

# Conservation Status Report for *Arabis rectissima* E. Greene var. *simulans* Rollins (Brassicaceae), the Washoe Tall Rockcress.

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**SUMMARY:** *Arabis rectissima* var. *simulans* was first discovered and collected in 1962, and was first named and described in the scientific literature in 1993. It is a tall wand-like biennial or perennial herb with green, coarsely, sparsely, and uniformly branched-hairy, somewhat toothed basal leaves, leafy flowering stems to 11 dm high, a virtually hairless inflorescence, small flowers with four white to pinkish petals, and long-pointed fruits that point straight downward against the stem at maturity. *Arabis rectissima* var. *simulans* remains endemic to the north half of the Carson Range in northwestern Douglas and southwestern Washoe counties, Nevada, although there is anecdotal evidence that it may also occur in the California portion of the Lake Tahoe Basin. *Arabis rectissima* var. *simulans* appears to be most closely related to varieties of *A. holboellii*, intergrades and possibly hybridizes with *A. holboellii* var. *pinetorum* at 25% of the known sites, and should probably be treated as a variety of *A. holboellii* instead. Until further field surveys and taxonomic studies can be performed, the variety is still considered to represent a distinctive genetic, geographic, and ecologic entity worthy of separate conservation concern.

Because of ongoing concern about the conservation status of *Arabis rectissima* var. *simulans* resulting mainly from heavy recreational development and use of the habitat, the U. S. Fish and Wildlife Service and the Nevada Natural Heritage Program sponsored and conducted extensive field surveys in 1996 and 1997 to verify and refine the historical reports, discover any additional populations, and document the biology, ecology, and conservation status of all populations. This report summarizes the results of all known surveys and recommends conservation actions designed to prevent the variety from becoming a threatened or endangered species.

As now documented, *Arabis rectissima* var. *simulans* is known worldwide from 8 sites in two closely separated areas, totaling roughly 1138 plants and covering about 29 acres (12 ha) of county, state, Humboldt-Toiyabe National Forest, and private lands. The most distant two extant occurrences are separated by about 18 miles (29 km), and the number of extant occurrences is reduced to three if a 1 km minimum separation distance is imposed. *Arabis rectissima* var.

*simulans* has been found only in dry, deep, sandy, granitic or andesitic soils on mostly gentle slopes of all aspects, in full or filtered sunlight of thinly-littered openings in mid- to somewhat late-seral Jeffrey pine / Sierra Nevada white fir forests between 6035 and 7335 feet (1840-2235 meters) elevation. Densities of the *Arabis* were highest on very light and recovered disturbances such as in picnic and camping areas or on road banks, but the frequency of intergradation with *A. holboellii* was also highest at such sites. The variety was excluded from areas of bare ground, deep litter, dense tree or shrub cover, or intense disturbance. The true total population of *Arabis rectissima* var. *simulans* is estimated to be between 50% and 500% greater than that now documented.

Much of the known habitat of *Arabis rectissima* var. *simulans* will continue to be subject to impacts from recreational development and use, poor fire management, timber management activities, and possible hybridization with more common taxa. As of this report, significant impacts and some small amounts of permanent habitat loss from one or more of these sources had been observed at most of the known populations, although the viability of most did not yet appear compromised. Even without these impacts and threats, *Arabis rectissima* var. *simulans* as currently known would remain rare enough to merit conservation concern. Currently *Arabis rectissima* var. *simulans* has no legal status or protective designations.

Based on the best available scientific evidence, it is uncertain whether or not *Arabis rectissima* var. *simulans* meets the definition of a candidate for listing as threatened or endangered under the Endangered Species Act. The likelihood that many additional population exist in the Lake Tahoe Basin and surround region, and the uncertain taxonomic status of the variety, weigh against candidate status, but the heavy threats to the few small populations currently known to exist weigh in favor. Until many more and less vulnerable populations can be located, however, or until it can be shown to be taxonomically invalid, its long-term viability will remain of concern without protective management. It therefore meets criteria for sensitive species designation by the U. S. Forest Service. This report recommends several conservation measures which, if successfully implemented, offer the best chance to eliminate any future need to list *Arabis rectissima* var. *simulans* as threatened or endangered. Primary among these are active near-term cooperative management and public planning to minimize further impacts and habitat destruction, careful design and mitigation of fire suppression sites and activities, further surveys and taxonomic studies, frequent monitoring, and study of insect pollinators.

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*All information contained in this report was believed current and complete on the date it was printed. Please submit any and all additions, corrections, updates, comments, or suggestions, whatever their magnitude, to either of the addresses above.*

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## I. TAXONOMY

**Scientific Name:** *Arabis rectissima* E. Greene var. *simulans* Rollins (1993, p. 195).

**Synonym(s):** None.

**Vernacular Name(s):** Washoe Tall Rockcress.

**Family:** Brassicaceae (mustard family).

**Review of Alternative Taxonomic Treatments:** No alternative taxonomic treatment (nor another treatment of any kind) has been proposed for *Arabis rectissima* var. *simulans* since it was first described by Rollins (1993). During field work for this report, however, the populations at sites 01 and 08 were observed to intergrade morphologically, and possibly to hybridize, with *Arabis holboellii* Hornemann var. *pinetorum* (Tidestrom) Rollins. At the same time, the several populations of *Arabis rectissima* var. *rectissima* also observed during field surveys were very uniform morphologically even when mixed with *A. holboellii*, and showed no trace of the characteristics Rollins (1993) used to distinguish var. *simulans*. Furthermore, the two varieties of *A. rectissima* were never found together or even near each other, whereas *A. rectissima* var. *simulans* was always found growing with or adjacent to populations of *A. holboellii* var. *pinetorum* (though it appeared to remain distinct at all but the two sites noted above).

At the very least, these observations strongly suggest that var. *simulans* would better be treated as a variety of *Arabis holboellii* than of *A. rectissima* (no such nomenclatural combination is yet available). Indeed, in Rollins' (1993) key to *Arabis*, *A. rectissima* var. *simulans* keys out most closely to *A. holboellii* var. *collinsii* (Fernald) Rollins of the northern Great Plains and areas farther east, and not at all to *A. rectissima*!. (It appears that *Arabis rectissima* var. *simulans* may have been a last-minute addition to Rollins' [1993] publication, and was incompletely accounted for in the keys, and in the description of *A. rectissima* where the leaves were described only as entire.) It is possible that var. *simulans* may have originated via hybridization and introgression between *Arabis rectissima* and *A. holboellii*, but if so it appears that the resulting hybrid products were potentially interfertile only with the *A. holboellii* parents and completely isolated from the *A. rectissima* parents. It is also possible that var. *simulans* is merely a forest-adapted variety or ecotype of *A. holboellii*.

It is not clear from the descriptions in Rollins (1993) exactly how one would distinguish *Arabis rectissima* var. *simulans* from *Arabis holboellii* var. *collinsii*, other than by geographic distribution. Based on implications from descriptions of the full species, and on field observations of *Arabis rectissima* var. *simulans*, it appears that var. *simulans* may average taller than var. *collinsii* (up to 11 dm or more vs. up to 6 dm), be more sparsely hairy at the stem bases and on the lower leaves, with the spaces between the hairs appearing about equal to larger than the hairs themselves, have narrower petals (1-2 mm wide vs. 2-3.5), and have mature fruit tips that taper more gradually and acuminate (vs. possibly being merely acute to obtuse in var. *collinsii*). Verification of these and possibly other differences await close comparison of authoritative material of both taxa.

Further field surveys and observations, perhaps coupled with systematic studies at the molecular level, will be needed before the taxonomic validity of *Arabis rectissima* var. *simulans* can be determined conclusively. The two sites at which morphologic intergradation was observed were also the two sites that had received continuous light disturbance from recreational use, and disturbance-induced hybridization and introgression could explain the variation observed. (The plants were also relatively abundant at these sites, suggesting that light disturbance may also

temporarily increase population numbers.) Whatever its eventual taxonomic disposition may be, for now *Arabis rectissima* var. *simulans* is considered a distinctive genetic, geographic, and ecologic entity worthy of separate conservation concern and further taxonomic study.

## II. TAXON HISTORY

Unless otherwise cited, reports and correspondence documenting the following chronology are on file with the Nevada Natural Heritage Program.

- 1962: First discovered and collected by John Thomas Howell of the California Academy of Sciences in or near what is now Galena Creek County Park, Washoe County, Nevada (site 01) on 20 June. The specimen was labeled by Howell as *Arabis holboellii* var. *pinetorum*, and would later become a paratype of *Arabis rectissima* var. *simulans*.
- 1983: Specimens that would eventually become the type material were collected by Reed and Kathryn Rollins, along with Aileen G. Roads, Arnold Tiehm, and Margaret Williams of the Northern Nevada Native Plant Society, at Galena Creek County Park on 4 July.
- 1993: Formally named and described by Rollins (1993).
- 1995: Formally recommended for category-2 candidate status under the federal Endangered Species Act on 7 April.
- 1996: Category-2 candidate designations were eliminated for all species on 28 February by the U. S. D. I. Fish and Wildlife Service (1996).
- 1996-1997: Surveys were conducted by the Nevada Natural Heritage Program for this report, during which the variety was first documented in the Spooner Summit area of the Carson Range, south of the type locality.
- 1997: A salvage timber sale was approved and implemented within potential habitat adjacent to the east of the Spooner Summit sites. The project used existing roads and landings, and impacts to undocumented *Arabis rectissima* var. *simulans* populations were likely minimal.

## III. PRESENT LEGAL OR OTHER FORMAL STATUS

**International:** Using a system established by NatureServe (formerly part of The Nature Conservancy), the various state Natural Heritage Programs rank sensitive taxa at state, national, and global levels on a scale of 1 to 5, with 1 being the most vulnerable and 5 the most secure. *Arabis rectissima* var. *simulans* was most recently ranked 1 by the Nevada Natural Heritage Program (2003) at all levels.

**Federal:** *Arabis rectissima* var. *simulans* was proposed to be a category-2 candidate for listing as endangered or threatened under 16 U.S.C. 1531 *et seq.*, the Endangered Species Act as amended in 1988, until the U. S. D. I. Fish and Wildlife Service (1996) eliminated that category. Category-2 included taxa for which "*proposing to list them as endangered or threatened species is possibly appropriate, but for which substantial data on biological vulnerability and threat(s) are not currently known or on file to support the immediate preparation of rules*" (U. S. D. I. Fish and Wildlife Service 1985). *Arabis rectissima* var. *simulans* remains a "species of concern" to the Fish and Wildlife Service, but this term has no formal or legal status. *Arabis rectissima* var. *simulans* is also proposed for addition to the sensitive species list of the Humboldt-Toiyabe National Forest.

**State:** No formal status has been designated at the state level. *Arabis rectissima* var. *simulans* is on the Nevada Native Plant Society's Threatened List (Nevada Natural Heritage Program, 2003).

#### IV. DESCRIPTION

*Arabis rectissima* var. *simulans* is distinguished from similar species by its combination of biennial or short-lived perennial habit; tall, wand-like, dark-green to purplish stems to 11 dm high; stems and leaves sparsely and coarsely hairy near base of plant with spreading, 3-5-branched hairs, becoming hairless below the first flowers; the basal leaves spreading, stalked, the largest 20-30 x 4-9 mm wide, spoon-shaped, usually somewhat toothed, generally remaining deep green and not withering until after the first fruits form, the spaces between the hairs appearing about equal to somewhat larger than the hairs themselves, the blade edges not fringed with straight unbranched or forked hairs, sometimes fringed with long 3-5-branched hairs, a few straight unbranched or forked hairs sometimes fringing the stalk base; the higher stem leaves becoming smaller, more upright, and stalkless, lance-shaped, with small basal lobes clasping the stem; the four petals white to pinkish, erect, each 4-6 x 1-2 mm; the four sepals of the flower cup 2-3 x 1 mm, sparsely hairy; the fruits straight, pointed straight downward against the stem, 50-80 x 2 mm, hairless, the tip long-pointed with a style about 1 mm long; fruit stalks 4-12 mm long, bent straight downward at the stem, hairless; seeds in one row per chamber, circular, flattened, winged all around (based on Rollins 1993 and field observations).

No drawing or photographs of *Arabis rectissima* var. *simulans* have yet been published. Comparative photographs of *Arabis rectissima* var. *simulans*, related species, and their habitats were made for this report, are reproduced in Appendix 2, figures 3-12, are filed with the Nevada Natural Heritage Program, and are available on its public web site at <http://heritage.nv.gov>.

#### V. GEOGRAPHIC DISTRIBUTION

Globally, *Arabis rectissima* var. *simulans* has been documented from only 8 sites in two closely separated groups, containing 13 total patches or stands, in the lower-elevation forests of the north half of the Carson Range, an eastern outlier of the Sierra Nevada forming the east rim of Lake Tahoe, in northwestern Douglas and southwestern Washoe counties, Nevada, on public County, State, and Humboldt-Toiyabe National Forest lands, and on private lands. The most distant two extant occurrences are separated by about 18 miles (29 km), and the number of extant occurrences is reduced to 3 if a 1 km minimum separation distance is imposed.

Although much potential habitat was examined without success during surveys for this report (Appendix 3 maps), the habitat type in which *Arabis rectissima* var. *simulans* is found is widespread and common in the east-central Sierra Nevada of California and Nevada, and many additional populations likely remain to be documented. My incidental and out-of-season observations over several years have suggested the presence of this taxon in several places in the southern portion of the Lake Tahoe Basin in California, but confirmation there awaits focused surveys at optimal times of year.

Site descriptions of occupied habitat are provided in Appendix 1. The table cross-references each site to its related maps and figures, as well as its most recent year observed and source(s) of documentation. The tables also show estimated areas and numbers of individuals for each occupied site, along with elevations, apparent land management status, types of impacts or threats, and estimated annual average precipitation. The site numbers correspond to the element occurrence

numbers for *Arabis rectissima* var. *simulans* in the databases of the Nevada Natural Heritage Program.

To the best of my knowledge, no privately managed sites were entered upon to obtain any of the new information documented by these surveys against the restrictions of the owners or managers. In many cases, private sites were small and easily viewed and documented from adjacent public lands or public access areas. In a few cases, sites were not surveyed due to lack of access.

## VI. HABITAT CHARACTERISTICS

**Environment and Habitat Summary:** (Appendix 2 figures) *Arabis rectissima* var. *simulans* has been found only in dry, deep, sandy, granitic or andesitic soils on mostly gentle slopes of all aspects, in full or filtered sunlight of thinly-littered openings in mid- to somewhat late-seral Jeffrey pine / Sierra Nevada white fir (*Pinus jeffreyi* / *Abies lowiana*) forests between 6035 and 7335 feet (1840-2235 meters) elevation. Densities of the *Arabis* were highest on very light and recovered disturbances such as in picnic and camping areas or on road banks, and the variety was excluded from areas of bare ground, deep litter, dense tree or shrub cover, or intense disturbance. The sites receive their moisture almost entirely from incident precipitation, which averages about 22.68 to 30.50 inches (576-775 mm) per year. Additional plants most frequently associated with *Arabis rectissima* var. *simulans* included *Artemisia tridentata vaseyana*, *Ceanothus prostratus*, *C. velutinus*, *Arctostaphylos pungens*, *Purshia tridentata*, *Elymus elymoides*, *Achnatherum* sp., *Arabis holboellii pinetorum*, *Penstemon* sp., *Apocynum androsaemifolium*, *Gayophytum* sp., and *Linanthus ciliatus*.

**Other endangered, threatened, and sensitive species:** At least 33 other sensitive plant and animal species are found in Nevada within 6 miles (10 km) of the known populations of *Arabis rectissima* var. *simulans*. Of these, only one location of the Sierra Nevada snowshoe hare (*Lepus americanus tahoensis*) has been found within 0.5 mile (0.8 km). Contact the Nevada Natural Heritage Program for further current information on rare and sensitive species found in the vicinity of *Arabis rectissima* var. *simulans*.

**Land Management:** (Appendix 1, table 1) Most of the sites occupied by *Arabis rectissima* var. *simulans* are on public lands in or adjacent to parks managed primarily for recreational uses. Some of these lands are also subject to timber harvest and management activities. For all sites, management status was determined based on the best maps, GIS data, and other information available, but generally was not further verified. Ownership status of associated minerals and water rights was not determined for any site, nor was the presence or absence of any easements or other encumbrances.

## VII. BIOLOGY AND ECOLOGY

Based on the information gathered for this report, the total known global population of *Arabis rectissima* var. *simulans* was estimated to be 1138 individuals, and to occupy about 29 acres (12 ha) of habitat divided among 8 sites in two closely separate areas, containing 13 total patches or stands. The most distant two occurrences are separated by about 18 miles (29 km), and the number of extant occurrences is reduced to three if a 1 km minimum separation distance is imposed. From estimates of the total individuals within total occupied habitat, an average density of 39.1 plants per acre (96.6/ha) can be estimated. However, individual site estimates ranged from about 5 plants per acre (12/ha; site 08) to about 83 plants per acre (204/ha; site 01; Appendix 1, table 1). Based on the probable extent and occupancy rate of unsurveyed potential habitat,

the true total population of *Arabis rectissima* var. *simulans* is estimated to be between 50% and 500% greater than that now documented.

Depending on elevation and the annual timing of precipitation and temperature changes, flowering probably begins sometime in May and continues through July. The fruit appear to mature by about 5-8 weeks after flowering, between mid June and August.

During surveys for this report, a small white butterfly species was observed visiting the flowers of both *Arabis rectissima* var. *simulans* and *A. holboellii*; its possible role in pollination or gene flow between the two species could not be assessed. A mildew-like fungus was observed fairly heavily infesting the leaves, stems, and fruits of *Arabis rectissima* var. *simulans* at Galena Creek County Park after heavy late-spring precipitation (see Appendix 2 figures), but this did not appear to be affecting productivity or mortality of the plants.

At all sites *Arabis rectissima* var. *simulans* appeared to be adapted to competition in deep soils on partially shaded forest floors or brushy forest openings where mid- to somewhat late-seral conditions prevailed. The species appeared to be excluded from areas where the vegetation was exceptionally dense or sparse, or where the forest litter was absent or exceptionally deep. At several sites, *Arabis rectissima* var. *simulans* was observed to increase in abundance (but also to intergrade more frequently with *A. holboellii*) where the habitat was recovering from light disturbances such as in picnic and camping areas or on road banks, but only within its specific mid- to somewhat late-seral forest habitat. Permanent loss of plants is evident where disturbance has been continuous and severe.

## VIII. EVIDENCE OF THREATS TO SURVIVAL

Causes of impacts and threats observed or reported for the known sites are summarized in Appendix 1, table 1.

### **Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range:**

Some small amounts of permanent habitat losses were observed to have resulted from recreational development and activities, and from road construction. The plants appeared to be most abundant, but also to intergrade more frequently with *Arabis holboellii*, where the habitat was recovering from light disturbances such as in picnic and camping areas or on road banks. The observed sources of impacts and threats to the habitat, in approximate order of greatest to least current significance, were: recreational development and use, road construction and maintenance, fire suppression activities, timber harvest, and off-road vehicle use. As of 1996, none of the habitat observed had yet been affected by the invasion of exotic species; not a single invasive non-native plant was documented at any of the sites.

Given its preference for mid- to somewhat late-seral forest conditions, the effects of fire suppression can be difficult to balance; too much suppression can lead to elimination of habitat by overgrowth followed by catastrophic fire, and too little suppression in areas already affected by too much suppression can also lead to loss of too much habitat at one time when fires do occur.

**Over-utilization for Commercial, Recreational, Scientific, or Educational Purposes:** The few scientific collections that have been taken to document populations (Appendix 1, table 6) are neither known nor likely to have had significant impacts on any population of the species. No other uses of the species for such purposes are known.

**Disease or Predation:** As discussed under Biology and Ecology on page 7, a mildew-like fungus was observed fairly heavily infesting the leaves, stems, and fruits of *Arabis rectissima* var. *simu-*



*lans* at Galena Creek County Park after heavy late-spring precipitation, but this did not appear to be affecting productivity or increasing mortality of the plants.

**Inadequacy of Existing Regulatory Mechanisms:** No enforceable protective designations, conservation agreements, or approved management plans are known to exist for *Arabis rectissima* var. *simulans* or its habitat. Unless it is listed as endangered or threatened (50 CFR 17.61, 17.71) and occurs within federal jurisdiction, a plant has no formal protection under the federal Endangered Species Act (ESA), except for regulatory determinations by some federal land management agencies (U. S. Forest Service, Bureau of Land Management) that candidate and other sensitive species will be managed in order to avoid the need for listing. No federal protection currently extends to plants under non-federal jurisdiction unless they are listed as endangered and removing, cutting, digging up, damaging, or destroying them would be "*in knowing violation of any law or regulation of any state or . . . of a state criminal trespass law*" [ESA Sect. 9(a)2(B)], and that law extended to non-federal jurisdictions. The Endangered Species Act and the various agency regulations implementing it are also in direct conflict with provisions of the mining law of 1872 (30 U.S.C. 21 *et seq.*), and are therefore of uncertain protective value when mineral-related projects are involved.

U. S. D. A. regulation 9500-4 directs the Forest Service to manage "*habitats for all existing native and desired nonnative plants, fish, and wildlife species in order to maintain at least viable populations of such species,*" and to avoid actions "*which may cause a species to become threatened or endangered.*" Forest Service objectives further state that viable populations of all species must be maintained "*in habitats distributed throughout their geographic range on National Forest System lands*" (Forest Service Manual [FSM] 2670.22). Addition of *Arabis rectissima* var. *simulans* to the sensitive species list of the Humboldt-Toiyabe National Forest would identify it as a species "*for which population viability is a concern as evidenced by . . . significant current or predicted downward trends in population numbers or density or . . . in habitat capability that would reduce a species' existing distribution*" (FSM 2670.5). Current Forest Service policy on species designated sensitive is to "*review programs and activities, through a biological evaluation, to determine their potential effect on sensitive species*" as part of the NEPA process, to "*avoid or minimize impacts*" from such activities or, if impacts cannot be avoided, to "*analyze the significance*" of those impacts for the species as a whole. Any decision to allow impacts "*must not result in loss of species viability or create significant trends toward Federal listing*" (FSM 2670.32). Department regulation 9500-4 has the force of law at least until changed; specific provisions of written Forest Service policy implementing that regulation are of uncertain legal standing in specific cases.

*Arabis rectissima* var. *simulans* is not listed as "critically endangered" under Nevada Revised Statutes (NRS) 527.270. Such listing would provide that ". . . no member of its kind may be removed or destroyed at any time by any means except under special permit issued by the state forester firewarden" on any lands in Nevada. The adequacy of this law, however, depends on informed and cooperative land managers, or on some form of deterrent enforcement, for either of which the current law does not provide. It also depends on the Nevada State Forester's discretion in placing species on the list of fully protected plants, in issuing or withholding permits, and in placing protective conditions on permits that are issued. Recently enacted regulations in Nevada Administrative Code (NAC) Chapter 527 greatly expanded and clarified the requirements and procedures for obtaining such permits.

Within state and county parks, where most of the known populations of *Arabis rectissima* var. *simulans* now occur, management for recreational use is primary, and management for rare species resources tends to be of lower priority if it is done at all.

**Other Natural or Man-made Factors:** To the extent that *Arabis rectissima* var. *simulans* may depend upon insect pollinators for successful reproduction, any natural or man-made factors affecting the viability of such insects would also affect the viability of *Arabis rectissima* var. *simulans*. Most of the known sites also have so few plants that natural population fluctuations would be expected to have a high probability of leading to local extirpation over time. Because this is most true of populations that appear least impacted by human activities, however, populations of *Arabis rectissima* var. *simulans* may just be naturally very small, and may in some way be biologically adapted to long-term survival at such low numbers.

## IX. RECOMMENDATIONS

**Status Recommendations:** At present it is uncertain whether or not *Arabis rectissima* var. *simulans* meets the definition of a candidate for listing as threatened or endangered under the Endangered Species Act. The likelihood that many additional population exist in the Lake Tahoe Basin and surround region, and the uncertain taxonomic status of the variety, weigh against candidate status, but the heavy threats to the few small populations currently known to exist weigh in favor. At the very least, the taxon should remain a "species of concern" to, and be reviewed and monitored frequently by, the U. S. Fish and Wildlife Service and cooperating agencies. With further surveys, taxonomic studies, active, long-term, cooperative management to reduce or eliminate further impacts to the habitat, and appropriate long-term monitoring, it may be possible to prevent *Arabis rectissima* var. *simulans* from becoming threatened or endangered. Absent such management, there is substantial near-term possibility of major population declines, and federal and/or state listing could become justified if more than about 10% of the known population was lost to preventable causes.

The species is also ranked 1 (critically imperiled) at the global and state levels by the Nevada Natural Heritage Program, and is on the Threatened list of the Nevada Native Plant Society (NNPS). Because of the variety's few and small populations, their small geographic range, and their continued susceptibility to intense threats, these designations remain appropriate for *Arabis rectissima* var. *simulans*. Because of its documented occurrences on or very near National Forest lands, the Humboldt-Toiyabe National Forest and the Lake Tahoe Basin Management Unit should add *Arabis rectissima* var. *simulans* to their sensitive species lists. If more than about 10% of the known populations ever became seriously degraded or were lost, the Nevada Division of Forestry should consider adding *Arabis rectissima* var. *simulans* to the Nevada list of critically endangered flora under Nevada Revised Statutes 527.270.

**Conservation and Recovery Recommendations:** The following recommendations, roughly in descending order of priority, are offered as the best opportunities to maintain the long-term viability of *Arabis rectissima* var. *simulans*, to avoid any future need to list it as threatened or endangered, and to reduce the overall long-term management costs for the species. They generally do not take into account political will, limited agency resources, or other conservation priorities, which may preclude implementation of some recommendations. Some of the recommendations may already have been implemented. If monitoring indicates that preventable declines in viability of the species are occurring, then more aggressive conservation and recovery measures should be identified and pursued.

1. Washoe County, the Nevada Division of State Parks (NDSP), the Humboldt-Toiyabe National Forest (HTNF), and the Lake Tahoe Basin Management Unit (LTBMU) of the U.S. Forest Service, should immediately review their recreation management and plans at Galena Creek County Park, Spooner Lake State Park, and vicinities, and should carefully manage further recreational development and use so as to avoid impacts to the known populations of *Arabis rectissima* var. *simulans* sufficient to create a trend toward state or federal listing as threatened or endangered, and so as to take advantage of interpretive opportunities involving the species.
2. HTNF, LTBMU, and the Nevada Division of Forestry (NDF) should plan future fire-suppression actions and strategies, including identifying potential sites for fire breaks, access roads, landing pads, etc., to avoid or minimize impacts to known *Arabis rectissima* var. *simulans* populations and other sensitive resources.
3. HTNF, LTBMU, The Nevada Department of Transportation (NDOT), NDSP, and the counties of Douglas and Washoe should plan any future road development and maintenance to avoid or minimize impacts to known populations. Roads should avoid known habitat, and impacts from grading or other maintenance activities should be contained within the existing roadbed.
4. HTNF, LTBMU, NDSP, NDF, NDOT, and the Counties should conduct or require additional surveys, following recognized professional standards (Nelson 1994), for undocumented *Arabis rectissima* var. *simulans* populations prior to implementation of timber management activities, recreational development, road construction or maintenance, and other projects within potential habitat of the species, and any new populations found should be thoroughly documented. Impacts to new populations should be avoided or minimized during project implementation. Whenever funding and personnel permit, similar surveys should be continued outside of the project evaluation process as well.
5. The U.S. Fish and Wildlife Service (USFWS), HTNF, LTBMU, NDSP, NDOT, the Counties, and any other parties interested in participating, should cooperatively field-check as many *Arabis rectissima* var. *simulans* sites as possible each year, particularly where significant impacts have previously occurred or are reasonably foreseeable, to detect any new or intensified impacts, and should take immediate steps to eliminate and correct any such impacts on lands under their management. Field checks should include field tours for appropriate personnel to familiarize them with the plant and its habitat.
6. HTNF and LTBMU should immediately add *Arabis rectissima* var. *simulans* to their lists of sensitive species, and should manage it accordingly for all future project planning and implementation.
7. Systematic and taxonomic studies of the variation between *Arabis rectissima* var. *simulans* and other related taxa should be encouraged and supported whenever possible.
8. Studies of pollinator populations, and their effectiveness in the reproductive success of *Arabis rectissima* var. *simulans*, should be encouraged and supported. If found to play a significant role, pollinators should be monitored on the same schedule as *Arabis rectissima* var. *simulans* to detect any downward trends that could contribute to reproductive failure in *Arabis rectissima* var. *simulans*, and the cause(s) and possible remedies of any such declines should be assessed.

9. Any future artificial revegetation actions in and near the range of *Arabis rectissima* var. *simulans* should only use plant species native to the local area. HTNF, BLM, NDF, and other agencies anticipating the need for artificial revegetation should plan for reasonably foreseeable needs to ensure sufficient sources and/or supplies of 100% native-species seeds. In appropriate cases, other species documented not to persist under local conditions could be added at non-competitive levels for temporary stabilization until the native species can establish.
10. If impacts to populations begin significantly impacting species viability, the Nevada Division of Forestry should add *Arabis rectissima* var. *simulans* to the Nevada list of critically endangered flora under NRS 527.270, and should act to minimize further impacts through landowner contacts, through its permitting process, and if necessary through law enforcement actions.

## X. INFORMATION SOURCES

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**Specimens:** All specimens known to document *Arabis rectissima* var. *simulans* sites are entered in the databases of the Nevada Natural Heritage Program. These data were compiled from all

available published and unpublished sources, but are not necessarily complete. Although new collections from previously documented sites are discouraged, the Nevada Natural Heritage Program welcomes further additions or corrections to the collection data as they become known.

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