Acceptability of Using the Natural Heritage Program's Species Ranking System for Determining Ventura County Locally Rare Plants

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Considerable thought has been given to the methods used to identify and classify locally rare plants of Ventura County. The Ventura County Planning Division has convened meetings of local and regional botanist and zoologist experts to discuss and select a scientifically sound system by which to identify those species that would qualify as locally rare. This group of scientists agreed that the most appropriate criteria to be used for this purpose was the same system that is used statewide, nationwide, and globally, known as the Natural Heritage Program (NHP) ranking system.

The Nature Conservancy (TNC) created the NHP in the 1970s as a means to gather data on rare species in a given area. TNC worked over the years to establish NHPs in each of the 50 states, which have mostly been included in each state's Natural Resources divisions (or equivalent). California has done so, by incorporating it into the California Department of Fish and Game, Natural Diversity Database (NDDB or CNDDB). The NHP ranking system has two basic levels, a global ranking and a state ranking, each of which include subrankings, based on degree of rarity in the area of jurisdiction. No adjustments have ever been made to this ranking system for any of the jurisdictions that use it, including all 50 states. The criteria included in this system are provided below in Table 1, Natural Diversity Database Element Ranking System.

Some people have expressed concern that it may not be appropriate to use the same criteria (NHP ranking system) that are used for a much larger area such as the entire state of California. To address this concern, this paper shows that the same system is used universally for all of the 50 states of the United States. States similar is size to Ventura County were examined specifically as a comparison. Three states were studied as part of this analysis: Rhode Island, Delaware, and Connecticut. Rhode Island is a little more that half the size of Ventura County. Delaware is about 5% larger than Ventura County. Connecticut is 2.6 times larger than Ventura County. Table 2, Small States Using NDDB Ranking System Compared to Ventura County, summarizes floristic and rare plant data of these states compared to Ventura County. Alaska, the largest state, is included for comparison. All of these states use the same rarity ranking system as the State of California, and as proposed for use for Ventura County. Therefore, it is entirely reasonable and justifiable to use the NHP ranking system for Ventura County. In addition, a summary of the concepts of rarity and biogeography concepts and studies is provided to provide context and a comparison to rarity at a local level.

In general, plant species rarity is a function of habitat rarity. That is to say, rare plants occupy rare habitats. White (2004) points out that "rarity is a comparative biogeographic attribute based directly or indirectly on measures of their spatial distributions". He goes on to explain, "rare organisms are those that fall below a certain threshold and are thus comparatively smaller or more limited in distribution than other organisms". Rapoport (1982) and Gaston (1994) describe over a dozen different measurements to capture the full breadth of area within which a taxon occurs, which gets at indirectly to the complexity of defining species rarity. Decades ago Stebbins (1942) recognized spatial patterns of rarity and identified different types of rarity based on overall range size, number of populations, and local abundance. Drury (1974, 1980) identified and described three different types of spatial rarity patterns:

- Geographically restricted and locally sparse,
- Geographically restricted but locally abundant, and
- Geographically widespread but locally sparse.

The plants that are locally rare in Ventura County fall into at least one of these categories. White (2004) explains that these are derived measurements related to geographical range size and local abundance. The

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opposite are taxa that are geographically widespread and locally abundant, which describes a spatial pattern of commonness. Rabinowitz (1981) combined the rarity categories of Stebbins and Drury into seven forms of rarity, adding degrees of habitat specificity, attempting to capture the ecological attributes.

Table 1. Natural Diversity Database Element Ranking System

Global Ranking (G)	
G1	Less than 6 viable element occurrences (populations for species) OR less than 1,000 individuals OR less than 809.4 hectares (ha) (2,000 acres [ac]).
G2	6 to 20 element occurrences OR 809.4 to 4,047 ha (2,000 to 10,000 ac).
G3	21 to 100 element occurrences OR 3,000 to 10,000 individuals OR 4,047 to 20,235 ha (10,000 to 50,000 ac).
G4	Apparently secure; this rank is clearly lower than G3 but factors exist to cause some concern (i.e. there is some threat, or somewhat narrow habitat).
G5	Population or stand demonstrably secure to ineradicable due to being commonly found in the world.
GH	All sites are **historic**; the element has not been seen for at least 20 years, but suitable habitat still exists.
GX	All sites are **extirpated;** this element is extinct in the wild.
GXC	Extinct in the wild; exists in cultivation.
G1Q	The element is very rare, but there is a taxonomic question associated with it.
Subspecies Level Subspecies receive a **T-rank** attached to the G-rank. With the subspecies, the G-rank reflects the condition of the entire species, whereas the T-rank reflects the global situation of just the subspecies or variety. For example: *Chorizanthe robusta* var. *hartwegii*. This plant is ranked G2T1. The G-rank refers to the whole species range (i.e. *Chorizanthe robusta*, whereas the T-rank refers only to the global condition of var. *hartwegii*.	
State Ranking (S)	
S1	Less than 6 element occurrences OR less than 1,000 individuals OR less than 809.4 ha (2,000 ac). S1.1 = very threatened S1.2 = threatened S1.3 = no current threats known
S2	6 to 20 element occurrences OR 3,000 individuals OR 809.4 to 4,047 ha (2,000 to 10,000 ac). S2.1 = very threatened S2.2 = threatened S2.3 = no current threats known..
S3	21 to 100 element occurrences OR 3,000 to 10,000 individuals OR 4,047 to 20,235 ha (10,000 to 50,000 ac). S3.1 = very threatened S3.2 = threatened S3.3 = no current threats known
S4	Apparently secure within California; this rank is clearly lower than S3 but factors exist to cause some concern (i.e. there is some threat, or somewhat narrow habitat). NO THREAT RANK.
S5	Demonstrably secure to ineradicable in California. NO THREAT RANK.
SH	All California sites are **historic**; the element has not been seen for at least 20 years, but suitable habitat still exists.
SX	All California sites are **extirpated;** this element is extinct in the wild.

Notes: 1. Other considerations used when ranking a species or natural community include the pattern of distribution of the element on the landscape, fragmentation of the population/stands, and historical extent as compared to its modern range. It is important to take a bird's eye or aerial view when ranking sensitive elements rather than simply counting element occurrences.

2. Uncertainty about the rank of an element is expressed in two major ways: by expressing the rank as a range of values (e.g., S2S3 means the rank is somewhere between S2 and S3), and by adding a ? to the rank (e.g. S2?). This represents more certainty than S2S3, but less than S2. (CNDDB 2002.)

Table 2. Small States Using NDDB Ranking System Compared to Ventura County

State	Land Area Sq. Miles	Flora Size	Rare Taxa	% of Flora
Rhode Island	1,045	1,700 (1,300 native)	309	24%
Ventura County	1,857	~2,071 (1,746 native) (1,467 mainland natives)	934 (mainland - S1 only)	45%
Delaware	1,955	1,571 (native)	629 (403-S1 or S2 only)	40%
Connecticut	4,845	~1,800 (native)	343	~19%
Alaska	576,594	1,063 (~1,000 native)	388	37%

White (2004) argues, "…local abundance and range size are highly simplified categories that do not capture many of the dimensions of a species' distribution, such as number of populations or the number of collecting localities". He states that local abundance should not be used in determining a taxon's rarity. Care must be taken with scales of measurement during studies of species distribution (Allen and Hoekstra 1992, Maurer 1999). White (2004) argues that distributional point data are one of the most useful forms for quantifying spatial distributions. Bevill and Louda (1999) point out that more consistency needs to be applied to theoretical understanding and management of rare plants, as 38 studies they examined rarely used the same attributes. Kunin and Shmida (1997) state that most species are rare, based on an analysis of global range, regional abundance, and local population densities of annual crucifers in the Mediterranean region. Luoto et al. (2002) suggest that "the local 'hotspots' of total flora (grid squares with >200 species) are mainly found…where habitat diversity is high".

The uniqueness of the California Floristic Province, which Ventura County occurs entirely within, should be taken into consideration when comparing numbers of rare plants using the NHP ranking system with those for other areas outside the California Floristic Province. Conservation International includes the California Floristic Province among its list of 25 biodiversity hotspots for plants in the world, and is estimated to have only 24.7% of its natural habitat remaining (Myers et al. 2000). This Province is one of the few places in the world with such high levels of endemism and rarity, due in large part to habitat diversity. Ventura County is located in the middle of this Province, and is uniquely positioned in California between northern and southern California, and next to the Mojave Desert. Ventura County also has a relatively steep topographic gradient (from Sea Level to 8,831 feet on Mount Piños, with many geologic and soil formations, creating numerous rare habitat conditions. This habitat richness and diversity, and rarity of them, creates conditions within Ventura County that predisposes it to containing lots of rare occurrences of species.

These conditions and the location of Ventura County explain for the most part why there are so many locally rare species. Regardless, for political reasons, the group of local and regional expert biologists decided to restrict the criteria used for Ventura County to only the S1 criteria rather than all the ranking levels typically and normally used by each of the 50 states. Due to the County's habitat and species richness, the number of plants meeting these criteria is approximately 45% of the known vascular plant flora of approximately 2,071 taxa[2]. As a comparison, the Sierra Nevada range of California contains

[2] Based on manuscript of: Magney, D.L. 2004 (manuscript). *A Flora of Ventura County, California*. October 2004. David Magney Environmental Consulting, Ojai, California. The numbers will change over time based on additional floristic research.

approximately 2,951 taxa, with at least 405 endemics and 218 rare taxa statewide and another 168 taxa rare in the Sierra Nevada, representing 27% of the Sierra Nevada flora (Shevock 1996). Shevock also points out the obvious that all the 220 newly described taxa found in California between 1968 and 1986 were rare, and that 30% of those occur in the Sierra Nevada.

The biogeography theory shown by the species-area curve is in part a reasonable explanation for the high species richness of Ventura County, and why so many taxa are rare in the County. Plant species are not randomly distributed over an area (Poltkin et al. 2000) such as Ventura County and such a distribution should not be assumed. There are a finite number of taxa in Ventura County, and it is reasonable to assume that floristic research to date has likely identified 98% of the vascular plant taxa presently and historically occurring within the County. Hubbell and Foster (1983) described three distinct groups of plant distribution patterns:

- Taxa appearing to be randomly or near-randomly distributed;
- Taxa clumped and whose patches follow easily recognized topographic features; and
- Taxa clumped but whose patches are spatially uncorrelated with topography.

In her comparison of New York county floras, Vogler (2004) summarized the reasons for species distribution according to the species-area curve theory as the species richness-area relationship being affected or the result of:

- Surface area (as described by Coleman et al. 1982);
- Distance to neighboring populations (as described by MacArthur and Wilson 1967); and
- Habitat heterogeneity (as described by Nichols et al. 1998).

Ventura County is made up ecologically of several habitat islands on which a number of plant taxa occur. Relatively few taxa are distributed very widely geographically and across many habitats. On the other hand many more taxa are restricted to one or a few specific habitats. Since Ventura County contains a large number of restricted habitat types, and many of these habitats are relatively rare in the County, many more taxa fall within this category, and more taxa will be found rarely in Ventura County than taxa commonly found. The large number of described plant communities, at the series level, that occur within Ventura County, also supports this. Of the approximately 700 plant communities/habitats in Ventura County, 153 are considered rare statewide (Evens pers. comm.). If just five taxa were restricted to these 153 rare plant communities each, then approximately 765 taxa would be expected to be just as rare. This hypothetical (but plausible) statistic explains very easily the high number of locally rare plant taxa in the County.

Loss of Species Nationwide

An examination of rare plants from a much larger perspective was conducted. The number of species in the United States in each global rank is presented in Figure 1, Number of United States Vascular Plants by Global Rank. For example, more than 4,850 species (about 28%) of the native U.S. vascular plants are considered globally rare (ranked G1, G2, or G3) by The Nature Conservancy and the Natural Heritage Network. Of these, about 960 species are ranked G1 and occur at fewer than five sites globally or are comparably imperiled. Global Rank GH/GX means species is potentially extinct; G1 to G5 rank the species from rarest (G1) to most common (G5). (Morse et al. 2004.)

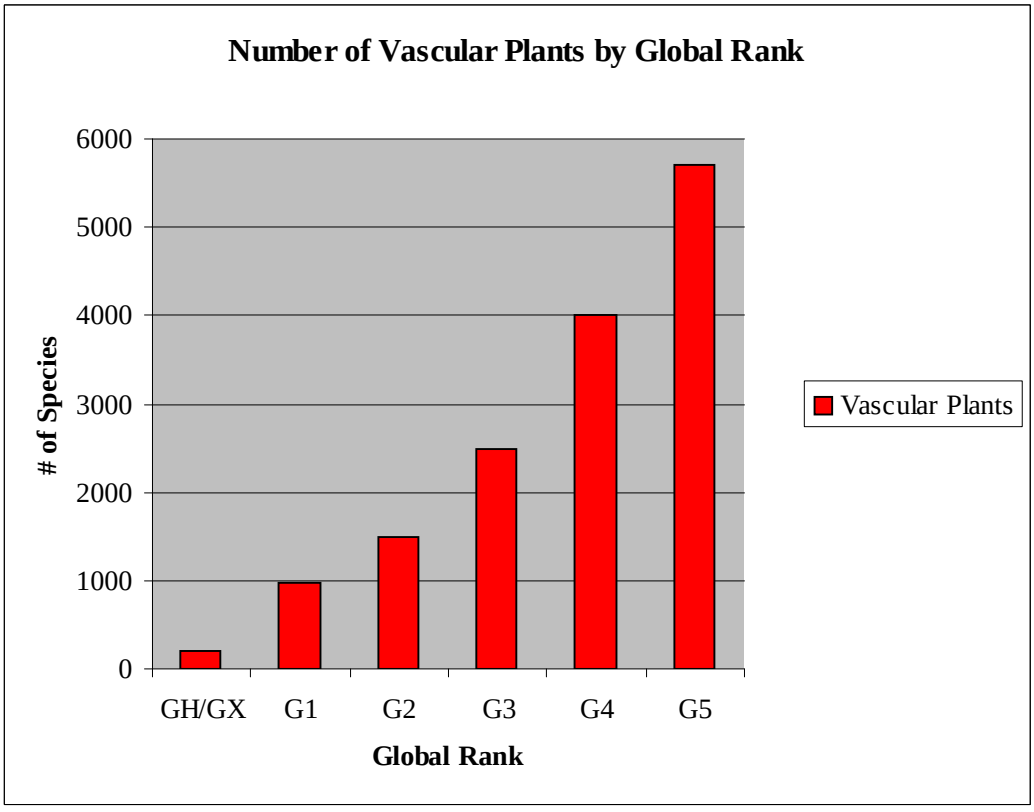
Assessments have been conducted on the distribution of globally rare vascular plants in the United States. Globally rare native species of vascular plants are concentrated in the western and southern states (Figure 2, Globally Rare Plant Proportional Distribution in the United States), with greatest proportions in Arizona, California, Florida, Georgia, Hawaii, Nevada, New Mexico, Texas, and Utah. (Morse et al. 2004.)

In addition to these globally rare species, about 4,500 other species of widespread or more common vascular plants (ranked G4 or G5) are being actively inventoried in at least one state where they are rare. (http://biology.usgs.gov/s+t/noframe/j085.htm.)

The patterns and causes of plant species' losses are often important components of state-level conservation studies, such as in California, and can reasonably be applied at a regional or county level. The loss, or suspected loss, of a species from a portion of the landscape is referred to as "extirpation".

Kutner and Morse (unpublished report) studied the losses of U.S. native vascular plants and found that about 1,772 (9.8%) of these species have been lost from at least one state. Of these species, 438 (25%) may be lost from the floras of two or more states. The proportion of species potentially extirpated from each state varies dramatically across the nation (Figure 3, Map of Proportional Loss of Plants by State), with the largest losses reported from northeastern states and from Hawaii. Delaware has experienced the proportionately highest loss from its flora, with more than 15% of its species potentially extirpated. Many of the northeastern and mid-Atlantic states have lost more than 5% of their native vascular plants. The 13 colonies region of the United States has experienced hundreds of years of human development and includes many of the most densely populated and intensely developed states. Many plants that have been lost from these states may now be also threatened in portions of their remaining ranges in neighboring or more distant states. (http://biology.usgs.gov/s+t/noframe/j085.htm)

Figure 1. Number of United States Vascular Plants by Global Rank



The Natural Heritage Network has determined that approximately 28 percent of the native U.S. flora is globally rare (ranked either G1, G2, or G3); however, only 12 percent of the potentially extirpated species are globally rare. Most potentially extirpated species have been lost from one or two states and are currently globally common (ranked G4 or G5). In the United States, 110 of these globally common species have been lost from three or more states, and more than 35 species have been lost from four or more states. Of the most common species (global rank G5), approximately 285 have been lost from two or more states. Globally common species that have been lost from many states may not be as secure from imperilment as previously believed. Additionally, the effect of species' losses on other plants and animals in a community is often unknown. (Morse et al. 2004.)

Figure 2. Globally Rare Plant Proportional Distribution in the United States

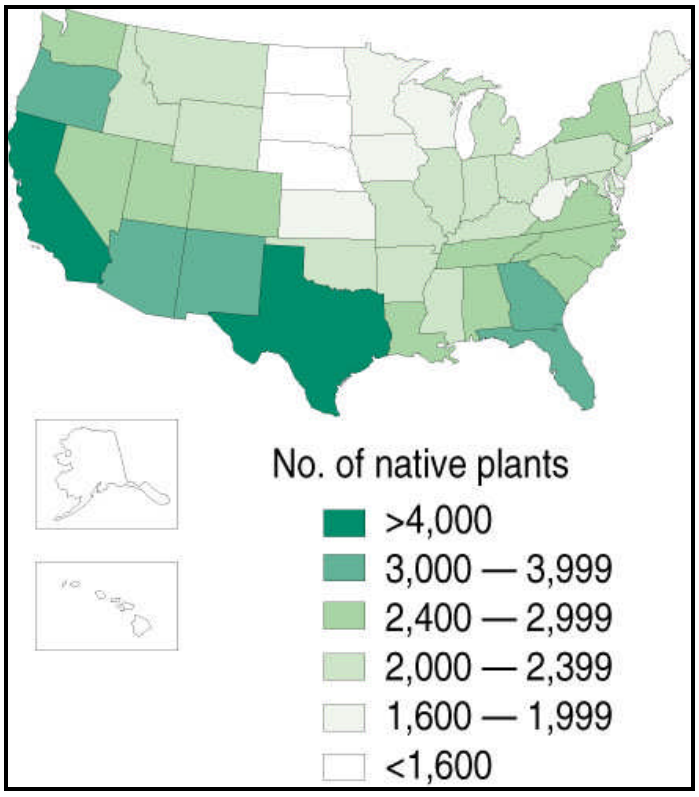
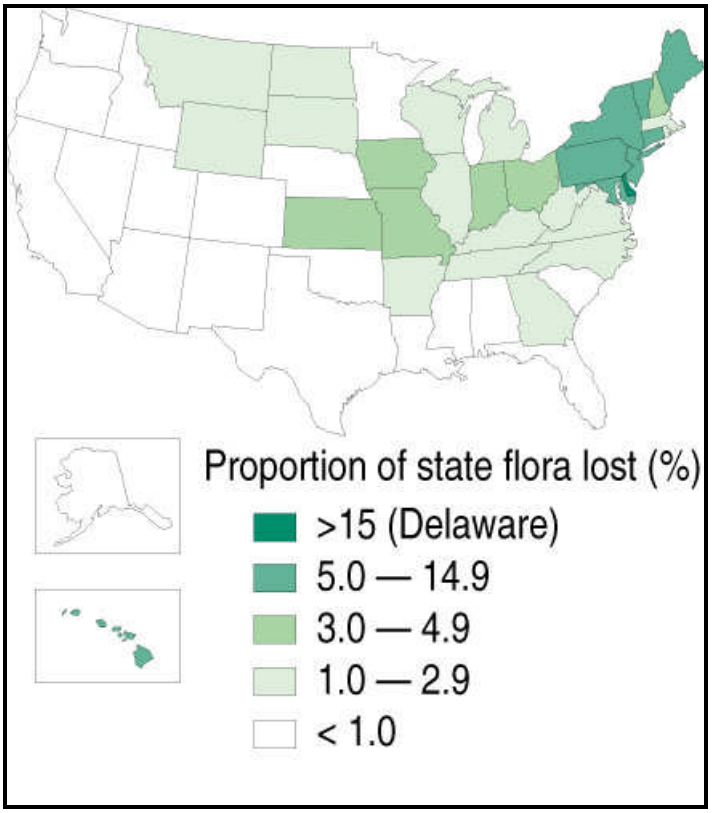


Figure 3. Map of Proportional Loss of Plants by State

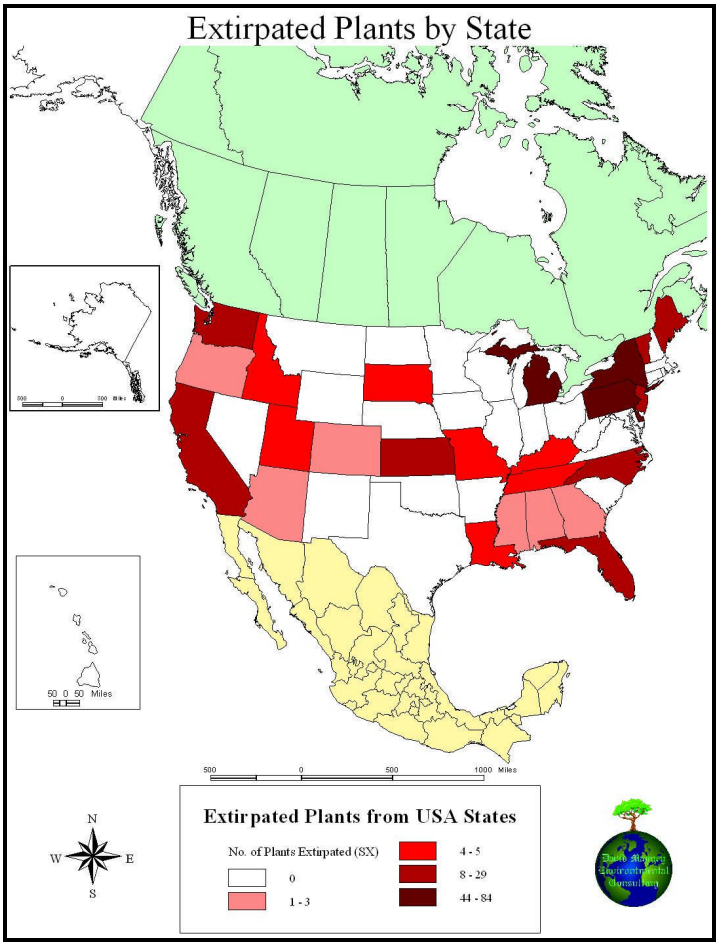


Many species that are endangered, threatened, or formal candidates for federal protection have also lost parts of their ranges in the United States. Approximately 6 percent of Federally listed and proposed Endangered species and 20 percent of Federally listed and proposed Threatened species are reported extirpated from at least one state. About 16 percent of the Category 1 Federal candidate species (top candidates for listing as Endangered or Threatened) and almost 11 percent of the Category 2 Federal candidate species (possibly qualifying for Threatened or Endangered status, but more information is needed) have been similarly affected. (Morse et al. 2004.)

Some currently rare species had widespread historical distributions. For example, American Chaffseed (*Schwalbea americana*) is a Federally listed endangered species with a Natural Heritage rank of G2. The historical range of this species extended from Mississippi to Massachusetts. American Chaffseed is currently known from about 20 populations in five states, primarily in South Carolina. The most significant threat to this species is fire suppression, which allows plant succession to proceed to the point where there is not enough light for the plant to compete successfully. Habitat loss has also caused the extirpation of several *Schwalbea* populations. For rare species such as *Schwalbea americana*, further state-level extirpations could seriously affect the species' survival. (Morse et al. 2004.)

Another way to look at the extirpated plants issue is to compare the extirpations by each state based on the NHP's State Rank for extirpated plants (SX). The results are interestingly different, as illustrated in Figure 4, Extirpated Plants by State. While data are lacking for a few states (Hawaii, West Virginia, Texas, and Washington DC.), the overall results are significantly different than that presented by Morse et al. (2004). No state has reported more than 84 taxa extirpated from it's jurisdiction. Several states report no extirpations.

Figure 4. Map of Extirpated Plants by State



It has been widely recognized that plant species do not respect or recognize political boundaries such as national, state, or county (political) boundaries. Regardless, all our laws are applied strictly to such boundaries, including laws and regulations established to recognize and protect rare species. These regulations are only applicable and enforceable within the jurisdictions in which they were enacted. Furthermore, one country's laws are not applicable or enforceable in another country, and on down the line of lesser jurisdictions. Given the fact that a state or county can only regulate activities within its jurisdiction, it is entirely reasonable and valid to consider what species are rare only in Ventura County, regardless of what a neighboring jurisdiction does to protect or not protect the same species. It is also irrelevant what the status of a species in another jurisdiction given that the local jurisdiction has no authority over any other jurisdiction of equal rank (e.g. county vs. county, state vs. state).

To address the validity of how the NHP ranking system is applied to jurisdictions of different sizes, an analysis of states close in size with Ventura County have been examined. Below are brief descriptions of some of the other small state NHPs.

Small States Assessment and Comparison

The rare plants of three of the smallest states were used as a comparison to Ventura County: Rhode Island, Delaware, and Connecticut. A brief assessment of the rare plants of each of these small states is provided, and compared to Ventura County.

Rhode Island Rare Plants. Rhode Island is the smallest state in the Union, occupying 1,045 square miles, a little more than half the size of Ventura County. Rhode Island ranges from sea level to 248 meters in elevation (nearly flat compared to Ventura County). The entire state is divided into the following four main areas: Interior Upland, Narragansett Lowland, Narragansett Bay Area, and Salt Pond/Coastal Plain.

Rhode Island has a flora of approximately 1,700 vascular plant taxa, of which 77% (1,300) are native. The Rhode Island Natural Heritage Program, Department of Environmental Management (RINHP), established in 1978, ranks and maintains a database of Rhode Island's rare species. The RINHP tracks its rare plants, animals, and natural communities through comprehensive mapping and GIS databases, which are used to establish management and environmental review priorities. (Enser 2002.)

The RINHP created its original list of rare plants based on the independent research of and publications by Irene Stuckey and that of George Church and Richard Champlin. These works have since been supplemented and supported by additional research and evaluations by the New England Botanical Club with the U.S. Fish and Wildlife Service, and the New England Plant Conservation Program in 1991. (Enser 2002.)

Enser and several other professional and amateur botanists have since worked to verify the locations and identities of Rhode Island's rare plants, resulting in making the RINHP the largest repository of rare plant information for the state. The database is updated regularly to ensure that it is up-to-date. Currently Rhode Island considers 24% of its flora to be rare, with 309 vascular plant taxa considered rare. (Enser 2002.)

Delaware Rare Plants. Delaware has a land area of 1,955 square miles while Ventura County has a land area of 1,857 sq. mi., slightly smaller, but very comparable to the County in size. Delaware ranges in elevation from sea level to 442 feet, considerably less than for Ventura County. It is quite flat, from sea level at the ocean beaches to an elevation of 442 feet above sea level in New Castle County. Delaware has a moderate climate with an average monthly temperature ranging from 32 degrees Fahrenheit in the winter to 75.8 degrees Fahrenheit in the summer. The average annual precipitation is about 45 inches.

The Delaware Natural Heritage Program (DNHP) is part of the Division of Fish and Wildlife, Delaware Department of Natural Resources and Environmental Control. The program was established in Delaware in 1987. DNHP's mission is to track the status of rare and uncommon species of plants and animals, as well as pristine and unique natural community types. (McAvoy 2003.)

The DNHP provides reliable and up-to-date biological and ecological information. Through systematic statewide field surveys, the DNHP has compiled a database containing thousands of records of state rare

plants, animals, and unique natural communities that are of conservation concern. These data are used by government agencies and conservation organizations for management, conservation, and land protection purposes. As a measure of rarity within the state, the DNHP uses a ranking system developed by TNC, a private international conservation organization. This ranking system is explained in detail in Table 1 (above). Every species from the known flora of Delaware has been assigned a state rank, which reflects the degree of rarity within Delaware. In addition, a global rank has also been assigned to indicate the degree of rarity worldwide. State and global ranks are used to prioritize conservation efforts so that the rarest species receive more immediate protection. In general, ranks are determined by the number of known occurrences (or populations) of a particular species. Ranks are determined through field investigations and consensus within the scientific community. (McAvoy 2003.)

DNHP divides its list into two sections. Section I lists rare species of conservation concern (S1, S2, SH, SX) and Section II contains "watchlist" species, which are ranked S3 or SU (which are thought to be uncommon but not of conservation concern). The rare species list contains 629 species and varieties of vascular plants, the watchlist contains 156 species and varieties of vascular plants.

Considering the overall native flora of Delaware (1,571 taxa), 40% of the native flora (629 taxa) are of conservation concern (S1, S2, SH, SX), 26% (403 taxa) are rare to extremely rare (S1, S2), 11% (170 taxa) are thought to be historical (SH), and 3% (56 taxa) are thought to be extirpated (SX). In addition, 4% (69 taxa) of the states native flora is known from only a single occurrence or population (S1.1). Species are rare for a variety of reasons, but rarity is primarily a result of the loss of habitat, such as the draining and filling of wetlands and the destruction and development of upland forests. The DNHP hopes that these lists will be used to facilitate efforts towards the conservation and protection of Delaware's rare native plants and their habitats. (McAvoy 2003.)

Connecticut Rare Plants. Connecticut is the third smallest state in the Union, occupying 4,845 square miles, more than double the size of Ventura County. Connecticut natural habitats have been largely modified and disturbed by development over the last 200 years. Connecticut ranges in elevation from sea level to 725 meters, considerable less than Ventura County.

Connecticut has a flora of approximately 1,800 native vascular plant taxa (Morse et al. 2004, Dowhan 1979). The Connecticut Natural Heritage Program, Department of Environmental Protection (CDEP), established in 1983, ranks and maintains a database of Connecticut's rare species. The CDEP Natural Diversity Data Base (NDDB) tracks its rare plants, animals, and natural communities through comprehensive mapping and GIS databases, which is used to establish management and environmental review priorities. (http://dep.state.ct.us/cgnhs/nddb/nddb2.htm.)

Currently Connecticut considers at least 19% of its flora to be rare, with 343 vascular plant taxa considered rare. (http://dep.state.ct.us/cgnhs/nddb/nddb2.htm.)

Information from biologic inventories of the state's species and habitats, conducted over the past 100 years by the Connecticut Geological and Natural History Survey, has been incorporated into the NDDB. Ongoing field research, in addition to information received from universities, biologists, naturalists, and conservation groups, continues to add new information and update existing information in the NDDB. The NDDB currently contains information on the status of more than 1,000 species of plant and animals, including invertebrates, and 45 significant natural communities, which includes the Endangered, Threatened, or Special Concern species listed in Connecticut. (http://dep.state.ct.us/cgnhs/nddb/nddb2.htm.)

The International Union for the Conservation of Nature recently released a report calling attention to the widespread imperilment of the world's plants. The report estimated that one in eight species of plants worldwide and one in three plant species in the United States are threatened with extinction. While the numbers in the United States are disturbing, they most likely reflect the amount of available information on plant distribution.

In Connecticut, plant species have been impacted from pressures related to habitat loss and degradation, invasive species encroachment into natural habitats and overbrowse resulting from an over abundance of deer. The State Endangered Species List, updated in March of 1998, includes:

- 118 State Endangered Plant species;
- 34 State Threatened Plant Species; and
- 198 State Special Concern Plant Species.

Conclusions

Based on how plants are typically ranked globally and statewide, and how this ranking system is applied nationwide regardless of the land area covered, it is reasonable and justifiable to apply the same ranking system to Ventura County, which is twice the size of the smallest state and similar in size to another, both of which use the same rarity ranking system, on the plants within their respective jurisdictions regardless of the status of those same plants in neighboring states.

Obviously, at some point, the applicability of this ranking system loses some validity if the area considered is too small. What is that size? This question has not been answered; however, since this ranking system has been used nationwide consistently in all 50 states, including states equal or smaller than Ventura County, it can be reasonably argued that the "too small" threshold has not yet occurred. Maybe the small area end of the ranking system is at or slightly smaller than Rhode Island, the smallest state in the nation.

Assuming for the sake of argument that the ranking system comparison starts to lose its reasonableness for areas the size of or smaller than Rhode Island (and Ventura County?), it may not be unreasonable to restrict the criteria used for Ventura County to just the S1, SX, and SH categories to compensate for the fact that there are only two states in the United States that are equal or smaller in size. In further comparing the attributes of Ventura County and the two smallest states (Rhode Island and Delaware), Ventura County has much greater topographic, habitat, and substrate diversity and complexity, not to mention higher species richness then any of these three smallest states, as well as many other larger states in the nation.

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