Before the Gold Rush, California was a bountiful land of infinite resources and opportunity. Over the past century, millions of people have poured across our borders, seeking prosperity within the idealistic dreamscape. And the dream continues, as population stands at 37.6 million, and is expected to reach 52.7 million by 2060 (California Department of Finance 2014).

Nature, too, is on the move today in California. The rate at which our famously scenic and biologically diverse ecosystems are being displaced and fragmented is intensifying amid California's burgeoning population. Uses of natural areas for recreation (see photograph above) and the extraction of water, timber, and mineral resources are concurrently expanding. Looming impacts from increased urbanization, climate change, nitrogen deposition, altered fire regimes, invasive species, and energy development pose transformative landscape-level threats to species and ecosystems. And much of the projected increase in California's population is expected to occur in some of our most intact and cherished biodiversity hotspots.

As summarized in this issue of Fremontia, over the past four-and-a-half decades the CNPS Rare Plant Program...
Program (RPP) has raised the bar nationally in rare plant conservation, and we celebrate these accomplishments. Moving forward, however, the RPP will be challenged to fulfill its mission amid the overwhelming pace and scale of threats to California’s native plants. We discuss some obstacles and opportunities that lie ahead, and outline several expanding roles and potential new directions for the program.

**THE INVENTORY OF RARE AND ENDANGERED PLANTS**

The RPP will continue to emphasize its long-standing core responsibilities, especially the maintenance of the CNPS Inventory of Rare and Endangered Plants (CNPS 2001; 2014), which is the foundation of the program. The CNPS Inventory continues to grow and currently totals 2,327 rare species, comprising 35% of California’s native vascular plants. With more than one-third of California’s native flora now of conservation concern, we are clearly falling behind in our mission to maintain natural and functional biodiversity throughout the state. This alarming trend suggests the RPP has no alternative but to expand its scope. Ultimately, CNPS will need to work with regulatory agencies, conservation organizations, heritage programs in neighboring states, and other national and international programs to develop and implement conservation actions before species reach an endangerment threshold requiring their listing.

In addition to the 2,327 ranked species currently in the CNPS Inventory, 239 other plant species are currently proposed for new additions, deletions, or status changes. The review and processing of this substantial and growing backlog will take considerable time and commitment. Why the increasing backlog in listing? With a modest revival of field exploration, reassessment of herbarium collections, and the recent emphasis on molecular phylogenetic studies facilitated by new molecular techniques, we are actually seeing an increase in taxonomic discovery in California.

In the past two decades the native flora of California has expanded by roughly 350 species, and many of these meet criteria for listing in the CNPS Inventory. As plant taxonomy relies more heavily on new molecular tools, there has been a concurrent and rapid progression of the phylogenetic species concept. And while the increased awareness of phylogenetic relationships among species is paramount to rare plant conservation in general, it also complicates the CNPS rare plant review and listing process.

**PROTECTION BEYOND THE SPECIES UNIT**

As concepts of taxonomic units undergo rapid change, we are reminded that rare plant conservation needs to encompass not only species, but also protect groups of interacting populations (metapopulations) and species within and across related taxonomic groups. For example, genetic relationships within and among populations of plants may influence regulatory or policy decision outcomes (Ellstrand 2014). The RPP will be exploring ways to use the increasingly abundant phylogenetic information to help maintain the integrity of both genetic and ecological relationships and processes for rare plants. Doing this will involve collaboration with scientists, the CNPS Conservation Program, as well as agencies overseeing regulatory processes and land management decisions.

Locally rare populations of more common California species also merit increased conservation recognition. The CNPS RPP is currently working to establish specific local rarity criteria that can be used at the county level. The concept is certainly not new to CNPS. In the early 1990s, Dianne Lake (East Bay Chapter) referred to locally rare plant species as “unusual and significant.” In the 2000s the North Coast Chapter’s Gordon Leppig and Jeffrey White referred to them as “peripheral populations,” while Ventura County’s David Magney used the term “locally rare plants.”

Research in evolutionary biology has shown that isolated populations or those on the periphery of their range often exhibit higher rates of speciation. Speciation is the evolutionary process by which new biological species arise. Locally rare species are also important for the preservation of biodiversity and ecological processes that are critical amid rapid climate change. These populations represent our “canaries in the coal mine.” Clearly, locally rare plants are significant from several conservation perspectives. But what can we do to protect them?

Along with Benjamin Crane, Jeffrey White developed the L-Rank (L = Local) concept, which assigns rare or uncommon status to species within a local geographical boundary that are more common outside that boundary. The L-Rank designation is based on species abundance relative to the size of a given study area. For instance, in Napa County the level of local rarity is derived by counting the number of 1km x 1km grids in which a species is present. The fewer grids it occurs in, the more locally rare it’s considered.

L-Ranks can be included in NatureServe’s Natural Heritage Ranking System and applied to all corners of the state, as they have similar conservation ranks ranging from 1 to 5, preceded by a letter reflecting the appropriate geographic scale of the assessment (G = Global, N = National, and S = Subnational/State) (Table 1).

Currently, a list of L-Rank species has been applied to Napa County through the efforts of Crane and...
White, with other county programs in various stages of development. CNPS, through the RPP and its volunteers, can help identify data gaps necessary to implement the concept of L-Ranks statewide by building a database of local or county level floras that need updating or completing. This is an excellent way to develop locally rare plant programs and bolster chapter-level conservation efforts, since governance and development scenarios are more similar within county boundaries than across county lines. Given its proven history of success with the CNPS Inventory of Rare and Endangered Plants, CNPS, and especially the RPP, is in a strong position to seek funding for these valuable endeavors.

REGIONAL PLANNING EFFORTS

Michael Soulé, the grandfather of conservation biology, proposed four core principles on which the concept of biodiversity would be built (Soulé 1985): 1) a high diversity of organisms; 2) ecological complexity; 3) functioning evolutionary processes; and 4) the intrinsic value of biodiversity.

Noss and Cooperider (1994) built upon Soulé's work by developing conservation principles that operate at regional and landscape scales. Beginning in 1983, the concept of regional conservation planning has been implemented via the mechanism of Habitat Conservation Plans (HCPs), and later, Natural Community Conservation Plans (NCCPs), in an effort to attain the core principles of conservation biology. Since 1983 when the first HCP was developed for San Bruno Mountain, regional planning efforts have multiplied. Currently there are 44 HCPs/NCCPs statewide that have either been implemented or are being developed, and more are being conceptualized.

One common failure of regional conservation planning is that the process lacks significant participation by rare plant stakeholders. Another problem arises when HCPs and other jurisdictional and legislative boundaries do not coincide. For example, the Bay Delta Conservation Plan (BDCP) is being developed for species affected by the operation of California’s two biggest water delivery systems. It overlaps with one plan that is already implemented, and four other plans presently in their development stages. Delta region species ranges extend beyond the boundaries of these regional planning efforts. The BDCP will need to be carefully developed in concert with the conservation goals of the East Contra Costa HCP so that the same rare plant species are being covered, habitat modeling uses similar ecological parameters,
and efforts are consistent with existing recovery plans for federally listed species.

CNPS needs capable volunteers embedded in the planning phases to produce the most effective regional planning efforts that involve rare plants. For example, the East Bay Chapter collaborated in developing the East Contra Costa HCP, and their input assured that the plan now covers relevant affected rare plant species. Other collaborators included environmental consultants, agency biologists, and knowledgeable activists. The East Bay Chapter’s conservation analyst was especially helpful in guiding the development of this HCP by serving as the watchdog in situations where public comment and botanical expertise were necessary. He was able to take data from the plant science committees of the Chapter and use it to guide wise decisions for rare plant conservation.

CNPS, through the RPP, should strive to develop this framework of collaboration in every chapter.

**FACILITATING FESA/CESA LISTINGS**

It has been 41 years since the passage of the federal Endangered Species Act (ESA). Since then we have enacted the Native Plant Protection Act (NPPA) and the California Endangered Species Act (CESA), although the NPPA provides little protection for our rare plants. During this time frame, 237 plant species received state and/or federal ESA protection, but the vast majority of these (226 species) were first listed prior to year 2000. Since 2000 only 11 species have been listed under ESA or CESA, and listings have dramatically slowed from 8 to 1 per year.

Conversely, since 2000 the number of species added to the CNPS Inventory has increased. The 237 ESA-listed species collectively represent just 4% of our native flora. By contrast, the CNPS Inventory lists 1,648 species (25% of our flora) as Rank 1B or 2B (plants that may meet criteria for FESA or CESA listing). Clearly there is a strong disconnect between the numbers of qualifying taxa and the reality of successful listing efforts.

Looking closely at rare plant data maintained by the California Department of Fish and Wildlife’s Natural Diversity Database (our state’s Natural Heritage Program), it’s staggering how many rare plant species with a CNPS Rank of 1B or 2B are represented by only one or two populations and not listed under either ESA.

A total of 41 Rank 1B species are known from just one occurrence, and 48 species have only two occurrences. A total of 69 Rank 2B species have just one occurrence in California, and 39 are known from only two occurrences. These 197 rare species meet criteria for state and federal ESA status and should be on a fast track for listing.

What does this mean for the Rare Plant Program (RPP) in the years ahead? One potential role for the RPP and Rare Plant Program Committee (RPPC) will be to marshal resources and expertise to help the agencies determine which plants merit the highest listing priority. The RPP will also need to work with CNPS chapters, including their rare plant coordinators, volunteers, and regional experts, to develop petitions for ESA listing. Generally if the species in question is on federal land...
then FESA would be appropriate. Under all other situations, it’s generally better to file under CESA. To achieve this, CNPS Chapters will need active and engaged rare plant committees and guidance from the RPP and RPPC.

**RESEARCH AND INVENTORY NEEDS**

Of the 2,327 rare plants presently listed in the CNPS Inventory, only a very small percentage have complete information about their distribution, fundamentals of their biology and ecology, and complexity of their threats. CNPS will continue to make funding the RPP and Rare Plant Treasure Hunt program a high priority, along with supporting other directives to inventory and map rare plant species. In addition to known rare plant species, the RPP recognizes that California remains a floristic frontier where more than 10% of the flora remains undescribed. Many of the newly-discovered species will be rare, and usually not afforded the necessary protections until their taxonomy is confirmed.

Unfortunately, a comprehensive statewide inventory will take many decades to complete. Meanwhile the RPP will continue to partner with California herbaria by organizing efforts such as bioblitzes (intensive surveys of small areas involving many groups of scientists, naturalists, and volunteers) that target poorly documented regions. CNPS volunteers can also make a tremendous difference in this effort by offering their help to herbariums that are understaffed and have a substantial backlog of specimens that await processing and database entry.

Rare plant management plans are poorly developed because they lack basic information about the biology and distribution of rare plants. As outlined in previous editions of *Fremontia* (Moore and André, 2014), very few rare plant species in California are protected by established conservation management plans or long-term baseline monitoring and research programs. Many rare species remain on California Rare Plant Rank 3 (more information needed) or Rank 4 (a watch list), because the necessary additional information that research and monitoring would provide is unavailable. The RPP is well positioned to work with agencies and academia to help direct species-specific research needs for rare plants.

Landscape-level and global processes such as climate change may have significant impacts on local rare plant populations. And although species-specific research and management is also necessary, protec-
Catalina Island mountain mahogany (*Cercocarpus traskiae*), one of the rarest plants in California, was state and federally listed before 2000 and is known from only one population containing fewer than 15 individuals.
Protecting the habitat in which rare plants thrive is essential to protecting threatened species. Clockwise from above: The narrowly distributed fringed false-hellebore (*Veratrum fimbriatum*) in Salt Point State Park, Mendocino County. • Looking south along the crest of the White mountains with bristlecone pine (*Pinus longaeva*) in the foreground. • Looking east at serpentine chaparral on the east slope of Walker Ridge, a biodiversity hotspot. Bear Valley and the Sutter Buttes in the distance. • One of the most brilliant orange flowers in the state, flame ragwort (*Packera greenei*), on Walker Ridge, Colusa County.
tion of large contiguous and functioning ecosystems that encompass the critical habitats of rare species is clearly the single most important objective of any rare plant conservation program.

Since the birth of our Society nearly 50 years ago, we have fought for the native and rare plants of California. The RPP has been the flagship endeavor of CNPS and has contributed to the protection of many of our treasured rarities. In order to keep up with the impacts of growth in the Golden State we will need to expand the sources of funding, personnel, and expertise of the RPP, while increasing the presence and functionality of rare plant committees at the chapter level.

Although the principal role of the RPP within CNPS is to serve as the science-based arm of the organization, we must also actively work with academic and agency partners, fundraisers, and the state legislature to continue to facilitate and strengthen rare plant awareness and conservation at all levels.

REFERENCES


California Native Plant Society. 2001. CNPS Inventory of Rare and Endangered Plants of California. 6th ed. Rare Plant Scientific Advisory Committee, David P. Tibor, Convening Editor. Sacramento, CA.


Heath Bartosh, Nomad Ecology, LLC 832 Escobar Street, Martinez, CA 94553, hbartosh@nomadecology.com; James M. André, University of California Riverside, Department of Biology, UCNRS, Granite Mountains Desert Research Center, HCI Box 101, Kelso, CA 92309, granites@telis.org