
INTRODUCTION

This book should serve as an introduction and field guide to the rarest plants of Arizona. It is intended to serve as a handy reference to use in the field and as a brief introduction to each species and its status. We hope this field guide will stimulate surveys and conservation actions, and promote the collection of new information.

The Arizona Heritage Data Management System, managed by the Arizona Game and Fish Department, serves as a central repository for rare plant data in Arizona. The Navajo Natural Heritage Program provides the same service for rare plants occurring on the Navajo Reservation. As new information is collected, it should be offered to the appropriate repository. Species information is periodically evaluated by botanists and used to set priorities for plant conservation in Arizona or by the Navajo Nation.

In 1998 and 1999 a committee of botanists convened to create this field guide. In developing the list of species that would be covered, the committee confronted the challenge of clarifying the definition of "rarity" for the purposes of this guide. The following paragraphs outline the many discussions and decisions made during the course of this process.

WHAT IS RARITY?

Superficially, a rare plant is a species with low numbers, few populations, or a small range. There are many types of rarity and many factors influencing rarity in plants. A number of botanists have struggled to define the elusive word as it applies to plant species, but no single definition can encompass the diversity of types of rarity.

Fiedler (1986) explored the complex definition of rarity. She listed nine factors—either alone or in combination—causing plant rarity:

- evolutionary age
- genotypic heterogeneity of the species or populations
- evolutionary history
- taxonomic position
- ecology, habitat and present environmental conditions
- population biology
- reproductive success
- land-use history and
- recent human land uses

The first seven factors are aspects of the natural environment, while the last two are human induced causes of rarity. Thus, many plants are naturally rare while others have become rare and endangered through human activities. Each rare plant is the idiosyncratic product of a unique combination of these factors and must be understood individually.

Stebbins (1980) recognized that "...each example of such species has its unique features, and must be considered with respect to three major parameters: the intricate mosaic of the environment in which it grows; the complex genetic structure of its populations...and finally the past history of the populations."

Kruckeberg and Rabinowitz (1985) considered three distribution factors in plant rarity: geographic area, ecological breadth, and isolation. Different types of distribution patterns result from different combinations of these factors.

Fiedler described three different geographic distributions of plant rarity:

1. widespread geographically and locally rare,
2. restricted ranges but locally abundant, and
3. both geographically restricted and locally sparse.

Examples of these three types of distributions can be found in this field guide. An example of a geographically widespread and locally rare species is *Tumamoca macdougalii*. Small colonies of this plant sparsely occupy over a million square miles in the U.S. and Mexico. Another example is *Coryphantha scheeri* var. *robustispina*, which is sparsely distributed across a range of a few million acres, much of which has been urbanized.

Fiedler's second category would include the limestone endemics *Echinocactus horzonthalonius* var. *nicholii* and *Coryphantha robbinsorum*. Another example is *Penstemon discolor*, which is not uncommon on narrow range of substrates in a few mountain ranges in southeastern Arizona.

The third category includes species that are geographically restricted and locally sparse. An Arizona taxon in this category would be *Cirsium virginensis*, which occurs only on the wet soil near springs along a short stretch of the Virgin River. *Dalea tentaculoides* also qualifies for this category; fewer than 200 plants survive in Sycamore Canyon, Santa Cruz County.

Yet another way to categorize rare plants is to define them as "endemic," "disjunct," or "peripheral." An endemic species is one that occurs only within a defined natural or political boundary. *Purshia subintegra* is endemic to late Tertiary lacustrine outcrops and it is also endemic to Arizona. A disjunct population is one with an isolated population widely separated from the main body of the species, where it may be common or rare. For example, only a few populations of *Cypripedium parviflorum* occur in Arizona, but the species is common in temperate forests in other parts of the United States and in Canada. A peripheral species is one with a contiguous population at the edge of the range of the species and usually not widely separated from the main body of the species. *Lophocereus schottii*, which is common and widespread in Mexico, reaches the periphery of its range in extreme southern Arizona.

There are species in this book that might not fit comfortably into any categorization scheme. These species will serve as reminders that categories of rarity are artificial constructs that imperfectly fit the natural world.

SPECIES INCLUDED IN THIS FIELD GUIDE

The plant species included in this field guide were selected from more than 4,000 taxa of plants that occur in Arizona. The team of botanists who authored this book systematically evaluated several hundred species considered to be rare or uncommon in Arizona. After lengthy discussions, we arrived at a final list of over 140 taxa.

We began with a list of species generated by the Arizona Heritage Data Management System and the Navajo Natural Heritage Program. Each species in these databases are ranked according to global rarity and state rarity. All species with a global ranking of 1 or 2 (G1 or G2) and some species with a G3 rank (see Definitions and Codes section) were considered for inclusion in this book. The list of G1 and G2 species was too lengthy, given space and budget limitations, so the team had to shorten the list.

Using written records, personal experiences and knowledge, the team carefully evaluated each species and derived the final list. During the selection and evaluation process some *a priori* decisions were made. Endemic species were generally included in the field guide. Excluded were species that occur in Arizona as disjuncts or whose range in Arizona is peripheral to a larger range outside the state. For a list of species that were considered but not included in this field guide, please refer to the table at the end of the book.

Rare taxa not included in this edition of the field guide may be included in subsequent versions of this book. The 3-ring binder format was chosen to allow the addition of new species and updates of species that have already been treated. Please send your comments and suggestions to the Arizona Heritage Data Management System at the Arizona Game and Fish Department in Phoenix.

REFERENCES:

- Fiedler, P.L. 1986. Concepts of rarity in vascular plant species with special reference to the genus *Calochortus* Pursh (Liliaceae). *Taxon* 35:502-518.
- Kruckeberg, A.R. and D. Rabinowitz. 1985. Biological aspects of endemism in higher plants. *Annual Review of Ecology and Systematics* 16:447-479.
- Stebbins, G.L. 1980. Rarity of plant species: A synthetic viewpoint. *Rhodora* 82:77-86.