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Some Intermountain Endemics

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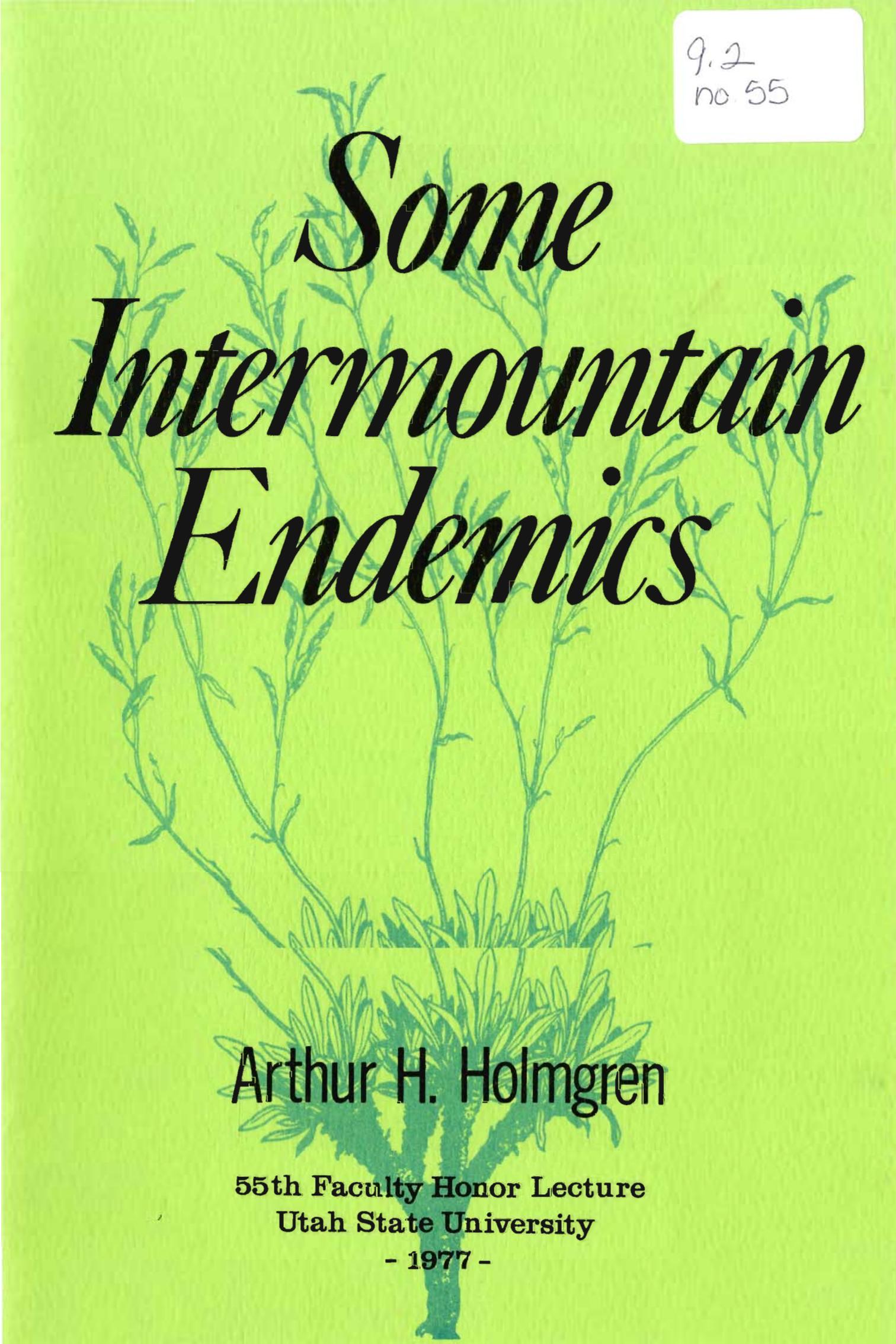
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*Some
Intermountain
Endemics*

Arthur H. Holmgren

55th Faculty Honor Lecture
Utah State University

- 1977 -

Smelowskia holmgrenii Rollins

FIFTY-FIFTH HONOR LECTURE

DELIVERED AT THE UNIVERSITY

A basic objective of the Faculty Association of Utah State University, in the words of its constitution, is:

to encourage intellectual growth and development of its members by sponsoring and arranging for the publication of two annual faculty research lectures in the fields of (1) the biological and exact sciences, including engineering, called the Annual Faculty Honor Lecture in the Natural Sciences; and (2) the humanities and social sciences, including education and business administration, called the Annual Faculty Honor Lecture in the Humanities.

The administration of the University is sympathetic with these aims and shares, through the Scholarly Publications Committee, the costs of publishing and distributing these lectures.

Lecturers are chosen by a standing committee of the Faculty Association. Among the factors considered by the committee in choosing lecturers are, in the words of the constitution:

- (1) creative activity in the field of the proposed lecture;
- (2) publication of research through recognized channels in the field of the proposed lecture;
- (3) outstanding teaching over an extended period of years;
- (4) personal influence in developing the character of the students.

Arthur Holmgren was selected by the committee to deliver the Annual Faculty Honor Lecture in the Sciences. On behalf of the members of the Association we are happy to present Professor Holmgren's paper.

Committee on Faculty Honor Lecture

Faculty Honor Lecture

SOME INTERMOUNTAIN ENDEMICIS

Introduction

A growing concern for the welfare of endangered or threatened plant and animal species has developed during the past few years, coinciding with an awareness of mankind's deleterious influence on the environment. Technological man has altered vast areas of the earth's surface to such an extent that many species have been endangered or made extinct. Transcontinental highways, shopping malls, industrial parks, home sites where they shouldn't be, and huge acreages turned over by the plow for monocultures, have taken a toll on our native vegetation to such an extent that many species have either lost their diversity or have disappeared. There are natural extinction rates, but these have been accelerated by man's activities. And, a sobering thought, extinction is forever.

Zoologists have had an effective voice in making us aware that birds and mammals are endangered. In newspapers, magazines and television, we are constantly being told the story of endangered animals. Most of us have heard of the endangered Utah prairie dog, the California condor, the whooping crane, the brown pelican and American peregrine falcon, but how many of us have heard of the Passey wild onion, Maguire primrose, Toquima geranium, tufted gilia, or even the Holmgren smelowskia?

The feeling of responsibility for the plight of many animals has led to strong protective legislation for animals on the international, federal and state levels. We know that caging animals is not the solution to protecting them. Yet when we hear of a rare plant that lies in the pathway of construction our first instinct is to

say “transplant it.” We must go beyond consideration of individual species and instead preserve entire plant-animal communities in their native site, their best haven.

Endangered Species Act

In the “Endangered Species Act of 1973” (Public Law 93-205) all federal departments and agencies are directed to insure that their actions do not jeopardize the continued existence of endangered or threatened species. The act applies to plants as well as to animals. The list of plant taxa is many times greater than the list of animals. The plant list of endangered or threatened, or possibly extinct taxa will be in the neighborhood of 2,000 for the United States, while the animal list is scarcely more than 100. Animal species and infraspecific categories are often well known to the layman, while the sheer numbers of plant taxa make them more difficult to determine. Animals make themselves known more readily than plants by obvious means. They move about, make sounds and have noticeable behavior patterns. Plants also perform in their ecological niche, but they do so silently and in many cases unobtrusively. Many plants are so small, so indistinguishable in appearance to the untrained eye, or located in such remote areas that they may seem unimportant to the uninformed. Some plant species, subspecies, or varieties are known by a single collection or often little more than fragments. Several others, found by early collectors who were unable to give exact localities, have not been found since the original collection was made. Some plants thought to be rare may be of questionable taxonomic status.

Units of Classification

The term “taxon” (pl. taxa) refers to any unit of classification. The basic taxon in plant taxonomy is the species. More literature has been amassed on this concept than any other single idea in biology. No two individuals in the living world are exactly alike. The variability among living things is not continuous but may result in morphological gaps. The job of the taxonomist is to organize the individuals so that the species will differ from one another by consistent differences. While there are exceptions, the members of a species will be capable of interbreeding freely, and members of different species cannot interbreed..

Species of plants have risen in many ways and no attempt will be made here to elucidate this complex biological problem. Evolution is a continuous process and there are some taxa which have become sufficiently distinct so that some taxonomists will call them separate species whereas other taxonomists will treat them as single polymorphic species. Intraspecific categories such as the subspecies or variety result in even a greater diversion of opinions. Still, the taxonomist treats the species as the fundamental unit of classification. The genus is the level of classification above the species and the genus and species in combination is the binomial we always use in referring to a species. A genus may be composed of a single species, or another genus may contain hundreds of species. The genus is made up of closely related species. The binomial refers to a group (the genus) and the kind (the species). The group above the genus is the family. A family may consist of a single genus or it may consist of many genera.

Endangered Species

Plants included in the "endangered" category are in danger of extinction throughout all or a significant portion of their ranges. These are plants known from very limited areas or from fragile habitats where land abuse may soon bring about their extinction.

Threatened Species

Plants included in the "threatened" category are those likely to become endangered within the foreseeable future throughout all or a significant portion of their ranges.

Extinct Species

Plants considered to be "extinct" are those which have not been found after repeated searches where they were once known to exist. If these species are located in similar areas after much searching, they will then be added to the endangered list and removed from the list of extinct species.

The above categories as they are defined are fraught with many difficulties as few plant distributions are completely known. *Smelowskia holmgrenii* Rollins may be extinct as several searches have been made by others for this unique species since I originally found it. I plan to return, after thirty years, to the Toquima Range

in Nye County, Nevada, during the summer of 1977 with a group of botanists in an attempt to again find these plants.

A rockcress, known botanically as *Arabis shockleyi* Munz, has been placed on the threatened list. This rockcress is known from four or five localities from Tooele County, Utah, to a dry canyon in the San Bernardino Mountains in California. The paucity of known stations for this species emphasizes the fact that many of the mountain ranges between Utah and California have seldom been visited by a botanist.

The fescue-grass, *Festuca dasyclada* Hackel, from central Utah was believed to be extinct for many years, but it is alive and doing well in at least two Utah counties and several places in western Colorado. We have yet to determine whether this fescue is endangered or threatened.

It must be understood that all lists of endangered and threatened plants (Ripley 1975; Welsh, et al., 1975; Cronquist, et al., 1972) prepared to date are merely preliminary and must remain open for constant revision for an indefinite period of time.

The herbaria at Brigham Young University, at New York Botanical Garden, at University of Utah, and at Utah State University are the important data sources for the flora of the Intermountain Region. Just as libraries are a history of man, herbaria are a history of the plant life of an area. Most of our new species being described today are endangered or threatened species that have remained undetected since botanists first began to collect and gather data in the Intermountain Region, an area about the size of Texas. The flora of this area contains approximately 4500 species, about ten per cent of this number is included on the endangered or threatened lists we are working with at the present time. The rate of discovery of new taxa about equals the rate of consolidation of poorly understood species. The ten per cent of our flora considered to be in the endangered or threatened categories are distributed throughout the entire Intermountain Region with four or five centers of concentration: The Uinta Basin, the southern five counties in Utah, Nye County in Nevada and the southernmost portion of Nevada.

Many families and numerous genera have been enumerated as having endangered or threatened species but two genera in different families are standouts. The genus *Astragalus* in the Fabaceae family leads with endangered or threatened taxa numbering between 75 to 90 while *Eriogonum* in the Polygonaceae family has about 50 to 60 taxa.

Nativeness and rarity are criteria used in determining which plants should be placed on the endangered or threatened list. Plants which have highly restricted ranges are referred to as endemics. Several of these species are so rare and restricted that the number of individuals in each one could readily be counted. *Sphaeromeria ruthiae* Holmgren, Shultz, and Lowrey is confined to the cliffs of Walter's Wiggles in Refrigerator Canyon in Zion National Park. This cliff hanger has been spared through the years as these plants have been protected on the vertical walls from storms and heat of the canyon. Another very narrow endemic has been found on the Toquima Range in Nye County, Nevada. *Smelowskia holmgrenii* Rollins has been found on one rock prominence and no other place. This species was last seen in 1947 and has since been searched for by Noel Holmgren and James Reveal. Attempts to locate this species have been unsuccessful. When I return to the area this summer, more than thirty years after I first found this species, I hope to find living material of this species, one that may have become extinct.

Rare Plants

The discovery of a rare and unique species never fails to provide a thrill for the field botanist. There are different kinds of rare species, and the word "rare" may have several meanings.

An example of one kind of rare plant is the yellow lady's slipper orchid, *Cypripedium calceolus* L., known from several localities when the pioneers first came to Utah. The beautiful yellow blooms attracted flower pickers until today it has been extirpated from all but one tiny locality in Utah. This species was known in our area from Utah County and Cache Valley. I had thought that our Utah plants had been lost until I found a population near the mouth of Logan Canyon in 1945. I kept this location a secret until the area became a choice location for home sites. The owners of this particular lot have protected this plant. One small clump that might otherwise have been lost was transplanted to my orchid garden at home. The plants have thrived and divided on numerous occasions and soon they will be reintroduced into several areas of Logan Canyon where they are likely to grow.

Another example of a widely distributed but rare species is *Cypripedium fasciculatum* Kell., the Brownie lady's slipper. While it is always rare, it is known from widely scattered localities through-



Lupinus holmgrenanus C. P. Smith



Gilia caespitosa A. Gray

out the country. It was found by Dr. Walter P. Cottam above Lake Blanche in the Wasatch Mountains. It has also been found in the Ashley National Forest in Uintah County. These two Utah stations are the only known Intermountain locations for this little lady's slipper orchid.

Still another orchid that is found only as scattered individuals separated by many miles from their nearest kin is the Calypso, *Calypso bulbosa* (L.) Oakes.

A second type of rare plant is one that is localized but occurring in large populations. An example of this is a little peppergrass, *Lepidium nanum* S. Wats. It is found in only a few widely scattered localities in northeastern Nevada, but is often abundant enough where found.

A third type of rare plant is one we refer to as a narrow endemic. Such a species may occur in only one or two places on the entire globe.

All three types of rare plants outlined here should be on lists that contain names of endangered, threatened or even sensitive species that may become threatened at some time in the future. These three types are connected by intermediate cases, and no two botanists would be in complete agreement on their boundaries.

Are They Beginners or Senescent Species?

Are these species rare because they are "beginners," or are they species that have become senescent? These concepts are difficult and no single simple answer is possible.

The rare wild buckwheat, *Eriogonum humivagans* Reveal, may be an example of a recently evolved species that is found only in a small area east of Monticello in San Juan County, Utah. This rare endemic is found in heavy soils in stands of Utah juniper [*Juniperus osteosperma* (Torr.) Little] and may well represent a species with an expanding range, as is true of many of the aggressive wild buckweats.

The very narrow endemic or possibly extinct relict, *Smelowskia holmgrenii*, is a species of ancient distribution that has survived glaciation and hot, dry periods that recent or historical man has not known. This relict species must have had a much wider distribution in the past, with many biotypes, but today it is a depleted species or perhaps one that has become extinct during the past 30 years.

Most of our rare plants fall into the second category given here.

These are the "conservatives" of our flora that are no longer capable of competing with more common species. They are species of very uniform plants no longer capable of spreading, often edaphically restricted to one little ecological niche.

A weakness in the concept of senescence is the implication that it results directly from the age of a species. *Smelowskia holmgrenii* is surely or was surely a species of great age that must have been common in the high mountains of central Nevada prior to Pleistocene times, while the tufted gilia, *Gilia caespitosa* Gray, is nearly as rare and may be a much younger species.

Another approach to this problem has been reviewed by Stebbins (1942) and this is the genetic concept. Widespread and common plant species consist of genetically different biotypes which may differ widely in their ecological preferences. And this can be reversed to say that a species with many ecotypes and biotypes will be widespread and common. It follows that a species which is poor in biotypes with perhaps no more than one biotype will be rare. A rare species then is one so specialized that its members can grow and compete with other species in only a limited area.

Gilia caespitosa Gray is a rare and very local species found in white barren sandstone cliffs one mile southwest of Teasdale in Wayne County, Utah. These plants are so much unlike most *Gilias* that Brand (1909) and Grant (1959) excluded this rare species from *Gilia* and even from the Polemoniaceae family. Brand suggested that these plants were probably in the Saxifragaceae and called attention to the calcareous-glandular hairs. A close look at the type specimen shows that the glands are nothing more than the white sand in which these plants grow. Further investigations showed that all of our Intermountain Herbarium specimens are covered with the same kind of calcareous "glands."

It is interesting to note the *Gilia caespitosa* has retained several primitive characters as outlined by Grant in his "Natural History of the Phlox Family." This beautiful little perennial has a woody caudex and a low point of stamen insertion. These plants may have arisen from an extreme biotype of the variable and common *G. subnuda* Torr. If a widespread species becomes established in an unusual edaphic situation, they will carry with them only a small part of the genetic variability of the original species. Inbreeding and random fixation will tend further to make this insular population more uniform and still more different from its ancestors as the years of isolation continue. This kind of species will become as homo-

genic as a depleted one. When *G. subnuda* is found under severe conditions it looks somewhat like *G. caespitosa*.

It does not seem logical that this species is a rare conservative or a senescent species which was once common. *G. caespitosa* is well suited to its habitat where it has no competition. It probably evolved where it is found today and adapted to a single ecological niche. Two closely spaced silica sand niches are known south of Teasdale and this little *Gilia* is common on both of them. It is a good example of an insular species which has arisen from a widespread ancestral species. No other *Gilia* is near enough to these "islands" to allow hybridization to occur and enrich this much reduced and homogenic species. Inbreeding and random fixation have made these insular plants uniform through long years of isolation.

The Maguire primrose, *Primula maguirei* Williams is a rare species that is confined to a ten mile stretch of Logan Canyon in Cache County, Utah. It is found on north-facing slopes on limestone cliffs where the plants have a good supply of water throughout their short period of growth. These primroses may be more abundant today than when Dr. Bassett Maguire first found them in 1932. This was the beginning of the drought years, and that has to be important in the number of plants an area will support. I first saw this primrose in 1939 and nearly four decades of favorable precipitation years have greatly increased the numbers of Maguire's primrose and perhaps here we are dealing with a narrow endemic whose range may be expanding. I have every reason to believe that this primrose does not occupy its potential range in Logan Canyon.

Allium passeyi Holmgren & Holmgren is a tiny wild onion which has been found on two isolated hills in Blue Creek Valley of Box Elder County, Utah. This rare onion is on thin lithosolic soil scarcely above the highest level reached by Lake Bonneville. The thin soil mantle that caps the dolomitic limestone stores enough moisture during the winter and spring months for this rare onion to mature seeds. The plants become dormant as the water supply runs short, at which time the bulb is protected from further drying by the series of persisting fibrous bulb coats. A few depauperate plants of cheatgrass and peppergrass surround the pure stand of onions where the soil begins to get deeper, beyond which several species of perennials occur, indicating a deep soil with a year-round water supply.

The grass milkvetch, *Astragalus chloödes* Barneby, is an unusual species which looks like a grass at first glance. This species is

confined to the mouth of the Green River gorge within and near Dinosaur National Monument, Uintah County, Utah. Plants of this species (Barneby, 1964) are so obligately associated with the white sandstone of the Navajo Series that it appears as though the species has been planted by man. Mason (1946) has pointed out how important the edaphic factor is in narrow endemism. Insular species of the Intermountain Region are usually restricted by edaphic factors.

Exploiters of Rare Plants

Lupinus holmgrenanus C. P. Smith is a narrow endemic known only from four rather closely spaced localities in Esmeralda County in Nevada and adjacent Inyo County, California. This beautiful lupine has considerable horticultural value—and this brings up a serious problem with so many of our rare and endangered species.

Exact locations of our endangered, threatened, or possibly extinct species are being prepared and this will be a definite aid to exploiters who are looking for new and exciting plant material for our gardens. Cactus rustling has long been a serious problem in Arizona and orchid hunters have taken a tremendous toll on species in the tropics. The number of botanists wouldn't begin to equal the number of people interested in orchids.

Our rare primroses could also become prime targets for collectors; their unusual habitats could be mutilated beyond restoration as soil and mosses would be removed with the plants.

Population pressures have virtually taken the habitat of our largest orchid, the yellow lady's slipper. The lovely little western pansy violet, *Viola beckwithii* Torr. & Gray, has practically disappeared from the foothills of Salt Lake Valley, and now the same problem has beset this species in Cache Valley. Urbanization continues to consume important acres as people move to the country. Why must we drain wetlands and inundate deserts? We build super highways and make cuts and fills. We spread polluted air over the landscape. We overgraze vast areas, and soon the biggest rape of all will begin as we are "blessed" with tremendous coal fields. Our appetite for energy continues to increase, and it is generally unpopular to take a stand that is seemingly opposed to progress.

We must favor a land use that will relieve the use of certain natural areas. Plants must be preserved in their native habitats. Rare and endangered species should be mapped and given continued protection. Lists must be updated from time to time and all pertinent

information made available to national and international organizations.

We must understand that the Ripley report (Endangered Species Act) is merely a beginning as many species, subspecies and varieties of plants are placed in categories where they do not belong, and omissions are common. A more realistic list has been developed by Welsh, et al., (1975) and this might well become the backbone for a more nearly final work produced by a review board and enlarged to include the entire Intermountain Region.

Research is needed to answer questions in the Ripley report, the Utah list by Welsh et al., and all state lists prepared to date. Is the species, subspecies, or variety a valid taxonomic entity? And is the taxon extinct, rare and endangered, threatened, or merely a sensitive group? Answers to these problems will require intensive field work and not just cursory researches because of supposed sudden "needs" by government agencies.

How thorough must environmental impact studies be? Most areas of the Intermountain Region are so poorly known that literature and herbarium studies alone cannot supply the answers we need. A single visit to an area may not turn up plants that have unusual blooming times or long dormant periods. A severe drought can change an area to such an extent that it seems questionable whether or not field searches should be conducted during such times of stress. Detailed studies should be conducted by competent people in limited areas over a period of several years.

The *Salt Lake Tribune* on the 9th of November 1976, carried a story with headlines "Rare Plant Discovery May Foil Project Plan." This plant, known botanically as *Pedicularis furbishiae* S. Wats., has the unbecoming common name of Furbish lousewort. This species was thought to be extinct, but botanists surveying the Upper St. John River found 35 specimens as they were working on the environmental impact of the proposed Dickey-Lincoln hydroelectric project, one of the largest federally funded projects ever planned for New England. The little lousewort certainly has little intrinsic value and it would seem ludicrous to most people that 35 little lousewort plants could stop a multimillion dollar project.

However, the most important consideration here is the protection of an unusual habitat and the possible loss of 88,000 acres of forest land and the loss of one of the last wild rivers in the Northeast, as well as protection of the lousewort.

A February 3, 1977, editorial in the *Salt Lake Tribune* discussed the Tennessee Valley Authority dam which has been under construction since 1966. This \$116-million dam is now threatened because of a fish nobody knew existed until 1973, seven years after construction started. A three-inch member of the perch family, the snail darter, would be threatened by operation of the Tellico Dam. The editorial closes with the following two paragraphs:

Now that the snail darter has been found after all these eons, classified and determined by the appropriate federal bureau to be endangered, a completed \$116-million construction project is endangered — after the fact.

What seems to be also endangered is rational thought. A few more decisions like that apparently forced upon the Sixth Circuit Court by existing endangered species laws and rational thinking might be extinct.

These two problems point to the needs for careful environmental impact studies to be conducted before construction begins. The Furbish lousewort was found early enough to save a habitat and 88,000 acres of forest land and a river with running water. The second problem came to light much too late and now we must hope that the snail darter can somehow be saved. Problems of this sort will arise from time to time if environment impact statements are not carefully and scientifically done.

Conclusions and Recommendations

We must do everything we possibly can to halt the accelerated rate of extinction of both animals and plants. As we do this we preserve a wide array of the genetic variation within species. We must also preserve habitats that contain endangered species.

Several species found in the Ripley list are not valid taxa. This may on occasion be a problem not easily resolved but carefully-planned research work using morphological studies, cytogenetics, controlled breeding studies, and phytochemical studies may determine affinities within and among plant populations.

Finally, it must be determined by a group of botanists whether or not the species are extinct, endangered, threatened, or merely sensitive. And what kind of land use may save narrow endemics on the verge of extinction.

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