes. If there is a film of moisture on the "leaves" of the plant, such as from heavy dew, the flagellated gametes swim to the specialized structures containing the non-motile ones, and a happy union occurs. This now diploid cell will grow into the diploid plant that is attached to, and slightly parasitic on, the haploid plant below. These are the little brown stalks with caps that you see on the top of leafy green moss. These diploid plants produce haploid spores, just like algae. Instead of swimming around, however, these spores are encased in a specialized wall that resists drying out.

In most familiar land plants, the haploid generation never forms a distinct "plant". The pollen grain can be considered the male haploid generation, the eggs and parts of what will become the seed can be considered the female haploid generation. Instead of the male gamete swimming to the egg, a pollen grain that lands on a stigma will sprout a pollen tube that grows down to the egg in the ovary, where fertilization takes place. None of this swimming freely about stuff. Seeds are packages that encase the embryonic diploid plant.

The algae living in lichen have developed an alternative approach to dealing with life on land. Structurally, the lichen consists of algal cells that are surrounded, or sometimes even infiltrated by filaments of fungi. Both partners can grow alone, although their partnership allows both to live where they otherwise could not.

Lichens can inhabit some of the harshes environments on earth, places a moisture loving alga could never dream of occupying on its own. The common arctic reindeer moss, for example, is no moss at all, but is the lichen *Cladonia*. The associated fungi provides a suitably moist environment for the algae. Conversely, the fungi derives the benefits of a food source from the photosynthetic activity of the algae.

Lichens reproduce through fragmentation of the body, or by the production of specialized structures called soredia. These generally consist of a few algal cells surrounded by fungal hyphae. They are sometimes light enough to float in the air, thus dispersing long distances.

Lichens demonstrate a range of diversity in color and form. Hair lichens are long and stringy. Crustose lichens form colorful plaques on rocks. Some rangeland lichens look like mint green cauliflower florets.

Lichens, algae, mosses, fungi are different, but fascinating "plants". Hopefully articles in this issue, and perhaps in issues to come, will spur you to learn about organisms that all have at one time been considered the domain of botanists.

The Role of Microbiotic Plants in the Sagebrush Steppe

-by Roger Rosentreter, PhD.

Microbiotic plants include mosses, lichens and algae that grow directly on the soil. They occur among and beneath the scattered clumps of shrubs and perennial grasses. These plants cushion the impact of rain drops and increase soil moisture infiltration. Once moisture is in the soil, microbiotic plants act as an organic mulch by shading, cooling, and decreasing evaporation of soil moisture. Thus, sites with well developed microbiotic plants will retain more soil moisture within the soil profile.

Some of the organisms in the soil and within the lichens are blue-green bacteria or "cyanobacteria" (note that these are sometimes called "blue-green algae"; they are not algae at all).

Cyanobacteria will fix atmospheric nitrogen and change it into a form (nitrate) that other plants can utilize. Nitrogen is the second most limiting factor after moisture in the sagebrush steppe. Therefore, the additional input of nitrogen by the bacteria and lichens is important for them and for their neighbors. These lower plants lack a waxy epidermis for retaining the nitrogen, so it is simply "leaked out" into the surrounding soil.

Studies have shown that fewer seeds germinate in areas covered by microbiotic plants, but more total plants become established compared to bare soil sites (Harper and St. Clair, 1985). Without the microbiotic plants, the bare soil sites are harsh, with greater temperature extremes and less moisture retention. Microbiotic plants may also serve as a check for invasion by exotic annuals. For example, cheatgrass will invade bare soil sites much more densely than it will a site colonized by microbiotic plants.

During much of the summer and fall, the sagebrush steppe is dry and susceptible to extreme wind erosion. Where colonies of microbiotic plants are intact, they protect and hold the soil in place, reducing this wind erosion. When they are absent, much valuable topsoil is lost.

When microbiotic plants are moist, they are pliable and resistant to livestock trampling. Once the soil surface dries, however, trampling will break apart the plant's network of microscopic, root-like rhyzoids, severely damaging the crust they form. Historically, it appears that the native ungulates, such as deer and pronghorn antelope, stayed in the higher country until winter weather drove them down to the sagebrush steppe. With moist or frozen surface soils, the animals could walk on the microbiotic plants with minimal impact. In spring, the animals moved to higher elevations before the soils completely dried, again with minimal impact. Season of use for livestock should include consideration of microbiotic plants and soil moisture, for protection of the plants, and ultimately, for protection of the watershed.

Literature Cited

Harper, K.T. and L.L. St. Clair. 1985. Cryptogamic soil crusts on arid and semi-arid rangelands in Utah: effects on seedling establishment and soil stability. BLM contract report; Utah State Office; Salt Lake City, Utah.

Fungi can be classified into three groups. The first are the parasites which feed on, and eventually kill, their hosts. The second group are the saprophytes, which decompose dead material. The third group are the mycorrhizal fungi, which form a symbiotic relationship with their host organism.

On Finding Something Strange in the Woods

-By Bob Chehey, Southern Idaho Mycological Association

Let's say you're walking through the woods on a spring day. The sun is shining. *Calypso bulbosa* is in bloom. Tender fiddleheads and nettle shoots are beckoning for you to make a soup of them. Suddenly you almost step on some weird thing that looks like a conical sponge or a dropped plate of dark brown spaghetti or tiny stainless steel umbrellas or a goat's brain dyed tan. You step back and say "What in the heck is that?!"

That, my friend, may well be a mushroom. Sure, it doesn't look like the kind you buy in the store, but then all wild plants don't look like cabbage. Wild mushrooms come in a huge variety of edibility, color and form, just as wild plants and animals do.

What are mushrooms? Mushrooms are the sexual fruiting bodies of some of the most highly evolved fungi. Most fungi haven't even heard of sex yet, but the mushrooms have. The sexes live apart for much of their lives, invading soil, compost, wood, and even living plants and animals with fine, thread-like mycelia. When two mycelia of opposite sexes (or mating types, as mycologists unromantically call them) meet, they combine and produce a larger, coarser type of mycelium. You may well have seen it as a cottony mass on logs near melting snow or holding together the needles on the forest floor. And, as in all such unions, they usually bear fruit.

Fungi, and especially mushrooms, have been treated as plants for most of the time they've been known. Plants, however, are one thing fungi are not - stationary. Many fungi really do move. Fungi also differ from plants in that their cell walls are more like a lobster shell than wood. Recently, nucleic acid studies have shown them to be more closely related to animals than higher plants, so generally taxonomists now place fungi into their own kingdom.

That kingdom is not a small one. Sure, fungi are usually small in stature, but they are huge in terms of biomass. They are pretty big in the number of species department as well.

Mushrooms can be found anywhere you look for wild plants. They are found in tundra, taiga, forest, scrub, prairie, steppe and desert. They are found from the tropics to the arctic. In fact, you're more likely to find them in a place you look for plants because they are usually associated with plants in one way or another.

Some, like the honey mushroom (*Armillariella mellea*) or the fairy ring (*Marasmius oreades*) can actually suck the life out of living plants. Some, like *Cordyceps militaris*, kill and feed off the bodies of insects. Many more feed on the leaves and wood of dead plants. Some of these are so specialized that they feed only on the cones of one species of spruce or magnolia. Some, contrary to our purposes, cause dry rot in old floor joists or

bridge timbers. But most are symbiotic with higher plants, providing minerals and water in return for carbohydrates.

There is a certain kind of person who has to ask, "What are they good for?" I've already alluded to the facts that they are important decomposers in the environment, and that most plants cannot thrive without a fungal partner, but they have other uses as well. Many have been used for dyes, poisons, medicines from folk remedies to anti-cancer drugs and antibiotics, and, of course, some are just darn good to eat.

This brings up one of the most commonly asked questions that any amateur or professional mycologist faces: "How do you know which ones to eat?" The correct answer satisfies no one who asks. My version is, "Don't eat any mushroom you cannot accurately name, and don't believe any rules anyone has ever told you, except this one." Most berry pickers use this rule, even if they don't know it.

Probably only ten percent of wild mushrooms are dangerously poisonous. Another ten percent are edible and good to outrageous. The rest range from harmless, but taste like cardboard, to "I've been in this bathroom for six hours and I'm afraid to leave."

If you would like to find out more about mushrooms, Southern Idaho Mycological Association (SIMA) meets in the botany lab on the second floor of the new science building at BSU. Their meetings are held the second Monday of each month, except June and September when forays replace the meetings. Similar clubs are found in Coeur d'Alene and Pocatello. In addition, classes in amateur mycology are usually taught in the spring through community education programs. BSU and UI and probably ISU offer mycology courses as well.

Returning to the question you asked in the first paragraph, the umbrellas are *Lyophyllum montanum* (better not eat it). The goat's brains are *Gyromitra gigas* - edible, good and popular. the spaghetti may be its sometimes deadly cousin, *Gyromitra esculenta*. But the conical sponge is likely to be a mushroom that is so desirable that forests have been burnt just to induce its fruiting, so popular that many people will not tell you where they find it, the ingredient that can turn your cream of fiddlehead and nettle soup into nectar fit for the gods, *Morchella esculenta*, The Morel.

Poikilohydrics -vs- Homoiohydrics

-by Roger Rosentreter, PhD.

What type of land plant would you like to be? A Poikilohydric or a Homoiohydric? Homoiohydrics need to maintain water within their cells at all times to continue to persist. They can not totally dry up. Many of these types of plants are damaged or die from the drought conditions we are currently experiencing. These include plants such as forbs, and pine trees.

Poikilohydrics can totally dry up without harm or damage. They have cells which are tolerant of completely drying up. They are not damaged by drought conditions. These plants include some of the mosses and lichens and even certain algae.

How can poikilohydrics survive the drought? Homoiohydrics have large cells with internal water vacuoles that rip apart and are destroyed if they dry out. Poikilohydrics have smaller cells and many small water vacuoles within each cell. Poikilohydric plants match their water content with the humidity of their surroundings. The humidity threshold for activity is species-specific and determines the preferred range of distribution of the various species.

Poikilohydrics can compete in sites that are frequently dried up or have harsh weather conditions. The frequency of drying may determine the type of plant that occurs in a given site and substrate. Recent volcanic rocks and thin soil over rock are often sites dominated by Poikilohydrics. So think about your favorite site, to watch the sunset and dream about being a Poikilohydric plant. Think fast, though, before you dry up!

Woven-spore Lichen, a Biotic Soil Crust Rarity

-by Ann DeBolt, Pahove, BLM Boise District Botanist

Woven-spore lichen (*Texosporium sancti-jacobi*), the only species within the genus Texosporium, is a globally rare plant, rated by the INPS as a Priority 1 species. Based upon 1991 survey results, the lichen was recommended as an addition to the USFWS list of federal candidate species. It would thus become the first non-vascular candidate plant species for Idaho.

Woven-spore lichen is known from three general locations worldwide, including: Ada County, Idaho, near Boise and Kuna; Pinnacles National Monument in California; and sites near Culver, Oregon (McCune 1992). A historic site near San Diego, CA has not been revisited, but it is likely that most or all of those populations have been destroyed (McCune 1992). A total of ten known populations are known from the three principal worldwide locations.

To find this lichen is a true challenge, best done by crawling

on one's hands and knees. It forms an inconspicuous greyish crust on soil and organic matter, especially dead Sandberg's bluegrass (*Poa secunda*) clumps, and in some cases, old rabbit pellets (McCune 1992). In Idaho, the habitat consists of Wyoming sagebrush, Thurber's needlegrass, and bluebunch wheatgrass. Interestingly, three of the four Idaho populations occur on sites where slickspot peppergrass (*Lepidium papilliferum*), a federal candidate (C2) plant, is also present.

While woven-spore lichen has small reproductive structures (apothecia), they are a distinctive greenish-yellow color, readily distinguishable from any other component of the soil's biotic crust. The name *Texosporium* refers to the Latin *texere*, to weave, in reference to the woven appearance of the spore coat (Tibell and Hofsten 1968).

Several factors may contribute to the geographic rarity of woven-spore lichen (McCune 1992). First, it appears to be intolerant of saline and calcareous substrates, both widespread in the arid west. Secondly, it is intolerant of heavily disturbed sites. Grazing disrupts the biotic soil crust, promoting habitat conversion from sagebrush-bunchgrass communities to annual grasslands dominated by *Bromus* species, especially *B. tectorum*. Suitable microhabitats may also contribute to the lichen's very restricted range.

Woven-spore lichen is potentially valuable as an indicator species for sagebrush steppe communities (McCune 1992). Its presence may serve as an indicator of extended periods without fire and overgrazing. However, much more must be learned about the dynamics of biotic crusts and their resilience to various types of disturbance before we can understand *Texosporium*'s place in arid ecosystems.

Literature Cited

McCune, B.P. 1992. Status of a globally ranked (G2) rare lichen species, *Texosporium sancti-jacobi*. Unpublished report, Cooperative Challenge Cost Share Project, Boise District BLM. 38 pages.

Tibell, L. and A.V. Hofsten. 1968. Spore evolution of the lichen *Texosporium sancti-jacobi* (*Cyphelium sancti-jacobi*). Mycologia 110:553-558.

Mycorrhizal fungi are symbiotic organisms- they form partnerships. The fungi grows as a network of fine threads, some of which surround or even penetrate the cells within the root tips of its partner host. The roots and the fungi together are called mycorrhizae, or "fungus roots". The fungus helps the host plant by extracting phosphorus and other nutrients from the soil. The host plant provides carbohydrates to the fungus.

Tumbleweed Lichens

-by Roger Rosentreter, PhD.

Rolling across the desert comes the biggest tumbleweed lichen I have ever seen. I peer out from behind the sagebrush looking for another tumbleweed lichen, as the wind blows my hat off into the dirt. Why are these lichens blowing around? Don't they have a home, a habitat? How can they set up shop and start reproducing without settling down?

These lichens occur in cool windy habitats over shallow, sometimes ephemerally flooded soil, or on calcareous gravel. They prefer windswept, sparsely vegetated sites with little or no accumulation of litter.

How do these lichens reproduce? Some will produce spores, but most species merely fragment into pieces and begin growing larger again. In fact, most of these species have no common sexual form of reproduction. Nor do they have specialized, asexual forms of reproduction. Perhaps they are all clones of each other?

Idaho has more than its share of tumbleweed lichens. There are many different species within a number of genera, including *Xanthoparmelia*, *Rhizoplaca*, *Aspicilia*, and *Dermatocarpon*.

Montana Lichens..The Big Picture

--by Bruce McCune, PhD., Oregon State University. Reprinted from Kelseya, the newsletter of the Montana Native Plant Society, Volume 3(1), Fall 1989.

Vascular plant botanists who tend to view the end of summer as the beginning of the doldrums (leading inevitably to cabin fever season) should take advantage of the next few Indian Summer days to step outside and enjoy a bit of lichenizing.

Montana is so diverse environmentally that a casual observer can see large differences in the lichen flora over short distances. Although they respond to very small scale differences (such as bark furrow vs. ridge), you can also see differences across such larger gradients from your car at 55mph. Here are a few observations about regional differences in the lichen flora of Montana.

The continental divide sets up a major contrast between the heavy lichen flora on trees on the west slope as opposed to sparse epiphytic flora on the east slope. The best pass I know for seeing this is Marias Pass, just south of Glacier Park (Chief Joseph, Rogers and Logan Passes are OK too; Homestake Pass is poorer for the road down to Butte is cut into exposed south and west-facing slopes). There are lodgepole pine forests on both sides of Marias Pass. On the west side they are heavily clothed with lichens, the most prominent genus from a distance being *Bryoria*. There are about a dozen species of *Bryoria* in Montana and all are brown to blackish and stringy in appearance; they were formerly in the genus *Alectoria*, which now includes just straw to green colored stringy species.

Bryoria varies in appearance from horsehair to more kinky -- somewhat like steel wool. There, you've just learned your first lichen genera. That didn't hurt, did it?

The east side of Marias Pass is by no means a total loss. You just have to turn your eyes from the trees to the rocks, where you'll see a great diversity of species, many of them crustose. Pick any exposed outcrop -- you should see from one dozen to several dozen species on the typical square meter of rock. Limestones have almost completely different lichen communities from non-calcareous rocks. In general, lichen are more prominent on siliceous rocks, although there are exceptions to this. For instance, wherever the Madison Limestone outcrops, you are likely to see some huge areas splattered by the small orange foliose lichen *Xanthoria*. Good spots are 1) the Clark Fork valley between Drummond and Bearmouth; 2) along the Big Hole River between Wise River and Divide; and 3) Jefferson Canyon between Cardwell and Three Forks (all of these on Madison Limestone). This species is also common on acidic rock, but generally doesn't develop the same level of dominance as on calcareous rock.

Another kind of lichen "paint" easily seen on distant rocks is the yellowish-green *Acarospora chlorophana*. This crustose species is a vivid fluorescent yellow green when seen up close. It is mainly found on acid rocks, especially vertical or overhanging cliff faces on granite (both sides of the Divide). Virtually every siliceous rocky summit in Montana has some of this lichen.

The color of *A. chlorophana* is similar to the most garish of Montana lichen, the genus *Letharia*. These are bushy fruticose species, colored a stunning fluorescent chartreuse. Most often they grow on trees. The common name is wolf lichen" -- so named because the compound responsible for the garish color, vulpinic acid, is toxic to animals, and reportedly has been used to poison wolves in Scandinavia. There are two species in Montana. *Letharia columbiana* is almost always fertile, having brown apothecia (fruiting disks), and is found most often in subalpine forests and on isolated ridgetop trees. *L. vulpina* closely resembles *L. columbiana* but reproduces asexually by (and can be identified by) its powdery to granular propagules (soredia). It can be found at all elevations where there are trees and is more common than *L. columbiana*.

You can tell you're under strong oceanic influence when you see long streamers of greenish to yellowish *Alectoria sarmentosa* hanging from the conifers. Good places include the northern Swan Valley, the Lake McDonald area of Glacier Park, and just over the Idaho border in the Lochsa Valley. Another genus that is most prominent in the wetter climates of Montana (but also throughout western Montana forests) is *Hypogymnia*. From a distance, this genus gives tree branches a grayish wooly appearance. All members have hollow lobes (appearing inflated) and are generally white to gray above and black below. Although there are eight or so species in Montana, each with its own distribution pattern, the genus is generally most abundant west of the Divide. Moist forests of low- to mid- elevations have the greatest diversity of *Hypogymnia*.

But in south central Montana, yellow-green is the color of lichenized tree branches. The yellowish tinge is the color of usnic acid, the dominant secondary chemical in the genus *Usnea*. Up close, these are tufted or drooping fruticose species, generally with lots of small, erect branchlets. Because *Bryoria* and *Hypogymnia* are much less abundant and *Unsea* dominates, trees of the Gallatin Canyon and around the Madison Valley look yellowish green below the living branches.

Lichens on soil also show interesting regional patterns in Montana. East of the Divide on noncalcareous soils, there is a common vagrant lichen, *Xanthoparmelia chlorochroa*. This yellowish green lichen (also containing usnic acid) is foliose but forms tufts about 2-4cm broad. These lie loose on the ground. Look for them on open sites (sagebrush, rabbitbrush, grasslands), though you will seldom see this species west of the Divide. Calcareous soils have a variety of interesting crustose and small foliose lichens, one of the most prominent being the nitrogen-fixing, dull black *Collema tenax*. This one forms soil crusts on arid soils, usually in mixture with mosses, lichens and algae.

In western Montana, the most prominent ground lichens are in two genera: large-lobed, sprawling *Peltigera* and a genus with upright stalks (often tipped with cups), *Cladonia*. There are about 20 species of *Peltigera* in Montana and 50 species of *Cladonia*. There are two main groups of *Peltigera*: one group with a dominant green alga, giving the lichen a bright green appearance when wet (they look like they belong in a salad but are actually barely edible), the other group with a dominant blue-green "alga" which gives the lichen a grayish, blue-gray or blue-green color when wet.

In some ways, the distributional patterns in lichens seem to parallel those of vascular plants: Pacific coastal, boreal, cordilleran, intermountain, arctic-alpine, and Great Plains floristic elements are all represented. There are some other curious patterns, however, that may or may not be parallelled

> Some conifers can have as many as a 100 different species of fungi that serve as mycorrhizal partners.

> Mycorrhizal fungi often produce fruiting bodies. These are called "mushrooms" when they occur above ground and "truffles" when they grow below.

by vascular plants. For instance, a few lichens are known only from the western American alpine and the southwest coast of Greenland. One of these species, *Bryoria subdivergens*, is a ground-dwelling species that is so far known only from Greenland and several granitic summits in the Bitteroot Range. One of the few aquatic foliose lichens, *Hydrothyria venosa*, is known only from the Appalachians, a single site in the northern Rockies, and the west slope of the Cascades-Sierra axis.

Lichenology in Montana is in an exciting state of rapid discovery. Range extensions and new records for North America are fairly common. There are frequently new species; however, most of these are few -- if any -- lichen species endemic to Montana. There are certainly rare species of lichens, but with our present level of knowledge, it is sometimes difficult to be sure which are the rare and which the poorly known species.

Because there is no lichenological equivalent to Hitchcock and Cronquist (**Vascular Plants of the Pacific Northwest**), serious lichen identification requires a good collection of the primary literature, a big obstacle to beginners. Novices should use Mason Hale's **How to Know the Lichens** and a hand lens or dissecting scope. For Montanans, the second edition is much improved over the first edition, partly because the second incorporates Hale's teaching experience at the Flathead Lake Biological Station. The recent book by Vitt, *et al* on **Mosses, Lichens and Ferns of Northwest North America** has some good photos but many common Montana lichens have been omitted. *(See Good Stuff for ordering info. --ed)* Some lichenologists, including myself, are happy to exchange our identifications for well-labeled duplicates. My address is: Department of General Science, Oregon State University, Weniger Hall 355, Corvallis, OR 97331-8605.

Genetically Altered Fungus Used on Missoula Weeds

--from Kelseya, a newsletter of the Montana Native Plant Society, Volume 3(1), Fall 1989. While this article is somewhat dated, it may be of interest to readers. More information is likely available from MSU or the Missoula County CD.

Two strains of a genetically altered fungus were used in weed control experiments at sites in Missoula this past summer.

The applications were made to weeds in vacant lots of the Big Flat area of Missoula under the direction of Gregory Kennet, Missoula County Conservation District officer and project coordinator for the experiments.

Montana State University plant pathologist Dave Sands says the goal of the release in Missoula is to control broadleafed weeds in a manner that is environmentally safer than chemical herbicides.

"This fungus occurs naturally on food crops and will not grow at human body temperature," says Sands. Other research has shown it to have no adverse effects on mammals.

These fungi would not even harm nearby fields of wildflowers. However, if the wildflowers were broad leaved and in the field to which the fungi and a "vitamin" were added, the wildflowers would die along with the weeds.

Both applications involve strains of *Sclerotinia sclerotiorum* that have been altered by ultraviolet light.

Three years ago, these strains were released at a range site at the MSU Agricultural Experiment Station's Red Bluff Research Ranch in Madison County. As hoped, they did not survive the winter. From hundreds of selections of altered fungi, Sands, together with MSU plant pathologists Gene Ford and Vince Miller, chose these because their survival will be limited unless humans help them.

The first strain, called A1-PYR, was altered so that it can only live and reproduce if the area in which it is applied also contains a chemical that is not freely available in nature; without human help, it self-destructs.

The second strain, referred to as SL-1, cannot survive through the winter.

Creating biological control agents that self-destruct is the newest approach researchers are using to ensure that altered organisms have a minimum impact on our environment, says Sands.

Sands has been working with Kennet and University of Montana environmental analyst Don Bedunah for the last six years on *Sclerotinia sclerotiorum*.

One of the earliest indications that the fungus might be effective in weed control was its effect in nature on spotted knapweed that was observed in an irrigated alfalfa field in the Bitteroot Valley, according to Sands. He, Bedunah and Kennet released an unaltered form of the fungus on knapweed near the Lubrecht Experimental Forest two years ago and got about 80 percent control at one of the sites and less control at the other site, according to Bedunah.

The alterations in the *Sclerotinia* strains allow them to be contained on only specifically-treated areas, says Sands. The release was done under an Environmental Protection Agency permit issued to MSU.

A Bouquet of Algae

-by Loren Bahis. Reprinted from Kelseya, the newsletter of the Montana Native Plant Society, Volume 5(4), Summer 1992.

The number of plant species living in pristine streams in the Rocky Mountain Region of Montana is significantly smaller than the number in least-impaired streams in the Great Plains Region. This is one of the findings of the Montana Reference Stream Study currently being completed by the Montana Department of Health and Environmental Sciences (MDHES).

Algae, especially diatoms, account for most of the plant diversity in Montana streams. Often fifty or more species of

algae inhabit a single riffle. By comparison, not more than a few species of aquatic vascular plants or mosses are typically found in any given reach of a Montana stream.

The MDHES study conclues that the lower biotic diversity of mountain streams is mainly due to a more harsh habitat than that of prairie streams. Factors such as lower temperatures, faster flows and lower nutrient concentrations limit the number of niches available for plant species.

Fish also exhibit this same pattern in species richness. A pristine mountain stream typically has only two or three species of native fish (usually cutthroat trout and sculpin, and maybe bull trout). Its least-impaired counterpart on the plains, however, may support twenty or more species of fish, most of which are native.

Mountain streams and plains streams also support different types of algae. While blue-green algae (Phylum Cyanophyta) often dominate the algal biomass of mountain streams, green algae (Phylum Chlorophyta) dominate in plains streams. This is probably because blue-greens have a competitive advantage in nutrient poor streams becasue of their ability to "fix" atmospheric (molecular) nitrogen. Diatoms (Phylum Bacillariophyta) are abundant in streams of both regions.

Other data collect by MDHES shows that when an otherwise pristine stream receives a slight to moderate amount of disturbance or pollution (e.g. from logging, mining or agriculture), plant diversity actually increases. This increase is usually due to an influx of "trash" or "weed" species - the diatom equivalents of dandelions - which may displace indigenous species adapted to the harsh environments of our mountain streams. The net effect is an increase in plant diversity at the local (stream) level, but a decrease in regional and global diversity.

Heavy pollution caused by problems such as acid mine drainage or the discharge of untreated sewage will reverse this trend. Instead of increasing diversity, a decrease in species richness results. Disturbance or pollution, especially nutrient enrichment, causes a shift in dominance from blue-green to green algae.

Environmental specialists at MDHES hope to better define the ecological impacts of common pollutants such as nitrates left over from blasting in hard rock mines. By measuring features of impaired and unimpaired communities, we are refining the use of algae and aquatic insects as monitors of ecological integrity in streams. For now, we know that diversity in aquatic plants and insects is a very good gauge of our surface water quality.

Please note, the new address for the editor is P.O. Box 64, Tendoy, Idaho 83468.

Good Stuff

Three good sources of books are the Garden Book Network, Island Press and Patricia Ledlie, Bookseller. The Garden Book Network carries some gardening with native plant books, and a large number of books on gardening and landscaping. Patricia Ledlie carries a broad range of natural history books -- botany, plant ecology, floras-- each with a short description. Prices are reasonable. Island Press publishes many environmental books and their booklist includes books produced by other publishers.

Garden Book Network; Horticultural Publishing Co.; 111 N. Canal St.; Suite 545; Chicago, IL 60606-7203.

Patricia Ledlie Bookseller, Inc. One Bean Road, P.O. Box 90, Buckfield, ME 04220. 207-336-2778.

Island Press; P.O. Box 7; Covelo, CA 95428.

Guide to Information Sources in the Botanical Sciences by E.B. Davis may be just the book you need to determine what references you might want to have in your library. Davis gives brief descriptions of 720 titles, organized into the following categories: Bibliographic Tools (Abstracts, Indexes, Databases); Current Awareness Sources; Dictionaries and Encyclopedias; Handbooks, Method and Technique books; Dictionaries; Identification Sources (Atlases, Field Guides, Floras, Keys); Historical Materials; Textbooks; Publishers. The book is thorough, practical and very informative. It is available for about $35 from Libraries Unlimited; Littleton, Colorado. 175 pages. ISBN 0-87287-439-7.

Discovering Wild Plants: Alaska, Western Canada, The Northwest by Janice Schofield. 1989. Alaska Northwest Books, 354 pp, $35 hardcover. This book profiles the medicinal, cosmetic, historic and other uses of 130 plants. Each is well illustrated with line drawings and photographs. Habitat and range information, along with season of harvest is included. Directions for recipes, liqueurs, toddies, cakes, smoking blends, tinctures and other uses are outlined for each species. The book also has a summary of harvesting and drying herbs, flower essences, an herb directory and treatments for acute poisoning.

Mosses, Lichens and Ferns of North America by Dale Vitt, Janet Marsh and Robin Bovey. Available from University of Washington Press, P.O. Box 50096, Seattle, WA, 98145-5096 for $17.50 plus $2 p&h (price from a review in '89). More recently advertised as available from Lone Pine Publishers; 414, 10357-109 St.; Edmonton, Alberta T5J 1N3; 403-424-1278 for $24.95 The book is a non-technical field guide to ferns, bryophytes and lichens. The book covers the area from Alaska to southern Oregon, from the Pacific to Montana. The 288 page book has 410 color and 35 black and white illustrations of 370 species. Major vegetation zones associations are described and distribution maps are included.

SAGE NOTES is published bimonthly by the Idaho Native Plant Society, incorporated since 1977 under the laws of the State of Idaho. Newsletter ads are $2.00 for personal ads; Commercial advertisements: 1/8 page $5.00, 1/4 page $8.00, 1/2 page $15.00, and full page $25.00. Newsletter ads should be camera ready and accompanied by payment. Members and others are invited to submit material for publication in Sage Notes. Articles in any form, even hand-written (if legible!), are encouraged. Submissions on 5 1/4 or 3 1/2 inch floppy discs for an IBM computer in WordPerfect, Muitimate or ascii file format are especially appreciated. Illustrations and even good quality photos may be reduced and incorporated into the newsletter. Computer disks, photos and illustrations will not be returned unless specifically requested. Provide a phone number in case the editors have questions on your materials. Send submissions directly to the newsletter editor: Caryl Elzinga; P.O. Box 64; Tendoy, Idaho 83468. **Due date for material for the December newsletter is 30 November 1992.**

The purpose of the Idaho Native Plant Society (INPS) is to promote interest in native plants and to collect and disseminate information on all phases of the botany of native plants in Idaho, including educating the public to the value of the native flora and its habitats.

Membership is open to anyone interested in our native flora. Contributions to our Society, are tax deductible. Send dues and all correspondence to I.N.P.S., Box 9451, Boise, ID 83707.

Please include me as an Idaho Native Plant Society member.

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__ Sah-wah-be (SE Idaho)

__ Upper Valley Chapter (Idaho Falls)

__ Wood River (Ketchum-Sun Valley) *Include $7 chapter dues*

__ None. Those who do not live near a chapter center are especially encouraged to join. We can put you in touch with other members in your area, and can coordinate with you on any state level activities you may with to be involved in. New chapters may be forming in eastern and northern Idaho.

*Household memberships are allocated two votes.

Idaho Native Plant Society
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November 1992 * SAGENOTES * A Publication of the Idaho Native Plant Society * Vol 15(5)

State News

The **Annual INPS Rare Plant Conference** will be held in Boise on the 9th and 10th of February. More details will be in the next newsletters.

State INPS **Elections** will be coming up in early spring. Submit nominations for state officer positions to the Nomination Committee by January 10. They can be sent to the INPS address (back page).

The next newsletter should be printed on recycled paper.

Anyone with an idea for the 1993 annual meeting should contact a chapter or state officer.

Chapter News

Pahove *Submitted by Michael Mancuso, President*

December 17, 7:00p. The chapter enjoyed a Christmas dessert potluck at Kathy Geier-Hayes' home. Roger Rosentreter gave a talk on lichens.

January 21, 7:30p. The January meeting will feature Ann DeBolt, who recently completed her M.S. degree (congratulations, Ann!): "Everything you always wanted to know about Hackberry but were afraid to ask".

Pahove members should be on the lookout for a questionaire coming soon.

Calypso *Submitted by Pam Gontz, President*

The Calypso Chapter, in this, its second year, had a very productive and rewarding agenda.

Early last spring we learned that the biology department of one of our local school districts collected quite a few wildflowers for one of their projects. We wrote to that school district pointing out possible problems with the continual collection of our wildflowers and the drastic loss of habitat we are experiencing due to our fast development and growth. We also included in the letter possible alternatives to collecting. They responded favorably with several changes to their curriculum. Besides using films and slides, and educating the students on rare plants, they will be collecting weeds and a limited amount of the more prolific wildflowers for their spring project.

We also personally invited these biology students to the public Wildflower Walk we sponsored during National Wildflower Week. We had a wonderful turnout of approximately 30 people. Chapter members led small groups throughout the trails and pointed out various flowers, trees and shrubs. The enthusiasm to learn was incredible -- many of these people even wanted to learn more about grasses and sedges. We had handouts printed by the Idaho Panhandle National Forest with illustrations and descriptions by Pam Gontz. Pamphlets entitled "Summer Wildflowers of North Idaho", "Edible and Medicinal Plants of North Idaho", "Early Spring Wildflowers of North Idaho", and a "Wildflowers of North Idaho Coloring Book" were handed out to each individual. There was also a beautiful wildflower display at the forest service office designed by Jill Blake using photos by Pam Gontz. Jill Blake reported at our November meeting that our local effort during National Wildflower Week was commended by Washington D.C. Colorful camas to Jill Blake for spearheading this effort and to all those who volunteered at the wildflower walk.

A bluebell buttonaire to Bob Mathiasen for making all the arrangements and teaching the Wildflower Identification Class the Calypso Chapter sponsored last spring at North Idaho College. Bob put in a lot of work structuring the class which covered the major plant families, and donated his time so the money received, minus expenses, went to our chapter fund. Buttercup bouquets also go to John McMullen for adding his talents and assisting in teaching this class along with other chapter volunteers.

For Earth Day in April, the Calypso Chapter had an informational display at North Idaho College and handed out INPS brochures. Stunning Shooting Stars go to Pat Coleman for organizing this display and to Jill Blake, Cathy Snider and John Bentley for helping with this project.

We had several wonderful field trips this past summer. Our April trip led by John Bentley and Pat Coleman took in a popular natural area in downtown Coeur d'Alene. This Tubb's Hill outing presented a variety of spring flowers and shrubs.

Our trip to Berlin Flats campground near the Coeur d'Alene River for a habitat-type field outing was a success and was a great follow up to Rick's wonderful program on forest habitat types given in May.

Our second overnight outing took us into the beautiful Cow Creek area northwest of Bonners Ferry. Our leaders were Rob Bursick and Jill Blake. Monitoring plots were established in the area to study the effects of cattle and timber harvest on the bog area of Cow and Smith Creeks. We saw several rare and sensitive plants. One I'm sure we will all remember is *Carex leptalea* (Bristle-stalked sedge). The trek to see this rare sedge turned into a memorable one as we gently crossed bogs and high-centered on the deadfalls. This little excursion added to the excitment of seeing this rare sedge. Another interesting rare plant shown to us by Rob and Jill was *Scirpus hudsonianus* (Hudson's Bay bullrush). The only other known population of this tiny bullrush is found in Glacier Park.

Scirpus hudsonianus

Orchids and ovations to all those who led our field trips and to those members who participated in these these outings.

I would also like to hand out mosses and lichens to Pat Coleman for putting in a lot of time and effort in our newsletter, the Calpyso Companion, as well as all the other little things she does. The newsletter is a vital communication link to our members and Pat has done a wonderful job of keeping all informed.

Christmas Poinsettias and cheers to all the Calypso members for their support. If we didn't have members who generously share their time and expertise, we wouldn't have had the successful year that we did. We had great programs, wonderful field trips and interesting projects. Let's face it Calypso Chapter members, "we dun good"!

Christmas Plant Lore

-by Kathy Geier-Hayes, Pahove Chapter. This was originally printed in the December 1989 issue of SageNotes. Many new members have joined since then so it seemed appropriate to print it again so more people can enjoy it.

Few holidays are as closely associated with plants as Christmas. Holly, mistletoe and the scent of an evergreen tree all remind many of us of the holiday season. Many of these plants are ingrained as part of our celebration because they have been a part of Christmas as long as there has been Christmas; in fact, many of these plant traditions are older than Christmas. Most uses are based on early pagan practices which have merely persisted as the Church would allow.

In 336 A.D. the Church assigned December 25th as the birthdate of Christ. No one knew the actual date and a great deal of speculation and mysticism was used to arrive at this date as well as a little political savvy (historians now believe that Jesus was born sometime between May and October 7 B.C. - 5 B.C.). Throughout the "conversion" of the masses from paganism to Christianity most Church leaders recognized that they could not persuade the people to convert if they did away completely with popular traditions, so the Church attempted to supplant the pagan rituals with sacred rituals. The selection of December 25th by the Church appears to have been an attempt to turn the celebration of several secular feasts, which occurred near the end of December and the beginning of January, into a more sacred celebration. Four major events were celebrated from December 17 to January 1:

Saturnalia - the remembrance of the "Golden Age";

Sigillaria - the Feast of Dolls when children were showered with toys;

Brumalia - the celebration of the solstice;

Kalendae Januarii - the special feast of Childhood and Youth (rebirth) when gifts were given to everyone.

As long as the Church could endow celebration traditions with sacred meaning, the people were allowed to practice them.

The significance of evergreen boughs at Christmastime dates back to the Saturnalia. The Romans used the boughs to decorate their homes as an offering of winter hospitality to the spirits that haunted the forests; if they were kind to the spirits, the spirits would be kind to them in the following year. Though the early Church allowed many of the original traditions to remain in place, later Church officials forbade the use of greenery as a dangerous pagan custom. Decorating with evergreen boughs again became popular in the 16th century. However, it was considered foolhardy to bring the boughs in before Christmas Eve since once in the house, the mischievous spirits might create an uproar. The spirits revered the Christ Child, and by placing the boughs on Christmas Eve, one could hope that the Christ Child would appear before the spirits were able to organize their merriment.

Holly and ivy were also very commonly associated with paganism; holly was the talisman for men and ivy the symbol of women. In England, it was traditional for a maiden to protect herself from goblins on Christmas Eve by placing a berried holly sprig under her bed. The Church eventually assigned very sacred meaning to holly. With its prickly leaves and blood red berries, holly came to represent the Crown of Thorns worn by Christ.

For many years, holly and ivy were always used together. Early tradition espoused that whoever in the household brought

the most of their symbol during the holiday season (holly for men, ivy for women) should rule the house for the next year. Eventually, however, the two become antagonists. While holly became associated with life and immortality, ivy was associated with death and mortality. Eventually, ivy was kicked out of the house during the Christmas season while holly was given a place of honor. This parting of the ways may have been exacerbated by the Church; holly was considered very sacred while ivy never gained a foothold in Christian custom.

Other traditionally popular plants have lost favor at Christmas over the years. Rosemary was once considered one of the most important (and sacred) of all Christmas decorations. The odor of rosemary was thought to be very offensive to evil spirits, and the possessor of a sprig could consider themselves well protected. According to legend, rosemary acquired its fragrance when the swaddling clothes of the infant Jesus were laid on the plant to dry. The color of rosemary, which was originally white, changed to blue when the Virgin Mary, fleeing from Herod with Joseph and the baby, laid her blue cloak on a rosemary. For some unknown reason, use of rosemary fell out of favor during Victorian times.

Christmas trees have always had a place of honor in most Christian houses. Though pagan religions honored trees as symbols of eternal life, Christmas trees came about out of a Christian sentiment. The earliest story of Christ's association with trees comes from George Jacob, a 10th century Arabian geographer who described a miraculous event. On the night Jesus was born, all trees, even those weighed down by snow and ice, burst forth into bloom. From that, it became popular to force branches of hawthorn and cherry to bloom at Christmas. In wealthy households, whole trees were moved indoors for the festivities, and there was a great deal of rivalry as to who displayed the biggest tree. The use of evergreen trees started in Germany with a German folktale. The story goes that one lonely, bitterly cold Christmas Eve, a cold, hungry child appeared at the door of a German forester. He was warmly welcomed and treated with the best the meager household could offer. The next morning the family, roused by a choir of angels, found that they had entertained the Christ Child. As a gift for the hospitality, He took a fir twig, planted it in the ground and said "I have gladly received your gifts, and here is mine to you: this tree will never fail to bear fruit at Christmas and you shall always have abundance."

Eventually, naturally blooming trees were replaced by artificially decorated trees in Germany, and it was here that the Christmas tree began to come into its own. The "modern" Christmas tree is ascribed by some to Martin Luther, who, on a Christmas Eve, was entranced by the wonder and beauty of a starry night sky. As a tribute, he set up a tree illuminated with candles to represent the heavens from which Christ came for his children. The first mention of decorated Christmas trees was from Strassburg in 1604. The popularity of decorated trees spread from there throughout Germany and eventually throughout Europe. Christmas trees made their debut in Paris in 1840 and Queen Victoria set up a tree in Windsor Castle in 1841. Early emigrants from Germany and England introduced the custom of Christmas trees in America. In 1925, at noon on Christmas Day, the famous General Grant Giant Sequoia was designated as the Nation's Christmas Tree. The lighting of the Christmas tree in Washington D.C., however, has supplanted its importance.

While the set-up of Christmas decorations was traditionally done on Christmas Eve, the removal was determined by local customs and beliefs. The disposal of Christmas plant material was another ritual in itself. Decorations were never tossed willy-nilly into the yard to decompose or set out with the garbage. While some were carefully saved, or in some parts of Europe burned in sacred burnings (in other areas never burned), most were used somewhere in the household.

Though many of the plants that we associate with Christmas have come to us through popular legends and folklore, some are merely utilitarian. For example, few homes are without a poinsettia at Christmas. Poinsettias have become popular only because of their red and green color. To provide some significance for poinsettias, the Junior League developed a story about a little orphan girl, Maria, who was invited on Christmas Eve to the cathedral with some friends. She hesitated to go, having nothing to offer the Christ Child as a gift, but her friends assured her that they would find something on the way. Along the road they found a plant and gave it to Maria to take, telling her that even the humblest gift given with love is beautiful. Maria was upset about having to take a simple weed, but she gathered some and they went along. At the church she laid the dried brown stems in front of the nativity at the alter, offering them with love and respect. As she turned to go, the dead stems turned green and the upper leaves changed to a beautiful scarlet. The humble plant had changed into the miracle flower, the Flower of the Nativity.

Enjoy your holiday traditions and have a safe and happy holiday and New Year!

Museum of Natural History
Monthly Workdays

The Orma J. Smith Museum of Natural History needs volunteers for a number of museum tasks. People are also need to adopt old display cases for rebuilding/refinishing. Come to the workdays, January 9 and February 6 at the Boone Science Building. Enter via west end basement door, 7am until evening. For more information call Bill Clark (375-8605) or Eric Yensen (459-5331).

Get a Handle on Pronouncing Scientific Names

-by Larry Mellichamp. Reprinted from the Newsletter of the Northern Nevada Native Plant Society, Volume 18(4), May 1992.

Whythesolongnames? Whatever your reaction to the preceding "word" is probably your reaction to Latin names of plants. Did you try and figure it out, or did you just take one look and say: "not for me!"

Scientific names can, of course, be difficult to pronounce and understand, especially if you don't use them every day. You probably accept that the two-part name of each plant -- a genus and a species name -- is a necessary component of botanical science and that they are widely used and understood by professionals; but you hesitate to use a name when you want to talk with someone because you are afraid you'll say it wrong. Take heart, you are not alone. Just remember, Linnaeus began using this binomial nomenclature in 1753, not because he wanted to make things harder for you, but because Latin was the language of science and medicine (as well as religion and other fields) at the time. Believe me, his two part name for each species was a great simplification over the multi-word phrase names used earlier (sometimes involving a dozen or more Latin words, literally a mini-description of the plant). Today, Latin allows knowledgeable people around the world to communicate about plants, no matter what their native tongue, and without the confusion of common names.

Actually Latin names are not as difficult to pronounce as you might think. After all, most of the vowel sounds are similar to those in English words (that is, with long i and e); and you can think back to Latin names you already know when trying to say a new one, such as the familiar *Rosa, Tulipa, Astilbe, Geranium, Hosta, Spiraea* (remember this one for later!), *Salvia, Sedum, Lobelia, Cyclamen, Crocus*, and many more. There are long or short a's, u's, etc., and enunciation is controlled by these sounds. The other thing you can do is break the work into syllables, just as you would an English word, putting a vowel between two consonants and trying to sound them out. English has a great many difficult words and pronunciations, so we shouldn't let the fact that a Látin word looks different give us the notion that it is more troublesome to pronounce. I get more variations on "Mellichamp" than most Latin names I hear people trying to pronounce.

Latin names still give us problems, just because they are usually so unfamiliar. How do you learn to correctly pronounce a strange scientific plant name? The question is analogous to asking someone how to get to Chapel Hill. You ask three different people and you will get three different answers. It all depends on where you are coming from, how well you can remember details, your past experience, how much time you have, and whether you can practice. My advice is that you ask three experienced people, and take the best two out of three pronunciations. Much of the way people say Latin names depends on their experience -- how they first heard it pronounced. You can apply various rules of Latin pronunciation, but there will always be variations and differences of personal preference. There are two ways of pronouncing Latin: the so-called original Roman way, practiced by Latin scholars, and the modern adaptation more-or-less to the speech people use today. We tend to "Anglicize" Latin words to make them easier for us to pronounce; and since not all scientific names originally come from Latin, we have to "Latinize" these words to fit our way of talking. For example, the genus name for pine is *Pinus*. In strictly correct Latin you would say PEA-noose; whereas, we tend to say PIE-nus. The latter is certainly easier to remember. [In this article, capitalizing a syllable indicates it's the one to stress.]

I encountered frustration as an undergraduate student taking my first systematic botany course where we had to identify wild species using the "Guide to the Flora of the Carolinas" in the late sixties at University of North Carolina-Charlotte. I had not paid much attention to pronouncing scientific names before, but I did not hesitate to try. As usual, you learn much more from your mistakes -- and I learned a great deal! My first eager effort was to pronounce *Cardamine* (spring cress) as "CARD-a-meen", by referring back to the more familiar word "histamine". You wouldn't think of saying "hist-AM-in-ee", but that is exactly how you pronounce *Cardamine*. One of the rules of Latin is to pronounce as many syllables as you can, by pronouncing every vowel. So that extra "e" on the end gets pronounced. There are significant exceptions, as we'll see, but that is a good rule to start with. Practice on *Silene, Chelone, Anemone*.

The second rule of pronunciation requires you to break the word into syllables, which can be a feat in itself, and then to enunciate the third from last (the antepenultimate) syllable, unless you know better. That is, you have to decide which sylLAble to put the emPHAsis on. Thus *Cardamine* would be

Using its own priority ranking system, as of 1990 Fish and Wildlife Service had identified 136 plant species as being "high priority" for recovery efforts. Yet, in that year, FWS spent only $256,200 on these plant species -- less than 1% of its total recovery expenditure of $35 million. Sixty-nine of the "high priority" species -- **half** -- received no funds. All federal agencies reported spending only $792,800 on these plants.

pronounced: "car-DAM-in-ee," not "car-da-ME-knee". There are many familiar examples you can recall such as kris-ANTH-e-mum (*Chrysanthemum*), LIL-e-um (*Lilium*), ah-NEM-on-ee (*Anemone*), del-FIN-ee-um (*Delphinium*), PRIM-you-la (*Primula*), ger-AIN-ee-um (*Geranium*) and cam-PAN-you-la (*Campanula*). See how funny they would sound if you but the emphasis on the second-from-last syllable? There are plenty of exceptions to this rule, though, both familiar and unfamiliar. Try Rho-do-DEN-dron, Cor-ee-OP-sis, Hi-BIS-cus, Ver-BE-na and Por-tu-LA-ca. See how these would sound if you tried to enunciate the **third** from last syllable. In summary, the rules are: there are as many syllables as vowels; words of two syllables are stressed on the first; of three or more syllables, on the next-to-last (penultimate) if the vowel in this syllable is long; if the vowel is short, accent may be on the third from last (antepenultimate). How many of the above names follow the rules?

So, how do you know which is the correct way on an unfamiliar name? You don't, until you hear someone pronounce it and then accept it for yourself as sounding right. Take the evening primrose genus, for example, *Oenothera*. I learned to pronounce it een-oh-THEAR-ah, but was shocked to later hear a British botanist say ee-NOTH-er-ah. Which is correct? The third from last syllable would be in keeping with the rules, but here in America, most experts emphasize the second from last in this case. There are many examples of this. Is it just traditional, or what? Perhaps it has to do with making the words sound more like they would as ordinary English words. I recently worked with a high school student on tree identification. He had taken three years of Latin and he pronounced plant names somewhat differently from me; he was applying rules I didn't even know. We almost had a breakdown in communication.

Two examples of mispronunciation that hurt my ears the most involved *Crassula* and *Clematis*. These are very common generic names, and frequently used. The "correct" way is to emphasize the antepenultimate syllable in both: CRASS-you-la (not crass-OO-la) and CLEM-a-tiss (not cle-MA-tiss). Think about it.

Before we get too far away from the British style, let me point out another difference upheld by the Atlantic Ocean (but often heard in Canada). It is the pronunciation of the "ch" as a hard "k" versus a soft "ch" as in "church." Americans tend to prefer the hard sound. Thus in Britain you will hear *Chioanthus* (fringe tree), *Cheilantes* (hairy lip fern), and *Chenopodium* (pigweed) with a "ch" sound as in "chutney"; we in the states would be more familiar with "ch" as in "chiropractor." But then we tend to say *Chaptalia* (sun bonnets) and *Chelone* (turtle head) with a soft "ch" (as in chapstick and cheese). Where is consistency? Makes things harder, doesn't it?

These two rules take care of many ordinary pronunciations, but here are additional cases you will encounter. Many species are named after people. There are two situations: generic names and specific names. It would be nice if we could pronounce the Latin plant name so as to preserve the name of the person being commemorated. Sometimes that works well, as in *Lobelia* (after the 17th century herbalist l'Obel), *Tradescantia* (after 17th century royal gardener John Tradescant) and *Sarracenia* (after 18th Century Quebec botanist Michael Sarrasin). But what about our silverbell tree, *Halesia*? It was named after the Rev. Stephen Hales, yet we usually say it hal-EES-cia, rather than HALES-ee-ah. And beautiful garden perennial Stoke's aster: some say stoke-EES-cia, rather than STOKES-ee-ah. Would people like to know about Dr. Jonathan Stokes? Or would they even know what name you were saying. When you say the words the way they look, you often lose something.

Similar variations concern the hard and soft pronunciation of the "ti" of such genera as *Stewartia, Tradescantia* and *Sabatia*. We say stew-ARE-tee-ah (or stew-ART-sha) and trad-es-CAN-tee-ah (or trad-es-CANT-sha), but sa-BAIT-she-ah (or sa-BAIT-sha); can the "ti" go either way in every case? Or should we try and preserve personal names?

The second situation deals with species names ending in "i" or "ii", like *Senecio smallii, Lilium grayi* and *Sarracenia jonesii*. Those i's are added to Latinize a non-Latin word and they should be pronounced, both of them. Thus: SMALL-ee-eye

Experience Hells Canyon and its Endemic Flora with the Wallowa Llamas, sponsored by the Wm. Cusick Chapter of the Oregon Native Plant Society.

Trip dates April 21-24. Cost is $375 per person for the three day expedition. Wallowa Llamas Outfitters provide everything but sleeping bags and pads. Llamas will carry up to 20 lbs of personal gear.

Trip Itinerary: At 8:00a we leave Halfway, OR and head down to Hells Canyon Dam. We boat down to Butler Bar just above Wild Sheep Rapids on the Idaho side, hike 4 miles and camp at Granite Creek for 2 days. A day hike towards the rim of the canyon takes us through several vegetation zones. The third day we hike 5 miles downstream to Bernard Creek where the boat picks us up and takes us back up to Hells Canyon Dam.

If interested, contact Berta Youtie, P.O. Box 1188, La Grande, OR 97850 or call 963-4907.

(not just SMALL-eye), GRAY-ee-eye (the "y" counts as one "i"), and JONES-ee-eye (not Joan-ESS-ee, as I have heard). Here preserving the person's name, with one or two "eye" sounds added, should be the rule. The tendency among inexperienced people is to pronounce only one "eye".

Sometimes, given alternative ways of emphasizing syllables, you would want to preserve a component of the name that refers back to a structure for which the name was chosen to reflect. For example, in the white-top pitcher plant, *Sarracenia leucophylla* (the species name means "white leaf") should be pronounced lew-co-PHILL-ah to preserve the Latin word "phyll" that means leaf (rather than saying lew-COPH-ill-ah as the antepenultimate Latin rule would have). And in another example, the genus of filmy fern *Trichomanes*, so-called because it has a hair-like, or trichome-like, central vein in the spore capsule, should be pronounced trike-OHM-an-knees, rather than trike-oh-MAIN-ees.

Now for the important exception I alluded to earlier: when NOT to enunciate every vowel. There are plenty of examples in Latin, just as in English, of diphthongs, a double vowel pronounced together as one. The most important diphthong in Latin names is "ae", though you will find plenty of examples of "eu" (*Eupatorium*), and "oe" (*Coelogyne* -- here you do pronounce all of the latter vowels: sea-LODGE-eye-knee, a tropical orchid).

The first place you encounter "ae" is in plant family names: *Asteraceae, Rosaceae, Geraniaceae,* etc. The "ae" is pronounced invariably as a long "e", as in "bee". (The classical Roman pronunciation would be a long "i", as in "eye".) So, as-ter-A-see-ee and ger-ain-ee-A-see-ee. All family names end in -aceae, which is pronounce -A-see-ee (not A-see-ah), but as if it is written "a-c-e" and given the pronunciation of those exact letters.

There are countless examples of generic and species names with the "ae" diphthong: enchanters nightshade, *Circaea* (sir-SEE-ah); *Chamaecyparis* (came-ee-SIP-ah-rus); and hawthorne, *Crataegus* (krat-EE-gus). Do not be confused by the occurrence of "ea", which is not a diphthong normally, such as in the genera New Jersey Tea, *Ceanothus* (see-ah-NOTH-us) and chestnut, *Castanea* (cast-TAIN-ee-ah, not cass-tan-EE-ah). As a self quiz on this rule, try to pronounce the family of climbing fern: *Schizaeaceae.*

[By the way, all family names are plural and should be accompanied by plural verbs. For example: the *Schizaeaceae* are a family of ferns.]

Answer: sky-zea-A-sea-ee.

I hope this brief lesson has helped. I'm sure you will know more examples, exceptions and variation than I have listed here. I realize it is tedious to try and put in writing the pronunciations of words and syllables, but if you are interested, you will spend many hours reading and trying to learn them.

A Tribute to the Amateur in Botany

-by Dr. Herbert G. Baker, Professor of Botany at University of California-Berkeley. Reprinted from Sego Lily, a publication of the Utah Native Plant Society, Volume 15(3), May/June 1992.

Although I have been a professional botanist for forty years, I feel very much more in tune with the amateur botanist than you might expect. I have a personal reason to believe that amateurs do good science because I myself had only two years of formal education-- and did my PhD research without a major professor-- in the London University system that allows so called "External Degrees" to be earned while one is working full-time in unrelated employment. Also, thanks to World War II and the subsequent hard times in Britain, my wife and I grew up as researchers in an environment where expensive equipment was out of the question. Consequently, we have always tried to keep the equipment necessary for our research as simple as possible, and to be economical as we can be in operating expenses.

On this basis, we believe that amateurs could contribute much more to plant science than they do at present. And we feel that they only need encouragement. In some respects, amateurs are hardly less well-placed to do research than professionals.

In academia, administrative work and innumerable committees take up much of the so-called "research time", and professionals stay productive only to the extent that they work evenings and weekends, and take vacations in botanically-determined places. Thus, in reality, the amateur has almost as much time available for research as the professional.

Here I see a big difference between the Botanical Society of America (to which I have belonged for 23 years) and the Botanical Society of the British Isles. This is not just a matter of numbers of members (between two and three thousand) even though the population of the British Isles is only about a quarter of that of the USA. The difference is that the Botanical Society of America is almost entirely made up of professionals, in institutions, whereas the Botanical Society of the British Isles is an amalgam of professionals and amateurs who are often very competent. I will return to this matter of membership in botanical societies later.

But how did this apparently greater emphasis on amateur botany in the United Kingdom come about? Perhaps we can get some insight by looking at the historical features of British botany.

In Britain, the 18th and 19th centuries were formative times. While botany was becoming established as a science in Europe, there were few professional botanists except for apothecaries, who produced their own supply of properly identified drug plants. Other botanists were amateurs, in the sense that they were not paid for their work with plants. Some were independently wealthy, such as Sir Joseph Banks, whose influence was felt widely in the 18th and 19th centuries. His

dedication to botany was such that he could never be considered a dilettante. Banks was the self-sponsored leader of a botanical team on Captain James Cook's first voyage to the South Seas, in HMS Endeavor. This voyage, from 1768 to 1771, was of enormous scientific and geo-political importance. Sir Joseph Banks was a great figure in British botany for many years afterwards. Since he was the fortunate possessor of great wealth and excellent political contacts, in addition to his own botanizing, he provided financial and organizational assistance for many other collectors in their overseas activities.

He was the President of the Royal Society for many years and his herbarium and library were presented to the British Museum, where they served as part of the foundation of its comprehensive collections. For a while, Banks was Honorary Director of the Royal Botanic Gardens at Kew-- when they were literally Royal Gardens. The Australian genus *Banksia* is named after him. He also travelled to Iceland and to Newfoundland (but I'm sure the Newfoundland Banks were not named after him).

Charles Darwin was a man of independent means-- at least after the voyage of the Beagle-- but few other persons have had such an impact on biology: evolution, breeding systems, pollination biology, plant physiology, the study of insectivorous plants and much more. Except for his thinking on the early stages of evolution by natural selection, all his ideas were worked on during the years he spent at home in Down House, in Kent. With his shyness and illness, he could never have survived in the rat-race which we suffer today in the academic world.

Darwin succeeded as a scientist partially because he had money enough to publish. This can prove to be a hurdle not easily overcome by the amateur botanist-- particularly in these days of high publishing costs.

Many of the other 18th and 19th century botanists were professionals, although not professionals in botany. For them, botany was, at least at first, a relief from the stresses of daily work. However, in this connection it should be noted that these people were mostly in professions that left ample time for the indulgence of their hobby. Often they were country doctors or members of the clergy who travelled frequently along country roads and paths. They could, and did, appreciate floristics, phenology and the more obvious aspects of pollination biology.

An outstanding example of the country doctor in Britain is Charles Darwin's grandfather, Erasmus Darwin, who, among other accomplishments, was a very competent doctor, a philosopher, an agriculturalist, a pioneer conservationist, and a political reformer. He is well-remembered for his biologically-inspired poetry, and for his two large books, *Phytologia* and *Zoonomia*. Erasmus Darwin had more philosophical influence on his grandson than Charles was originally willing to admit, even though some of his ideas, expressed in *Phytologia*, in which he treats plants as degenerate animals, now seem quaint.

Slightly earlier, in 1776, another country doctor, William Withering, wrote a popular manual called *The Botanical Arrangement of the Vegetables in Great Britain*. Despite its title, this was the first manual of wildflowers to be written in English. Though we remember Withering particularly as the discoverer of the heart-stimulating power of an extract of foxglove (*Digitalis purpurea*), his now largely forgotten book ran through many editions and had a strong public influence.

A later variant on the country doctor type was the naval surgeon. Henry B. Guppy was surgeon on HMS Lark when he first made significant observations on the dispersal of plants in the West Indies and in the Pacific Ocean. Naturally, he gave closest attention to dispersal by the sea itself.

The author and philanthropist Priscilla Bell Wakefield wrote

How 'bout them botanists
ain't they a show?
Runnin' here and there
to where the green things grow.

Sluggin' through the spring mud,
muckin' through the mire,
off to see an orchid
like their pants is on fire.

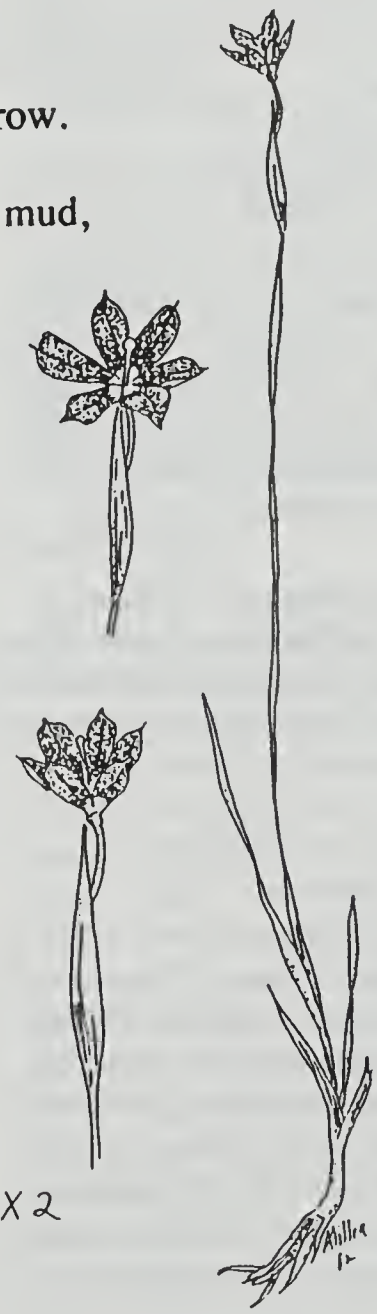
Them down-home botanists
take you for a ride,
find themselves a flower
and look inside.

Lookit that pistil,
stamens by the ton,
pokin at the privy parts
sure is fun.

How 'bout them botanists,
ain't they funny?
Can't get 'em clean
for love nor money.

How to be a botanist?
It'll make you sick.
Go and lose your shoes
where the mud's real thick.

X 2



a textbook entitled **Introduction to Botany in a Series of Family Letters with Illustrative Engravings**, which was first published in 1796. The letters in the book are between one sister at home in the country and another away visiting an aunt. Seasonal changes in the flora, plant structure and the details of the Linnaean classes are discussed. This was a popular book for the education of young ladies, and was printed in eleven editions, the last in 1841. Wakefield felt strongly that botany was a healthy and wholesome activity and hoped that her book would "cultivate a taste in young persons for the study of nature, which is the most familiar means of introducing suitable ideas of the attributes of the Divine Being by exemplifying them in the order and harmony of the visible creation."

Country parsons contributed nobly to British botany. This was to be expected because, in Nature, they could see the handiwork of God. J.C. Loudon, in the early years of the 19th century, wrote in the **Magazine of Natural History** that he published: "The naturalist is abroad in the fields, investigating the habits and searching out the habitats of birds, insects or plants, not only invigorating his health but affording him ample opportunity for frequent conversation with his parishioners. In this way, the clergyman at last becomes an advisor and friend, as well as a spiritual teacher."

In Britain, it is notable that the country clergymen included the Reverend Miles J. Berkeley, who is said to have personally named over 6,000 species of fungi, making him Britain's leading 19th century mycologist. However, the contributions of most of the clergymen were to the production of local floras of vascular plants and bryophytes.

Most plant collectors who have been responsible for introducing exotic species to horticulture have been professionals, but there have been some amateurs who were in foreign lands primarily for some other purpose. These have included religious missionaries, such as the Reverend William Colenso, who in 1834 went out from England to the colony of New Zealand. There he collected and described species of plants for 65 years, giving special attention to those of the mountainous regions. He was elected, presumably *in absentia*, to Fellowship in the Royal Society of London, and Sir Joseph Hooker dedicated one volume of the **Flora of New Zealand** to him.

Less completely in the country, lawyers have made their contribution. Probably the most famous of these in the 19th century was George Bentham, a taxonomist and flora composer whom we most readily think of as part of the team of Bentham and Hooker. This team represents the perfect example of the ability of an amateur and a professional to work together in harmony-- which they did at Kew. Bentham was the compiler of the floras of Hong Kong and of Australia, as well as a contributor to many others, and he wrote a **British Flora**, which was subsequently revised by Hooker. The greatest work of this team was the production of **Genera Plantarum**-- a conspectus of the world's great flora at the generic level, and a new systematic arrangement of families of plants.

Among the statesmen who were botanists, one man stands out-- Sir John Lubbock, later Lord Avebury. A neighbor of Charles Darwin, he was, among other accomplishments, a banker, a member of Parliament, a Privy Councillor, an essayist, an archaeologist, and an entomologist-- as well as a botanist. Between 1870 and 1905 he wrote more on these subjects than anyone, and became renowned as an expositor of biology for the amateur. His rewards were elevation to peerage, many honorary degrees, and election to scholarly societies.

Anne Pratt wrote several instructional books for younger readers. **The Pictorial Catechism of Botany** was published in London as early as 1842. In it, the structure of the flower is described and the necessity of pollen for seed-setting is stated although the details of pollination and fertilization are omitted.

(Continued in the next issue of SAGENOTES)

The Form of Leaves

--by Peter Lesica. Reprinted from Kelseya, the newsletter of the Montana Native Plant Society; Volume 4(2); 1991.

Most of us recognize different plants by their flowers, and we pay less attention to the not-so-showy but equally variable leaves. We all know that the myriad shapes, sizes and colors of flowers function as attractants to insect or animal pollinators, assuring cross-fertilization without wasting pollen. But why are leaves so variable? Leaves serve to capture carbon (in the form of $C0_2$) and light. They are also the principal site of photosynthesis where light energy converts CO_2 and water into carbohydrates used in growth. A plant's environment plays a major role in dictating what leaf shape will best fulfill these functions. Many observed trends in leaf size and shape can be explained in terms of trade-offs between efficiency of water use, photosynthesis and CO_2 absorption. Understanding the relationship between environment and function can be helpful in explaining why leaves are shaped the way they are.

Large areas provide more resistance to surface air movement. As a result, broader leaves will have higher temperatures and thus higher rates of water evaporation from tissues. Consequently, plants from dry, warm or sunny habitats tend to have smaller, narrower leaves than those from shadier, moister sites. For example, the yellow prairie violet (*Viola nuttallii*) and western violet (*V. adunca*), species of relatively dry open habitats, have smaller narrower leaves than our common deep forest species: pioneer violet (*V. glabella*), Canada violet (*V. canadensis*) and round-leaved violet (*V. orbiculata*). The leaves of showy aster (*Aster conspicuous*), our most common forest aster, are broader and larger than those of common meadow or grassland species such as smooth aster (*A. laevis*), mountain aster (*A. occidentale*) and western aster (*A. campestris*). Our common woodland pussytoes -- field pussytoes (*Antennaria*

neglecta) and raceme pussytoes (*A. racemosa*) -- have relatively larger, spoon-shaped leaves while those of rosy pussytoes (*A. microphylla*) and umber pussytoes (*A. umbrinella*), common dry grassland species, are smaller and narrower.

Large leaves, if they are deeply dissected, behave as a collection of small leaves. Thus the same trade-offs that affect leaf size also affect the degree of lobing or dissection. In addition, areas of tissue on the leaf margins between the veins are the most prone to desiccation. In dry environments these regions of the leaf become too costly to maintain and may be eliminated by natural selection, resulting in lobed or toothed margins. Like small leaves, lobed leaf margins are more pronounced in dry sunny habitats. For example, thimbleberry (*Rubus parviflorus*), with broad shallowly lobed leaves, generally occurs in cooler and shadier habitats than raspberry (*R. idaeus*) which has divided leaves. Our two woodland species of *Clematis*, *C. columbiana* and *C. ligusticifolia*, have leaves that are less dissected than the two prairie species, *C. hirsutissima* and *C. tenuiloba*. Sierra sanicle (*Sanicula graveolens*) has highly dissected leaves and is found in open habitats, while black snakeroot (*S. marilandica*), with less lobing, occurs in woodlands and riparian forests. Not only are plants with lobed leaves more common in dry or sunny habitats, but leaves on the shady side of trees or shrubs are often less deeply lobed than those on the sunny side.

Interestingly, plants with small, narrow leaves are also common in environments with waterlogged or nutrient-poor soils. In these habitats the efficiency of the roots in acquiring nutrients and water can be inhibited, making the production and maintenance of large leaves too costly. Bog blueberry (*Vaccinium occidentale*) has smaller, narrower leaves than our common upland huckleberry (*V. globulare*). The species of water-hemlock found in bogs, *Cicuta bulbifera*, has much narrower leaflets than those of common water-hemlock (*C. douglasii*), which occurs in less waterlogged environments.

Until now I have compared species from the same genus, but the same trends can be observed between floras of different habitats. For example, as you walk from a Douglas-fir forest into a grassland, more of the common species have small or divided leaves. These trends are also found between regional floras; lobed leaves are more common in trees of temperate forests than those of the humid tropical lowlands.

It is more difficult for plants to obtain sufficient CO_2 from water than from air. One solution to this problem is to increase the area over which the gas is absorbed in relation to the volume of tissue being supported. Thus, in aquatic plants, the submersed leaves are often long and narrow or highly divided. Common aquatic species such as water-milfoil (*Myriophyllum spicatum*) and bladderwort (*Utricularia*) have highly dissected leaves. Furthermore, many species of pondweed (*Potamogeton*) have narrow submersed leaves and broader floating leaves.

None of these trends are absolute, and exceptions to all of them can be found. Furthermore, many factors such as thickness, evergreeness and defense against herbivores have not been considered. I have also ignored the important factor of genetic constraints: roses always have divided leaves, whether they occur in forests or grasslands. Nonetheless, the above generalizations are robust enough to explain a good deal of the variation in leaf form that we see around us. Perhaps next time you stop to admire a flower, you'll think about the leaves as well.

Suggested Reading

Bailey, I.W. and E.W. Sinnott, 1916. The climatic distribution of certain types of leaves. **American Journal of Botany** 3:24-39.

Givnish, T. 1979. On the adaptive significance of leaf form. **In**: O.T. Solbrig, S. Jain, G.B. Johnson and P.H. Raven (eds.), **Topics in Plant Population Biology**. Columbia University Press, NY.

Givnish, T. 1987. Comparative studies in leaf form: assessing the relative roles of selective pressures and phylogenetic constraints. **New Phytologist** 106: 131-160.

Talbert, C.M. and A.E. Holch. 1937. A study of the lobing of sun and shade leaves. **Ecology** 38:655-658.

Good Stuff

New book: **The propagation of Alpine Plants and Dwarf Bulbs**, 1992 by Brian Halliwell. Timber Press, Portland, OR. 294 pp, hardbound, $24.95. This guide covers more than 1000 genera suitable for rock gardening. Detailed propagation techniques are supplemented by line drawings. This is the first such comprehensive book published since 1950.

The fourth edition of **Suppliers of Beneficial Organisms in North America** lists 60 companies that sell biological controls. Write Larry Bezak, California Department of Food and Agriculture, Biological Control Services Program, 3288 Meadowview Road, Sacramento, CA 95832; (916) 427-4590.

The Center for Plant Conservation has just updated their publication listing individuals and organizations involved in conserving native plants in the U.S. The publication includes listings of local federal and state government officials who can provide information, botanists and other contacts in the state Heritage Programs, rare plant laws by state and sources for obtaining state lists of rare and endangered plants. To order, send $15 to Center for Plant Conservation, Missouri Botanical Garden, P.O. Box 299, St. Louis MO 63166.

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The purpose of the Idaho Native Plant Society (INPS) is to promote interest in native plants and to collect and disseminate information on all phases of the botany of native plants in Idaho, including educating the public to the value of the native flora and its habitats.

Membership is open to anyone interested in our native flora. Contributions to our Society, are tax deductible. Send dues and all correspondence to I.N.P.S., Box 9451, Boise, ID 83707.

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