

Change from List 2.3 to 4.1 was rejected on 1 June 2006

Rare Plant Status Review: *Lycopodium clavatum*

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Distribution

Lycopodium clavatum (running-pine) is a rhizomatous herb in the club-moss (Lycopodiaceae) family. For a more detailed plant description, visit http://www.northcoastcnps.org/cgi-bin/nc/sensnw.cgi/Html?item=pp_lycl.htm. Gordon Leppig's article in *Fremontia* [32(4):20-22 (2004)] also provides useful information on the natural history of *Lycopodium clavatum*. The overall range includes the North Coast bioregion of California and extends north to Alaska and Montana. Moreover, this plant is widely distributed in other north temperate regions (e.g. in eastern North America, Caribbean, South America, Europe, Africa, Asia) (Hickman et al. 1993). In California, it is known from Del Norte, Humboldt, Mendocino and Sonoma counties. Most occurrences are located in Humboldt County, and the plant is rather scarce in the other counties.

Habitat

Lycopodium clavatum (hereafter abbreviated as LYCL) typically occurs in North Coast coniferous forests, such as redwood forests. LYCL is commonly associated with forest edges, openings, and has been observed growing on road banks and slash. Simpson Timber Company's assessment of the species (attached) found that excellent habitat occurred on their lands in areas that were either not managed, selectively logged, or protected during management activities. It can also be associated with marshes and swamps, which are protected under Watercourse and Lake Protection Zones (WLPZ). LYCL's elevation range is approximately 45 to 1225 meters.

Abundance and Status

Currently, LYCL is on CNPS List 2(.3) as it was in the 6th (2001) and previous editions of the *CNPS Inventory*. It has been tracked as a rare plant by CNPS since the first *Inventory*, which was published in 1974. NatureServe ranks it as G5 because it's considered widespread outside of California (G5). While reviewing the addition of the species to the first *Inventory*, the paucity of herbarium records must have suggested a low number of total sites and formed the basis of the initial ranking by CNPS and CNDDDB. However, some reviewers have recently questioned the rarity of LYCL, particularly in Humboldt County. Following field surveys by registered professional foresters, timber company botanists, and others, much additional data were received. These data and the 120 existing occurrences in CNDDDB suggested there are more than 50 viable sites in California and prompted those botanists to propose a downgrade in the status of this plant to List 4.

We evaluated all of the approximately 361 un-entered data sources received by CNDDDB/CNPS as of March 24, 2006 to determine whether they represented new or existing sites. Many of the un-entered forms were from new sites, but there were also many extensions or updates to existing occurrences. The new data included field forms that were aggregated and would be considered a single occurrence since they were located within 0.25 mile of each other. Following the analysis, 7 more un-entered field survey forms were received from PALCO. We did not re-analyze the dataset to include these forms, which could represent additional new sites or updates to existing occurrences in CNDDDB.

In our analysis of unprocessed and processed data, we determined that there were 400 polygons, which would result in a total of 215 occurrences if this were all updated in the GIS by CNDDDB. Most of the existing occurrences would remain virtually unchanged. A few would be lumped. 95 new occurrences would be added, nearly doubling the number of previously known occurrences.

Ryan Elliott used ArcMap's cluster tools to disassemble and reassemble all of the polygons based on the 1/4 mile rule to determine which polygons would make up which occurrences. Where applicable, the old occurrence number(s) which correspond to the clusters are displayed in the spreadsheet (attached). Any new source for each cluster is listed according to the Green Diamond (GDRC) or Pacific Lumber (PALCO) ID code, or other un-entered source code. In interpreting the spreadsheet, pay close attention to the source field, which is larger it appears. For example, Cluster 203 has about 90 new sources for it. Similarly, when displaying the clusters in GIS, some of the occurrences are up to 2+ miles long.

Acreages of the occurrences were calculated the same way they would appear in the CNDDDB. Non-specific features (such as 1/5 mile radii, etc) were not given an acreage value while specific features were. Note that each GPS point results in a 5 acre polygon. There were a few cases where we had existing non-specific features which would have been replaced with smaller specific features from the new Green Diamond data. Ryan produced the new graphic features by merging all the existing data with the new data. We will bring this graphic to the meeting in Hopland. ArcMap calculated the areas of the new features, which were exported to Excel and then modified manually where necessary. The estimated total area of all occurrences is 2530 acres.

Currently, there are approximately 215 LYCL occurrences presumed extant known to CNDDDB and CNPS. Historical sites are included in this case (we don't normally include them) because the forested habitats these occur on are more than likely still extant. One site previously considered historical was re-found in subsequent surveys. Additionally, private timberlands are typically unsurveyed or under-surveyed and sometimes botanists neglect to submit field survey forms due to lack of time. Thus, it is quite likely that additional occurrences for this taxon remain undiscovered and/or unreported, and our estimate of total occurrences is lower than the actual number.

Site rankings are generally based on a combination of field reporter opinion (what they indicated on the field survey form), number of plants, and habitat quality. The CNDDDB staff then apply what they hope is additional consistency to the rankings, modifying them if needed (for example, good habitat with only 1 plant cannot be an "A" ranked occurrence). However, due to the rhizomatous nature of LYCL, most reporters recorded either the number of mats or an estimated mat size. There did not seem to be consistency in the rankings when compared with the mat sizes. Thus, for LYCL, we were not able to find a clear method of standardizing and comparing the varying site quality rankings of different reporters. However, we did find total occurrence number and area to be informative in this status review. The spreadsheet showing occurrences with their data sources and estimated area is attached to give reviewers an idea of the size and rough estimate of quality of each occurrence.

Threats

The major activities within LYCL's distribution and abundance are logging and related disturbances, such as road building. Cultivation and transplantation efforts have been problematic probably due to the mycorrhizal relationship that is critical in the gametophyte stage (Leppig 2004). The nature of its lifecycle may also decrease its chances for survival because it can require more than 20 years to complete (Leppig 2004). Although the Simpson study showed that LYCL can persist in selectively logged areas, it also noted that clear cutting and prescribed burning leads to extirpation of occurrences. The Department of Fish and Game is working with private timberland owners to develop strategies that best maintain LYCL (e.g. leaving shade trees, excluding heavy equipment which would impact LYCL's shallow root system, and excluding herbicides).

Recommended Possible Actions

The high number of extant occurrences and the probability for more occurrences being found suggest that downgrading to CNPS List 4 and re-ranking to CNDDDB S4 are warranted at this time.

The sheer number and size of many of the larger occurrences make it seem reasonable to conclude that there is a good number of viable sites. The threshold for CNPS List 2 is typically 50 occurrences in the state, and the threshold for S3 is typically 21-80 occurrences and 3000-10,000 plants. Removal from the CNPS Inventory and CNDDDB is probably not appropriate because ongoing threats and the relatively low number of public land occurrences give cause for concern about the long-term viability of LYCL. Currently, we are aware of only eight occurrences on public land (Jackson SF, City of Arcata, BLM-Headwaters Forest Reserve, NPS-Redwoods NP).

Multiple threats related to timber land management were reported for most of the CNDDDB occurrences, so the threat rank needs review. We think that .1 may be a more appropriate threat rank than .3. It is unknown how much protection timberland occurrences receive at present since this species does not occur exclusively within protective zones for watercourses. It appears that disturbance plays a role in the life history of some occurrences. More information on the role of disturbance, current threats, and appropriate management strategies is needed.

CNPS: Re-rank to CNPS List 4.1

CNDDB: Re-rank to S4.1 (Please review threat rank; we set it as .1 because most occurrences have multiple timber management-related threats listed.)

General: Regardless of ranking, LYCL should be monitored at a number of sites under various management regimes and in various ecological situations to ensure the plant is not declining over time. LYCL habitat should be managed for long-term viability of the species and the ecosystem it depends on.