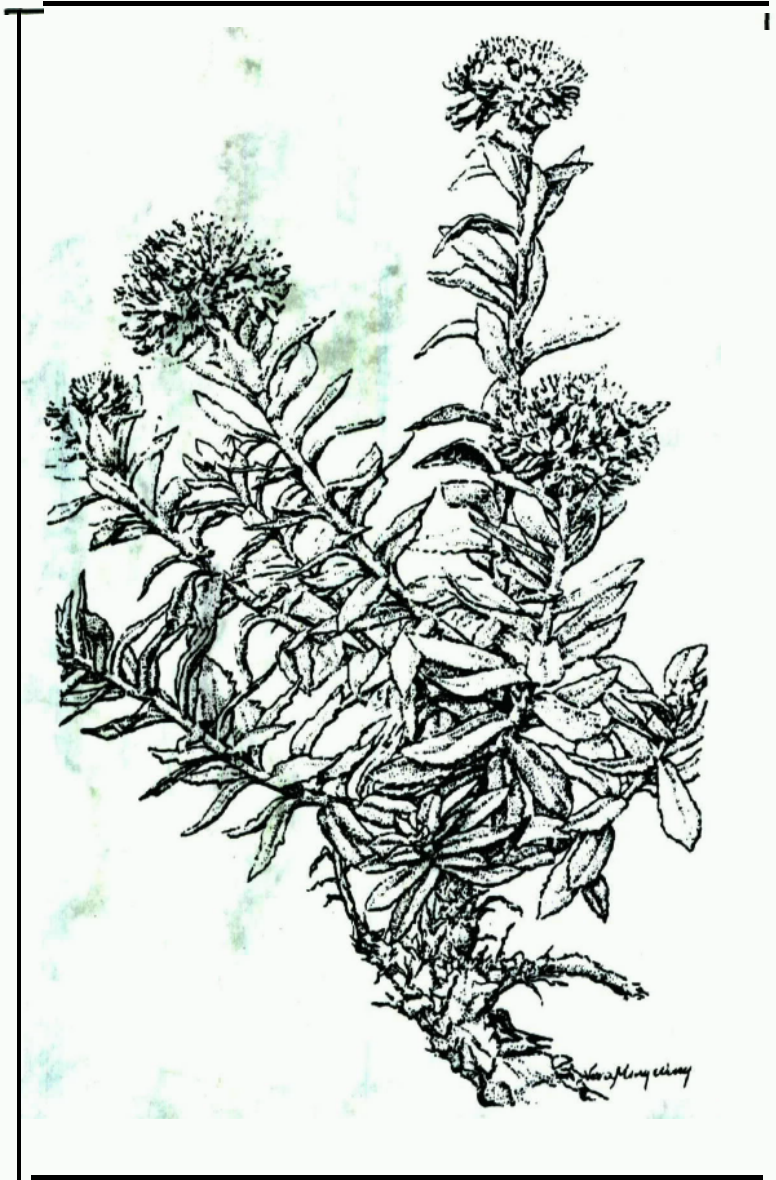


Leedy's Roseroot

Recovery Plan

(*Sedum intergrifolium* ssp. *leedyi*)



Department of the Interior
United States Fish & Wildlife Service



Front cover illustration of *Sedum integrifolium* ssp. *leedyi* (Leedy's roseroot) by Vera Ming Wong, copyright 1988 by the State of Minnesota, Department of Natural Resources.

The artwork on the front cover of this publication is copyrighted material and may not be duplicated.

SEDUM INTEGRIFOLIUM SSP. LEEDYI (LEEDY'S ROSEROOT)

RECOVERY PLAN

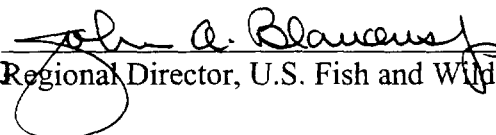
Prepared by

Nancy Sather
Minnesota Natural Heritage Program
Minnesota Department of Natural Resources
St. Paul, Minnesota

for

Region 3
U.S. Fish and Wildlife Service
Ft. Snelling, Minnesota

Approved:


Regional Director, U.S. Fish and Wildlife Service

Date:

9/25/98

DISCLAIMER

Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service **only** after they have been signed by the Regional Director or Director as **approved**. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature Citations should read as follows:

U.S. Fish and Wildlife Service. 1998. *Sedum integrifolium* ssp. *leedyi* (Leedy's roseroot) Recovery Plan. Ft. Snelling, Minnesota. vi + 31 pp.

Additional copies may be purchased from:

Fish and Wildlife Reference Service
5430 Grosvenor Lane, Suite 110
Bethesda, Maryland 20814

301/492-6403

or

1-800-582-3421

The fee varies for the Plan depending on the number of pages of the Plan.

ACKNOWLEDGMENTS

The following individuals contributed substantive information, field effort, or review of this document: Mark Clough, Zella Ellshoff, Chuck Kjos, and Ron Refsnider, U.S. Fish and Wildlife Service; Glenn Furnier and Joel Olfelt, University of Minnesota; Lisa Mueller, Minnesota Department of Agriculture; Wayne Ostlie, Midwest Regional Office, The Nature Conservancy; Welby Smith, Minnesota Department of Natural Resources; Stephen Young, New York State Department of Environmental Conservation, Natural Heritage Program; and Andrew Zepp, Western New York Field Office, The Nature Conservancy.

**EXECUTIVE SUMMARY OF THE RECOVERY PLAN FOR
SEDUM INTEGRIFOLIUM SSP. *LEEDYI* (LEEDY'S ROSEROOT)**

Current Status: *Sedum integrifolium* ssp. *leedyi* (Leedy's roseroot), classified as threatened, is endemic to western New York and southeastern Minnesota. Of seven known populations, two are on State-owned property and five occur on privately owned land; six populations are considered viable.

Habitat Requirements and Limiting Factors: This taxon's primary limiting factor is its specialized cliffside habitat along the shore of a lake in New York and on cool, moderate cliffs in Minnesota. The current major threats to *S. integrifolium* ssp. *leedyi* are its low numbers and few populations, its disjunct occurrences, on-site disturbances, and groundwater contamination.

Recovery Objective: Delisting.

Recovery Criteria: *Sedum integrifolium* ssp. *leedyi* may be considered for delisting when: (1) all three privately owned Minnesota populations are protected by conservation easements or fee acquisition by a public agency or private conservation organization; (2) the Whitewater Wildlife Management Area, Minnesota, population is protected from or removed from any confirmed contamination threat; (3) the Glenora Falls, New York, population is protected; and (4) habitat for 4,000 plants in multiple sites, evenly distributed along a 2-mile stretch of Glenora Cliff, New York, is protected. The two most-distant subpopulations protected at Glenora Cliff must be at least 1.5 miles apart; (5) protected populations must be geographically distinct, self-sustaining, and have been protected for five consecutive years by measures that will remain effective following delisting.

Actions Needed (Tasks):

1. Locate and map new populations and identify landowners.
2. Determine hydrologic relationships between upland areas and *S. integrifolium* ssp. *leedyi* populations.
3. Establish, administer, and secure funding for permanent infrastructure for site protection.
4. Secure landowner involvement in conservation and seek fee acquisition on a willing seller basis.
5. Implement and review monitoring.
6. Provide public education, including advance landowner contact.
7. Develop and maintain a genetic bank.

Estimated Cost of Recovery (X \$1,000)

YEAR	Need (Task) <u>1</u>	Need (Task) <u>2</u>	Need (Task) <u>3</u>	Need (Task) <u>4</u>	Need (Task) <u>5</u>	Need (Task) <u>6</u>	Need (Task) <u>7</u>	<u>TOTAL \$</u>
1	5	5	0	5	5	10	0.5	30.5
2	0	25	5	55	5	2	5.0	97.0
3	0	30	10	230	5	2	0.5	277.5
4	0	0	3	23	5	0.5	0.5	32.0
5	0	0	3	19	5	0.5	0.5	28.0
6	0	0	3	19	5	0.5	0.5	28.0
7	0	0	3	19	5	0.5	0.5	28.0
8	0	0	3	19	5	0.5	0.5	28.0
9	0	0	3	19	5	0.5	0.5	28.0
<u>10</u>	<u>0</u>	<u>0</u>	<u>3</u>	<u>0</u>	<u>15</u>	<u>0.5</u>	<u>0.5</u>	<u>19.0</u>
TOT. \$	5	60	36	408	60	17.5	9.5	596.0

Date of Recovery: 2009, if recovery criteria have been achieved.

TABLE OF CONTENTS

	<u>page</u>
DISCLAIMER	ii
ACKNOWLEDGMENTS	iii
EXECUTIVE SUMMARY	iv
LIST OF FIGURES	vi
LIST OF TABLES	vi
LIST OF APPENDICES	vi
I. INTRODUCTION	1
A. Background and Description	1
B. Distribution	2
1. Minnesota	2
2. New York	3
C. Habitat	3
1. Minnesota	4
2. New York	5
D. Biology	6
E. Threats and Limiting Factors	6
F. Conservation Measures	7
G. Strategy of Recovery	9
II. RECOVERY	10
A. Recovery Plan Objective	10
B. Step-down Outline	10
C. Narrative Outline	11
D. Literature Cited	15
III. IMPLEMENTATION SCHEDULE	18
IV. FIGURES	22
V. TABLE	26
VI. APPENDICES	28

LIST OF FIGURES

	<u>page</u>
1. Illustration of <i>Sedum integrifolium</i> ssp. <i>leedyi</i> (Leedy's roseroot)	23
2. Ranges of <i>Sedum integrifolium</i> (rosertoot) and <i>S. integrifolium</i> ssp. <i>leedyi</i> (Leedy's roseroot)	24
3. Diagram of idealized maderate cliff	25

TABLE

	<u>page</u>
1. Extant occurrences of <i>Sedum integrifolium</i> ssp. <i>leedyi</i> (Leedy's roseroot)	27

APPENDICES

	<u>page</u>
A. Principle Federal and State laws protecting <i>Sedum integrifolium</i> ssp. <i>leedyi</i> (Leedy's roseroot) and its habitat	29
B. Peer Reviewers	30
C. Comments Received	31

I. INTRODUCTION

A. Background and Description

Sedum integrifolium ssp. *leedyi* (Rosendahl and Moore) Clausen (Leedy's roseroot) was first collected by John Leedy in 1936 at the plant's type locality, characterized as "northeast-facing cliffs of limestone, North Branch of Root River opposite Herman McDaniel farm about 5 km south of Simpson, Olmstead (sic) Co., Minn." (Clausen 1975). First described as a new variety of *S. rosea* (roseroot) on the basis of three collections from the type locality (Rosendahl and Moore 1947), the taxon was redefined by Clausen (1975) as a subspecies of the western species *S. integrifolium* on the basis of a specimen collected by John Leedy in 1942.

Sedum integrifolium ssp. *leedyi* is a member of the Crassulaceae (orpine family), a family often characterized by succulent stems and leaves. The taxon has thick, scaly rhizomes; female and male flowers on different plants; axillary annual floral stems; and corymbose cymes (flat-topped flower clusters) of red to yellow flowers. Petals of *S. integrifolium* are 1.3 to 1.7 millimeters (mm) [0.05 to 0.06 inches (in)] wide in staminate flowers, and Clausen (1975) indicates this greater width is the best feature to separate the species visually from *S. rosea*.

Based on results of his morphological studies, Clausen (1975) differentiated *S. integrifolium* ssp. *leedyi* from three other subspecies of *S. integrifolium*. After analyzing measurements of multiple characteristics of 160 plants from 23 populations, he determined that plants from Glenora Cliff, New York, and the Root River, Minnesota, constitute a single distinctive subspecies. Key characters used by Clausen to differentiate *Sedum integrifolium* ssp. *leedyi* from the other subspecies are glaucous (covered with a whitish bloom) oblong leaves, which usually exceed 5 mm (0.2 in) in width, and seeds averaging 2.4 mm (0.09 in) long, the longest known for the species. Clausen (1975) characterized *Sedum integrifolium* ssp. *leedyi* as the most robust of the subspecies with blue green leaves which average 30 mm (1.2 in) long and are irregularly toothed or entire along the margins. Each flower usually has four, sometimes five, and rarely three petals which are dark red with a greenish yellow base (Figure 1, p. 22). Based on observations of plants collected from a single Minnesota population and raised in a garden in Ithaca, New York, Clausen (1975) reported that petals of New York plants are more yellow and petals of Minnesota plants are completely dark red or greenish white at the base. More recent field observations in Minnesota revealed petal color in ssp. *leedyi* can range from red with yellow center, red or green (Olfelt 1998), distinctly yellow (Ostlie 1988a,b,c), and even orange (Frest 1986).

Preliminary results of ongoing studies of genetic distances and variation within and among *S. integrifolium* taxa based on twenty random amplified polymorphic DNA (RAPD) markers corroborate that there are significant differences between Leedy's roseroot and the other subspecies of *S. integrifolium* (Olfelt and Furnier 1995). Genetic distances within the presently described subspecies *leedyi* are greater between any combination of the four sampled populations than between any of the western subspecies. These differences are upheld by both DNA sequencing and common garden experiment results, which address morphological differences.

Over half of 19 continuous vegetative (morphological) characters exhibit statistically significant contrasts at 0.05 and 0.01 levels between the Whitewater, Minnesota, population and two other sampled Minnesota populations, and between all Minnesota populations and the New York populations (Olfelt 1998).

Sedum integrifolium ssp. *leedyi* was added to the Plant Notice of Review in 1990 as a Category 2 candidate (USFWS 1990). Candidate category 2 (a designation no longer used by the Service) included taxa for which information in the Service's possession indicated proposed listing as threatened or endangered might be appropriate, but for which sufficient data on vulnerability and threat were not currently available to support proposed rules. Additional information indicated *S. integrifolium* ssp. *leedyi* warranted protection of the Endangered Species Act (Act) because of its rarity and threats of habitat alteration (USFWS 1991). A proposed rule was published in 1991 (USFWS 1991), and the plant was listed as threatened in 1992 (USFWS 1992). The taxon is listed as a State endangered species in Minnesota and New York by the Minnesota Endangered Species Act of 1984 and the New York State Environmental Conservation Law of 1989. As a subspecies with a moderate degree of threat and a high recovery potential, *S. integrifolium* ssp. *leedyi* has a Federal recovery priority of 9 (USFWS 1983).

B. Distribution

Sedum integrifolium ssp. *leedyi* is an isolated subspecies of a common western United States species. The range of *S. integrifolium* ssp. *leedyi* does not overlap the ranges of the three western subspecies (*S. integrifolium* ssp. *integrifolium*, *S. integrifolium* ssp. *neomexicanum*, and *S. integrifolium* ssp. *procera*). These western subspecies are found along the Western Cordillera from Alaska to California and Colorado (Clausen 1975). *Sedum integrifolium* ssp. *leedyi* has two dramatically disjunct centers of population, southeast Minnesota and western New York, a distributional pattern which suggests the subspecies is a relict of a Pleistocene flora that may have ranged across the continent before the last glaciation (Smith 1988). Seven populations from two states and a total of four counties are presently known (Figure 2, p. 23, and Table 2, p. 25).

1. Minnesota

Four Minnesota populations are known from two counties in the southeastern part of the State (Smith 1992, Olfelt and Luby in press). These include:

Bear Creek Cliff; T103N, R12W; Fillmore County. This population contains an estimated 173 plants (effective population 97 -- see note) on a steep north-facing cliff overlooking Bear Creek. The site has two private owners.

Note: The total number of plants in a *Sedum integrifolium* ssp. *leedyi* population may not equal the number of individuals contributing gametes to future *S. integrifolium* ssp. *leedyi* generations. Factors such as environmental stresses, plant age and health, and inbreeding can affect a plant's ability to reproduce; factors such as a population's male to female ratio

will affect the level of genetic variability in its progeny. A site's *effective population* is estimated by taking into account the site's male to female ratio and reproductive contribution of individuals and is much more useful than total censused population for estimating the probability of losing genetic variability from the population.

Deer Creek Cliff; T103N, R13W; Fillmore County. This population contains an estimated 278 plants (effective population 181) on a steep north-facing cliff overlooking Deer Creek. The site is privately owned by one owner.

Simpson Cliff (the type locality); T105, R13W; Olmsted County. This site contains an estimated 445 plants (effective population 280) on a steep north-facing cliff overlooking the North Branch of the Root River. The cliff has two or more owners.

Whitewater Wildlife Management Area; T107N, R11W; Olmsted County. This site contains an estimated 748 plants (effective population 291). The site is owned by the Minnesota Department of Natural Resources, Division of Fish and Wildlife.

2. New York

Three populations are presently known in western New York (New York Natural Heritage Program 1996):

Glenora Cliff, Yates County. At least 6,000 plants (effective population >4,750) have been counted along 3.2 kilometers (km) [2 miles (mi)] of Seneca Lake's western shore. Approximately 50 potential owners have been identified, but exact ownership of each group of plants has not been determined. This is the largest known population of *S. integrifolium* ssp. *leedyi*.

Glenora Falls, Yates County. About 40 plants have been documented on east-facing and south-facing shale and siltstone cliffs just north of Glenora Falls.

Watkins Glen, Schuyler County. The single plant known from this site in Watkins Glen State Park is reputedly a transplant, although seven plants were known to occur at the site in 1961 (Clausen 1975). The plant occurs near a parking lot in this heavily used park.

C. Habitat

Sedum integrifolium ssp. *leedyi* is found only in very specialized cliffside habitats. The major New York population occurs on cliffs along the western shore of Seneca lake. In Minnesota, populations occur on moderate cliffs, which are cooled by air exiting underground passages in the karst topography.

1. Minnesota

All Minnesota sites are in drainages of the Root and Whitewater Rivers in the Paleozoic Plateau at elevations between 274 and 378 meters (m) [900 and 1,240 feet (ft)] on north-facing moderate cliffs about 30 m (98 ft) in height (Smith 1992). These cliffs were formed through stream undercutting in unglaciated areas of karst topography. Stream erosion caused massive blocks of dolomite to shift forward along horizontal planes, which created upland sinkholes and resulted in a miniature cave system with internal air-flow networks feeding cool subsurface air to the cliff face. The cool air emerges in nearby areas where river erosion is less pronounced, in the talus itself, creating permanently cool algific talus slopes with temperatures as low as 4° C (40° F) in the summer (Ostlie 1989a, 1991). Talus slopes immediately below the moderate cliffs are not true algific slopes, because the cool air emerges at the cliff face itself. These cliffs are characterized by bands of bentonite and limestone. Bentonite, a clay impervious to water, causes consistent groundwater discharge at the contact point, which creates moist horizontal bands on the cliff face, the microhabitat where *S. integrifolium* ssp. *leedyi* occurs in Minnesota (Smith 1992). Associated species at all four Minnesota sites include mosses and *Cystopteris bulbifera* (bulbet fern), *Impatiens pallida* (pale touch-me-not), and *Solidago* sp. (goldenrod).

The type locality, Simpson Cliff, Minnesota, is nearly 0.8 km (0.5 mi) long. *Sedum integrifolium* ssp. *leedyi* plants are localized near the middle of the cliff. Sinkholes in the wooded area above the cliff are probably a major source of seepage on that portion of the cliff face (Refsnider 1988). The upland area is a hardwood forest dominated by *Acer* sp. (maple), *Quercus* spp. (oaks), *Tilia americana* (basswood), and occasional *Pinus strobus* (white pine) at the edge of the cliff (Ostlie 1988c). A 1977 site summary mentions the presence of *Carpinus caroliniana* (blue beech) and *Taxus canadensis* (American yew) as components of this forest (Morley 1977). In addition to *S. integrifolium* ssp. *leedyi*, the site harbors three other rare plant taxa: *Arabis laevigata* (smooth rock cress), *Draba arabisans* (Whitlow grass), and *Poa wolfii* (meadow bluegrass). Several Federal species of concern (former candidate category 2 species), including two recently discovered landsnail species, *Novisuccinea* sp. Minnesota A and *Novisuccinea* sp. Minnesota B, are also found at the site (Ostlie 1988c). An east-west road passes near the top of the cliff in some areas, and cropland occurs on the south side of this road within 23 m (75 ft) of the cliff face (Refsnider 1988).

At the Deer Creek, Minnesota, site, *S. integrifolium* ssp. *leedyi* occurs on an extensive, fairly low maderitic cliff face with talus along its base. The cliff face is stable with no undercutting by the creek at this time, and two springs exit the base of the cliff (Ostlie 1988b). The *S. integrifolium* ssp. *leedyi* population is concentrated near the center of the cliff around a perched ravine. Sinkholes on the uplands above the cliff produce cold air drainage from fissures in the cliff face (Refsnider 1988). These sinkholes are protected by woodlands of basswood, maple, oak, and scattered white pine. One of the recently discovered species of landsnail (*Novisuccinea* sp. Minnesota A) was found at this site. Nearby algific slopes at the site have been grazed by cattle, but the cliff does not appear to be adversely effected by grazing (Dulin 1993, Frest 1983).

The Bear Creek, Minnesota, site is a low moderate cliff with a crumbling rock face and a talus layer subject to slumping. The *S. integrifolium* ssp. *leedyi* population occurs east of the center of the cliff. Upland forest here is composed of basswood, maple, and oak, with scattered white pine, *Abies balsamea* (balsam fir), and *Betula papyrifera* (paper birch). The recently discovered landsnail species (*Novisuccinea* sp. Minnesota A and *Novisuccinea* sp. Minnesota B) are also found at this site (Ostlie 1988a). Level uplands beyond the narrow forest buffering the slope are used for agriculture.

The moist- to dry-mesic *S. integrifolium* ssp. *leedyi* site at Whitewater Wildlife Management Area, Minnesota, harbors *S. integrifolium* ssp. *leedyi* from its crest to its base on a steep north- to northeast-facing, nearly vertical cliff. The canopy above the cliff is dominated by paper birch and white pine. Basswood dominates the canopy above the talus layer at the foot of the cliff. Whitlow grass and *Novisuccinea* snails, both typical of maderitic cliffs farther to the south and west, have not been found at this site. A deeply eroded, unmaintained township road traverses the top of the cliff about 20 m (66 ft) from the cliff face (Ostlie 1989b).

2. New York

Plants at Glenora Cliff, New York, are almost continuously distributed along 3.2 km (2 mi) of the western shore of Seneca Lake. Plants occur on east-facing cliffs at elevations between 136 and 141 m (446 and 463 ft) from near the tops of the cliffs to the talus. These lakeside cliffs are thinly bedded shale with intermittent thicker beds of siltstone. Soil pH ranges from 6.8 to 7.5 (Clausen 1975). Drainage is good to poor, and most of the cliff face is dry. The largest concentration of *S. integrifolium* ssp. *leedyi* occurs in seepage areas, which may or may not remain moist throughout the year. Plants rooted in drier free-standing rock pillars are wilted [The Nature Conservancy (TNC) 1985-1991a]. In sheltered areas behind boathouses, plants occur on the talus itself. Associated species include the state rare Whitlow grass, as well as *Geranium robertianum* (herb-Robert), *Parietaria pennsylvanica* (pellitory), *Parthenocissus inserta* (Virginia creeper), *Poa compressa* (Canada bluegrass), and *Toxicodendron radicans* (poison ivy) (Clausen 1975, TNC 1985-1991a). The weedy nonnative *Polygonum cuspidatum* (Japanese knotweed) exhibits abundant growth on talus throughout the northern half of the site, obscuring both *S. integrifolium* ssp. *leedyi* and the cliff face (TNC 1985-1991a).

Plants at Glenora Falls occur on the east and south-facing cliff faces just north of a waterfall. The plants themselves occur on a wet, seepy cliff face with a talus slope below. Bulblet fern, Virginia creeper and pale touch-me-not are common on the talus slope, with *Tsuga canadensis* (hemlock) on the top of the cliff (New York Natural Heritage Program 1996).

The single *S. integrifolium* ssp. *leedyi* plant still found at Watkins Glen, New York, occurs near the top of a disintegrating shale slope in a developed area near the open, sunny mouth of a narrow, shaded gorge. Elevation of the site is 157 m (515 ft), exposure is southern, and drainage is poor (Clausen 1975). Dominant canopy trees are maple and hemlock (TNC 1985-1991b).

D. Biology

Both *S. integrifolium* and *S. rosea* (to which *S. integrifolium* ssp. *leedyi* was originally ascribed) are perennial dioecious species in an otherwise monoecious genus. Although *S. integrifolium* ssp. *leedyi* reproduces predominantly by sexual means, Olfelt and Luby (in press) found that the proportion of flowering to nonflowering plants differs between populations, with significantly more nonflowering plants at the single formally protected site. Flowers of *S. integrifolium* ssp. *leedyi* are usually functionally female or male or sometimes perfect. Clausen (1975) reported that pistillate plants in the Glenora Cliff, New York, population outnumber staminate plants. Olfelt *et al.* (1998) found the ratio of male to female plants did not differ significantly among populations, nor between these populations and the western subspecies.

Flowering occurs in early June. Clausen (1975) reports bees and syrphus flies as pollinators; Sather (1993a) observed bees on New York plants. Seeds are winged and adapted for wind dispersal. Seeds produced by plants at Glenora Cliff, New York, sometimes germinate in their follicles and produce seedlings on the parent plant (Clausen 1975). Plants grown in a Minnesota greenhouse from seed flowered their first season after germination (Joel P. Olfelt, University of Minnesota, pers. comm. 1996).

New plants grow in the talus at the Minnesota and New York sites (Sather 1993a,b). Although, newer growth on the long-lived rootstocks breaks off to form clones, which have lived at least 36 years in cultivation (Clausen 1975), Olfelt and Luby (in press) report finding little clonal reproduction. Of 81 stems they assayed, 75 had unique randomly amplified polymorphic DNR (RAPD) markers, indicating those 75 stems had not been produced by cloning.

E. Threats and Limiting Factors

Sedum integrifolium ssp. *leedyi* is threatened by its disjunct occurrences; its low numbers and the concomitant potential that stochastic events could severely impact its genetic diversity; off-site influences, such as groundwater contamination and hydrologic alterations. Direct, on-site disturbances, include erosion, rock slides, and staircase construction. Individual plants and habitat of the New York populations, which occur downhill from a number of lakeside homes, can be affected by clearing of vegetation on the cliffs and by pipes and staircases leading to the lakeshore (Sather 1993a).

Potential indirect impacts from upslope agricultural activities and residential development are not well understood, but groundwater contamination can occur after fertilizers and pesticides are applied to nearby fields or lawns or after sinkholes are used as dump sites. Household and farm wastes, including pesticide containers, have been discarded in sinkholes near Minnesota sites (Refsnider 1988).

F. Conservation Measures

Recognition through listing encourages and results in conservation actions by Federal, State, and private agencies; groups; and individuals. The Act provides for land acquisition, conservation easements, and cooperation with the States, and requires recovery actions for all listed species. In this recovery plan, "conservation measures" refers to both regulatory protection mechanisms and to on-site protective management mechanisms. The protection required of Federal agencies and the prohibition against certain activities involving listed plants are discussed, in part, below.

Because Environmental Protection Agency (EPA) pesticide registration is a Federal action, federally listed species must be considered when implementing the program. The EPA implementing regulations for the Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. (FIFRA 7 USC), apply to certain pesticides where federally endangered or threatened plants occur. The EPA is developing a Federal pesticide protection program for endangered species. As the State's lead cooperator with EPA, the Minnesota Department of Agriculture (MDA) developed a State-initiated landowner contact program in which landowners and a representative from MDA develop a mutually acceptable, voluntary, non-binding pesticide management plan to assure federally listed species present would not be adversely affected (Minnesota Department of Agriculture 1996a,b,c). There is presently no New York program comparable to the Minnesota program. However, the New York State Environmental Conservation Law, section 9-1503, protects listed plants from damage by the application of herbicides or defoliant.

The Act and implementing regulations setting forth general prohibitions and exceptions that apply to *Sedum integrifolium* ssp. *leedyi* are found at 50 CFR 17.71, 17.72, and 17.76. The following prohibitions apply to this taxon on Federal land: import or export; transport in interstate or foreign commerce in the course of a commercial activity; sale or offer for sale this taxon in interstate or foreign commerce; or to removal or reduction to possession; malicious damage or destruction; removal by cutting, digging, damage in knowing violation of any State law or regulation including violation of a State criminal trespass law. Violation of state law regarding this species is thus a violation of the Act. "Plant" means any member of the plant kingdom, including seeds, roots, and other parts. Violation of the Act carries civil and criminal penalties of up to a year of imprisonment and/or fines up to \$50,000.00.

The Act and 50 CFR 17.72 also provide for permits to implement otherwise prohibited activities involving threatened species under certain circumstances. Such permits are available for scientific purposes or to enhance survival of the species in its native habitat. Requests for copies of the regulations on plants and inquiries regarding them may be addressed to the Office of Management Authority, U.S. Fish and Wildlife Service, 4401 North Fairfax Drive, Room 432, Arlington, Virginia 22203-3507 (703/358-2104, FAX 703/358-2281).

In addition to its status as a federally threatened species, *S. integrifolium* ssp. *leedyi* is listed as a State endangered species in both Minnesota and New York. The Minnesota Endangered Species Act (Minnesota Statute 84.0895) prohibits the following:

. . . taking, import, transport, or sale of any endangered species of wild animal, plant or parts thereof, or the sale or possession with intent to sell any article made in whole or in part from the skin, hide, or any parts of any endangered species of wild animal or plant.

A violation of the Minnesota law is a misdemeanor, carrying a penalty of up to \$1,500.00 and up to 180 days imprisonment for endangered species and up to \$1,000.00 and 90 days imprisonment for threatened species. Requests for copies of Minnesota regulations on plants and inquiries regarding them may be addressed to Minnesota Natural Heritage and Nongame Research Program, DNR Box 25, 500 Lafayette Road, St. Paul MN 55155-4025.

The New York State Environmental Conservation Law, section 9-1503, part f, reads: It is a violation for any person, anywhere in the state, to pick, pluck, sever, remove, damage by application of herbicides or defoliant, or carry away without the consent of the owner, any protected plant. Each protected plant so picked, plucked, severed, removed, damaged or carried away shall constitute a separate violation.

Violators of the New York law are subject to fines of \$25 per illegally taken plant. Requests for copies of New York regulations on plants and inquiries regarding them may be addressed to Senior Forester, Division of Lands and Forests, New York State Department of Environmental Conservation, 50 Wolf. Road, Albany, New York 12233-0001.

Although only two of the known sites are protected by state fee ownership (Whitewater, Minnesota, and Watkins Glen, New York), other populations are enrolled in registry programs or protected by landowner associations.

A 0.4-hectare (1-acre) portion of the Glenora Cliff, New York, site, which contains 60 to 70 clumps of plants, is protected by the Finger Lakes Land Trust with a conservation easement held by TNC. A TNC easement on an adjoining ravine acts as a buffer to this easement (Andrew Zepp, Western New York Field Office, TNC, pers. comm. 1993).

The Simpson Cliff, Minnesota, site is enrolled in TNC's Registry Program. This informal program honors landowners for their stewardship with a plaque of recognition. Registry landowners agree to protect their site to the best of their ability, to notify TNC of any perceived threat, and to contact TNC before they change land use activities or attempt to sell the property. These nonbinding agreements are not always effective in alerting TNC or other interested parties before the property is transferred (Lisa Mueller, MDA, Agronomy Services Div., pers. comm. 1993).

During the Federal listing process, all known landowners were notified that individuals of *S. integrifolium* ssp. *leedyi* might occur on their property. There are fewer than 10 owners of sites in Minnesota and about 50 owners along the 3.2-km (2-mi) stretch of Seneca Lake shoreline

where this taxon occurs. Exact ownership of all the plants at the Glenora Cliff site has not yet been determined.

Appendix A summarizes principle Federal and State laws of current or potential applicability to the protection of *Sedum integrifolium* ssp. *leedyi* and its habitat.

G. Strategy of Recovery

The strategy for recovery of this taxon involves a variety of conservation actions, with conservation easements and private land trusts as pivotal elements, and fee acquisition as an alternative for willing sellers. Individual landowners or landowner associations and existing land trusts would play a major role in protecting populations from direct disturbance and in assuring land management practices on adjoining uplands do not have an indirect adverse effect on the taxon. Landowner, landowner allocation, or land trust enrollment in a conservation easement program designed to minimize direct and indirect adverse effects on the taxon can produce a high level of private stewardship. Development pressure and land tax structure discourage land use for stewardship at the Glenora Cliff site. An active public information program and financial incentives, such as tax relief or payment in lieu of taxes, can encourage protection as a desirable land use. With public support, government agencies and private conservation organizations could prepare site management plans, determine hydrologic relationships between adjoining uplands and *S. integrifolium* ssp. *leedyi* sites, review monitoring and management, and secure permanent funding for conservation easements.

Because of the natural protection afforded by the inaccessibility of its cliffside habitat, no tasks in this plan are deemed priority 1, tasks necessary to prevent extinction of *Sedum integrifolium* ssp. *leedyi*. Most tasks are priority 2, tasks necessary to prevent significant decline in habitat or populations. A logical sequence of tasks is reflected in the fiscal year of funding for each task in the Implementation Schedule (Table 1, p. 18). This sequence is important because the implementation of some tasks depends on the results of preceding tasks.

Efforts should begin as soon as possible to foster landowner involvement in shoreline protection and preservation of undeveloped land at the Glenora Cliff site. These efforts should include distribution of informational materials (Sather 1993b); contact with landowners, landowner associations, and land trusts; and public information programs to initiate and accelerate the protection process.

Efforts to obtain funding for easements, hydrological research, and life-history research are to be implemented concurrently. These efforts would assure data needed for management plan preparation and the financial basis for easement program initiation are in place when enrollment begins. To expedite the easement program, initial management plans could deal with direct impacts, and sections concerning indirect influences could be appended during periodic reviews of management and monitoring.

II. RECOVERY

A. Recovery Plan Objective: Delist the species.

Sedum integrifolium ssp. *leedyi* may be considered for delisting when: (1) all three privately owned Minnesota populations are protected; (2) the population at the Whitewater Wildlife Management Area, Minnesota, has been demonstrated to be self-maintaining for five years; (3) the Glenora Falls, New York, population is protected; and (4) habitat for 4,000 plants in multiple sites, evenly distributed along a 2-mile stretch of Glenora Cliff, New York, is protected. The two most distant subpopulations protected at Glenora Cliff must be at least 1.5 miles apart; (5) protected populations must be geographically distinct, self-sustaining, and have been protected for five consecutive years by measures that will remain effective following delisting.

The protected sites must represent the taxon's full range of genetic variability and may be protected by a combination of, but not limited to, the following conservation actions: Enrollment in permanent conservation easements, private land trusts, or landowner associations with effective land management plans to minimize impacts on *S. integrifolium* ssp. *leedyi* populations; fee acquisition; accompanied by tax relief or other compensation. Estimated date for recovery completion is 2009. These delisting criteria are preliminary, and may be revised on the basis of new information, including information resulting from research specified as recovery tasks.

B. Step-down Outline

1. Map all populations, and identify all affected landowners.
 - 1.1. Map populations.
 - 1.2. Identify landowners.
2. Determine hydrologic relationships between upland areas and *S. integrifolium* ssp. *leedyi* populations.
 - 2.1. Determine correlations between seepage areas and distribution of plants at all sites.
 - 2.2. Conduct hydrologic studies at all sites to determine water sources of seeps.
 - 2.3. For all populations, map areas within which groundwater contamination could influence *S. integrifolium* ssp. *leedyi* populations.
3. Establish and administer a permanent infrastructure for Leedy's roseroot site protection and secure funding for that protection.

4. Contact landowners, landowner associations, and land trusts; secure their involvement in conservation strategies; compensate them for costs of fee acquisition, enrollment in conservation easements or other programs; prepare management plans for public and private protected areas.
 - 4.1. Contact landowners, landowner associations, and land trusts; secure involvement in conservation strategies; compensate for costs of fee acquisition, enrollment in conservation easements or other program.
 - 4.2. Prepare management plans for easements and other protected areas.
5. Establish, implement, and review a monitoring program.
 - 5.1. Establish a uniform monitoring program.
 - 5.2. Implement the monitoring procedure.
 - 5.3. Review monitoring results and management methods.
6. Provide public education, including advance landowner contact.
7. Develop and maintain a genetic bank.

C. Narrative Outline

1. Locate new populations, map all populations, and identify all affected landowners.

1.1. Map populations.

Map full extent of all Minnesota and New York populations on topographic maps to determine full extent of areas requiring protection and potential drainage for groundwater contaminants.

1.2. Identify landowners.

Locate key concentrations of *S. integrifolium* ssp. *leedyi* at Glenora Cliff and identify owners of these key areas. Identify tracts owned by the Walnut Grove Association, Inc., and any other homeowner associations or land trusts that may already have protective restrictions on shoreline property. Ownership of Minnesota sites is presently known. Update ownership information for all sites as changes occur so current landowners can be informed of the plants and invited to participate in conservation of them.

2. Determine hydrologic relationships between upland areas and *S. integrifolium* ssp. *leedyi* populations.

2.1. Determine correlations between seepage areas and distribution of plants at all sites.

This information will be used to assess the potential for groundwater contamination.

2.2. Conduct hydrologic studies at all sites to determine water sources of seepage areas.

Active seepage areas are an essential component of *S. integrifolium* ssp. *leedyi* habitat. Knowledge of the surface and underground origins of this water would allow sources to be preserved and protected from contamination.

2.3. For all populations, map areas within which groundwater contamination could influence *S. integrifolium* ssp. *leedyi* populations.

Map on topographic maps the probable routes from water sources to seepage areas. Assess aboveground and underground routes for potential contamination arising from incompatible land use.

3. Establish and administer a permanent infrastructure for Leedy's roseroot site protection and secure funding for that protection.

Protection through purchase or perpetual conservation easements could be enhanced by tax relief. Because much of the shoreline at the Glenora Cliff site is residential, acquisition and/or easements would probably cost several thousand dollars per 30 m (100 ft) of shoreline. If proximity to protected land is considered an amenity, tax rates on protected properties and adjoining properties might rise and make enrollment in easements too costly unless landowners are provided tax relief. Property values of Minnesota's predominantly agricultural sites are lower than New York's, but owners must still receive fair market compensation for easements. Neither Minnesota nor New York have mechanisms to provide permanent funding for easements on protected species habitat. The Federal government or State legislatures may act to establish such funding, or one or more permanent private conservation trusts may be endowed for this purpose.

All Minnesota sites are in the Driftless Area of the state. Authority of the Service to purchase land for the Driftless Area Refuge should be extended to include unprotected Leedy's roseroot sites.

4. Contact landowners, landowner associations, and land trusts; secure their voluntary involvement in conservation; enroll sites in conservation easements or other programs; seek acquisition of lands containing significant populations on a willing seller basis; and prepare management plans for protected areas.

- 4.1. Contact landowners and/or private land trusts and homeowner associations; secure involvement in conservation; enroll sites in conservation easements or other programs; seek acquisition of lands containing significant populations on a willing seller basis.

Easements should be with individual landowners, wherever they are not in an existing homeowner association or land trust identified in 1.2, above, that may already have protective restrictions on shoreline property.

- 4.2. Prepare management plans for easements and other protected areas and for voluntary landowner association participants.

Include in the plan for each easement or other protected area the exact location of plants, actions that could adversely affect them, a management plan for the population, and a survivorship goal towards which the landowner should strive.

5. Establish, implement, and review a monitoring program.

- 5.1. Establish a uniform monitoring program.

After considering all important factors for preservation of this taxon and its habitat, coordinate with conservationists and researchers to develop a uniform and feasible monitoring program for use at all sites.

- 5.2. Implement a uniform monitoring procedure.

Whenever practicable, involve landowners, landowner associations, and land trusts in implementation of the uniform method of measuring their success in meeting their survivorship goals.

- 5.3. Review monitoring results and management methods.

On an biennial basis for the first six years of enrollment, or the first 5 years following change of ownership, and on a periodic basis thereafter, conduct a meeting between a State or Federal conservation agency representative and the landowner, home owners association, or land trust to discuss changes in population status and needed management modifications.

6. Provide public education.

Distribute existing educational materials (Sather 1993b) and develop new materials and opportunities to acquaint landowners and the public with the taxon and its need for protection. Initiate programs of public education in the first year of recovery, especially in New York, where such efforts could pave the way for conservation actions. Because most New York populations occur on private lands, such efforts in New York may be most effective when they involve landowners as educators or guides.

7. Develop and maintain a genetic bank.

The cool microclimates in which *S. integrifolium* ssp. *leedyi* survives may be affected by global warming or other unforeseen circumstances. The risk of lost viability or extinction resulting from stochastic events is exacerbated by the fact that each population is genetically distinctive. For this reason, redundant collections of seeds or cuttings from each population should be preserved in a genetic bank for possible reintroduction in the event of a natural catastrophe at any one of the sites. Should results of monitoring over time suggest that populations are declining because of inbreeding depression, material from other populations maintained in this bank could then be introduced into sites at risk to provide opportunity to increase their genetic diversity. Plants collected in Minnesota have been brought into cultivation at a Center for Plant Conservation garden (Brian Parsons, The Holden Arboretum, pers. comm. 1993).

D. Literature Cited

- Clausen, R.T. 1975. *Sedum* of North America north of the Mexican Plateau. Cornell University Press, Ithaca, New York. 742 pp.
- Dulin, G. 1993. Revised preserve design for Deer Creek moderate cliff. Unpublished report. Prepared for U.S. Fish and Wildlife Service, Fort Snelling, Minnesota.
- Frest, T. 1983. Survey information on algific talus slopes: MN19. Unpublished survey. The Nature Conservancy, Minnesota Field Office, Minneapolis. 7 pp.
- _____. 1986. Minnesota "*Succinea chittenangoensis*" survey. Contract No. 29000-37835. Unpublished final report. Prepared for U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. 27 pp.
- Minnesota Department of Agriculture. 1996a. Leedy's Roseroot Pesticide Management Plan, Deer Creek site. Endangered Species Protection Program, Division of Agronomy Services, Minnesota Department of Agriculture, St. Paul.
- _____. 1996b. Leedy's roseroot pesticide management plan, Bear Creek site. Endangered Species Protection Program, Division of Agronomy Services, Minnesota Department of Agriculture, St. Paul.
- _____. 1996c. Leedy's roseroot pesticide management plan, Simpson Cliff site. Endangered Species Protection Program, Division of Agronomy Services, Minnesota Department of Agriculture, St. Paul.
- Morley, T. 1977. Pleasant Grove *Sedum* Cliff. Unpublished memorandum. Prepared for The Nature Conservancy, Minnesota Field Office, Minneapolis.
- The Nature Conservancy (TNC). 1985-1991a. Site survey summaries, TNC trip reports and NHP field form updates for Glenora Cliff. Unpublished report. The Nature Conservancy, Western New York Field Office, Rochester.
- _____. 1985-1991b. Site survey summaries, TNC trip reports and NHP field form updates for Watkins Glen. Unpublished report. The Nature Conservancy, Western New York Field Office, Rochester.
- New York Natural Heritage Program. 1996. Element occurrence records for *Sedum integrifolium* ssp. *leedyi*. Unpublished records. New York State Department of Environmental Conservation, Natural Heritage Program, Latham.

- Olfelt J.P. 1998. Population biology of *Sedum integrifolium* ssp. *leedyi*. Ph.D. thesis. University of Minnesota, St. Paul. 58 pp.
- _____, and G.R. Furnier. 1995. Genetic distinctness and variability of *Sedum integrifolium* ssp. *leedyi*. Unpublished report to Natural Heritage and Nongame Research Program, Minnesota Department of Natural Resources, St. Paul. 21 pp.
- _____, _____, and J.J. Luby. In press. Reproduction and development of the endangered *Sedum integrifolium* ssp. *leedyi* (Crassulaceae). American Journal of Botany.
- Ostlie, W. 1988a. Bear Creek Maderitic Cliff, preserve design. Unpublished report. Prepared for The Nature Conservancy, Minnesota Field Office, Minneapolis. 2+ pp.
- _____. 1988b. Deer Creek Maderitic Cliff, preserve design. Unpublished report. Prepared for The Nature Conservancy, Minnesota Field Office, Minneapolis. 2+ pp.
- _____. 1988c. Simpson Maderitic Cliffs, preserve design. Unpublished report. Prepared for The Nature Conservancy, Minnesota Field Office, Minneapolis. 2+ pp.
- _____. 1989a. Minnesota algific slope survey. Unpublished memorandum to The Nature Conservancy, Minnesota Field Office, Minneapolis.
- _____. 1989b. Special plant survey form, Whitewater WMA. Unpublished data. Prepared for The Nature Conservancy, Minnesota Field Office, Minneapolis. 2+ pp.
- _____. 1991. Completion of the algific slope/maderate cliff landsnail survey in Minnesota. Unpublished report. Prepared for Minnesota Department of Natural Resources, St. Paul.
- Refsnider, R.L. 1988. Visit to the three *Sedum* sites in Minnesota. Unpublished report. U.S. Fish and Wildlife Service, Ft. Snelling, Minnesota. 2 pp.
- Rosendahl, C.O., and J.W. Moore. 1947. A new variety of *Sedum rosea* from southwestern Minnesota and additional notes on the flora of the region. *Rhodora* 49:197-202.
- Sather, N.P. 1993a. Field notes from a trip to New York sites, June, 1993. Minnesota Natural Heritage Program, St. Paul.
- _____. 1993b. Leedy's Roseroot, a cliffside glacial relict. Biological Report No. 42, Minnesota Natural Heritage and Nongame Wildlife Program, Minnesota Department of Natural Resources, St. Paul. 11 pp.
- Smith, W.R. 1988. Vascular plants: *In* B. Coffin, and L. Pfannmuller (eds.). 1988. Minnesota's endangered flora and fauna. University of Minnesota Press, Minneapolis. 473 pp.

- _____. 1992. A report on the status of *Sedum integrifolium* ssp. *leedyi* (Leedy's roseroot) in Minnesota. Prepared for U.S. Fish and Wildlife Service, Ft. Snelling, Minnesota. 5 pp.
- U.S. Fish and Wildlife Service (USFWS). 1983. Endangered and threatened species listing and recovery priority guidelines. *Federal Register* 48(184):43098-43105, 48(221):51985.
- _____. 1990. Endangered and threatened wildlife and plants; review of plant taxa for listing as endangered or threatened species; notice of review. *Federal Register* 55(35):6184-6229.
- _____. 1991. Endangered and threatened wildlife and plants; threatened status proposed for *Sedum integrifolium* ssp. *leedyi* (Leedy's roseroot). *Federal Register* 56(117):27038-27941.
- _____. 1992. Endangered and threatened wildlife and plants; determination of threatened status for *Sedum integrifolium* ssp. *leedyi* (Leedy's roseroot). *Federal Register* 57(78):14649-14653.

III. IMPLEMENTATION SCHEDULE

The Implementation Schedule outlines actions and estimated costs for the recovery program. It is a guide for meeting the objective in Part II of this Plan. The schedule indicates task priorities, task numbers, descriptions, and durations; responsible agencies; and estimated costs. These actions, when accomplished, should effect recovery of the taxon and protect its habitat. Estimated funds needed for all anticipated parties in recovery are identified; Part III, therefore, reflects the total estimated costs for recovery of this taxon. Estimated recovery cost for the 10-year program are \$596,000.00.

Priorities in the first column of the following implementation schedule are assigned as follows:

1. **Priority 1** - Actions that **must** be taken to prevent extinction or to prevent the species from declining irreversibly in the **foreseeable** future. There are no Priority 1 actions for this Plan.
2. **Priority 2** - Actions that must be taken to prevent significant decline in species population/habitat quality or some other significant negative impact short of extinction.
3. **Priority 3** - All other actions necessary to meet the recovery objectives.

Key to Acronyms Used in the Implementation Schedule

Bot. =	Botanical gardens
CPC =	Center for Plant Conservation
Cons. =	Other conservation organizations
EC =	Environmental Contaminants Program, USFWS
FA =	Division of Federal Aid, USFWS
MNDA =	Minnesota Department of Agriculture
MNDNR =	Minnesota Department of Natural Resources
NYDA =	New York Department of Agriculture
NYSDEC =	New York State Department of Environmental Conservation
Owners =	Landowners
RE =	Division of Realty, USFWS
R-3 =	Region 3, USFWS
R-5 =	Region 5, USFWS
TE =	Division of Endangered Species, USFWS
TNC =	The Nature Conservancy
Univ. =	University researchers
USGS =	U.S. Geological Survey
USFWS =	U.S. Fish and Wildlife Service
WGA =	Walnut Grove Association (landowner association)

Table 1. Implementation table for *Sedum integrifolium* ssp. *leedyi* (Leedy's roseroot) Recovery Plan.

TASK PRIORITY	TASK NO.	TASK DESCRIPTION	TASK LENGTH (YRS.)	RESPONSIBLE PARTY			COST ESTIMATES (\$000)				NOTES
				USFWS		Other Entity	Yr. 1	Yr. 2	Yr. 3	Yr. 4-10	
				Region	Program						
2	1.0	Map populations, and identify landowners.	2	R-3 R-5	TE FA	MNDNR NYSDEC TNC	5	0	0	0	
2	2.1	Determine correlation between seepage areas and distribution (NY).	2	R-3 R-5	TE FA	NYSDEC or MNDNR USGS NYDA MND TNC USGS Univ.	5	25	30	0	Combined work and costs with tasks 2.2 and 2.3
2	2.2	Conduct hydrologic studies.	2	R-3 R-5	TE FA	NYSDEC or MNDNR USGS NYDA MND TNC USGS Univ.	0	See note	See note	0	Combined work and costs with tasks 2.1 and 2.3

TASK PRIOR- ITY	TASK NO.	TASK DESCRIPTION	TASK LENGTH (YRS.)	RESPONSIBLE PARTY			COST ESTIMATES (\$000)				NOTES
				USFWS		Other Entity	Yr. 1	Yr. 2	Yr. 3	Yr. 4-10	
				Region	Program						
2	2.3	Map areas of potential groundwater contamination influence.	2	R-3 R-5	TE EC FA	NYSDEC or MNDNR USGS NYDA MND TNC USGS Univ.	0	See note	See note	0	Combined work and costs with task 2.1 and 2.2
2	3.0	Establish and administer a permanent infrastructure for Leedy's roseroot protection; secure funding for that protection.	3	R-3 R-5	TE RE	MNDNR NYSDEC TNC	0	5	10	21	
2	4.1	Contact landowners and/or private land trusts and homeowner associations; secure involvement in conservation; enroll sites in conservation easements or other programs; seek acquisition of lands containing significant populations on a willing seller basis.	3	R-3 R-5	TE FA	Cons. MND MNDNR NYSDEC TNC WGA	5	55	200	88	

TASK PRIORITY	TASK NO.	TASK DESCRIPTION	TASK LENGTH (YRS.)	RESPONSIBLE PARTY			COST ESTIMATES (\$000)				NOTES
				USFWS		Other Entity	Yr. 1	Yr. 2	Yr. 3	Yr. 4-10	
				Region	Program						
2	4.2	Prepare management plans for easements and other protected areas and for voluntary landowner association participants.	3	R-3 R-5	TE FA	Cons. MNDNR NYSDEC TNC WGA	0	0	30	30	
2	5.1 and 5.2	Establish and implement a uniform monitoring procedure.	ongoing	R-3 R-5	TE FA	MNDNR NYSDEC Owners TNC Univ.	5	5	5	30	
2	5.3	Review monitoring results and management methods.	ongoing	R-3 R-5	TE FA	MNDNR NYSDEC Owners TNC	0	0	0	15	
2	6.0	Provide public education, including advance landowner contact.	ongoing	R-3 R-5	TE FA	Bot. Cons. MNDNR NYSDEC Owners TNC	10	2	2	3.5	
3	7.0	Develop and maintain a genetic bank.	ongoing	R-3 R-5	TE	Bot. CPC	0.5	5	0.5	3.5	

Note: Ongoing tasks are anticipated to continue beyond the fifth year and beyond delisting.

IV. FIGURES

Figure 1. Illustration of *Sedum integrifolium* ssp. *leedyi* (Leedy's roseroot).



Copyright 1988, State of Minnesota, Vera Ming Wong.

Figure 2. Ranges of *Sedum integrifolium* (roseroot) (shaded area) and *S. integrifolium* ssp. *leedyi* (Leedy's roseroot) (black dots and blackened counties).

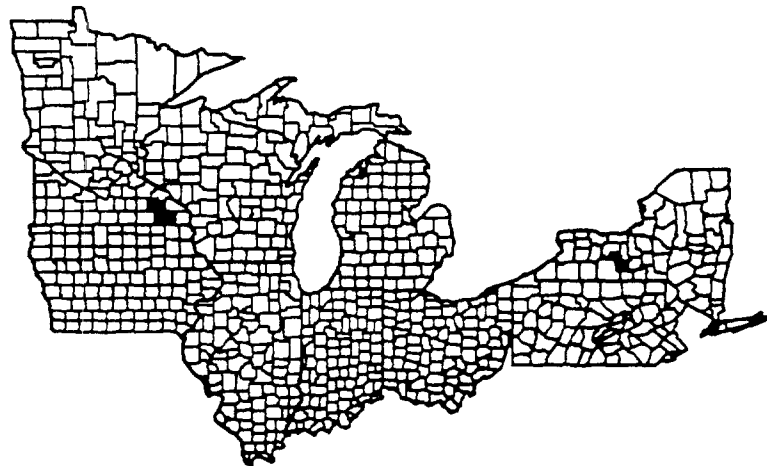
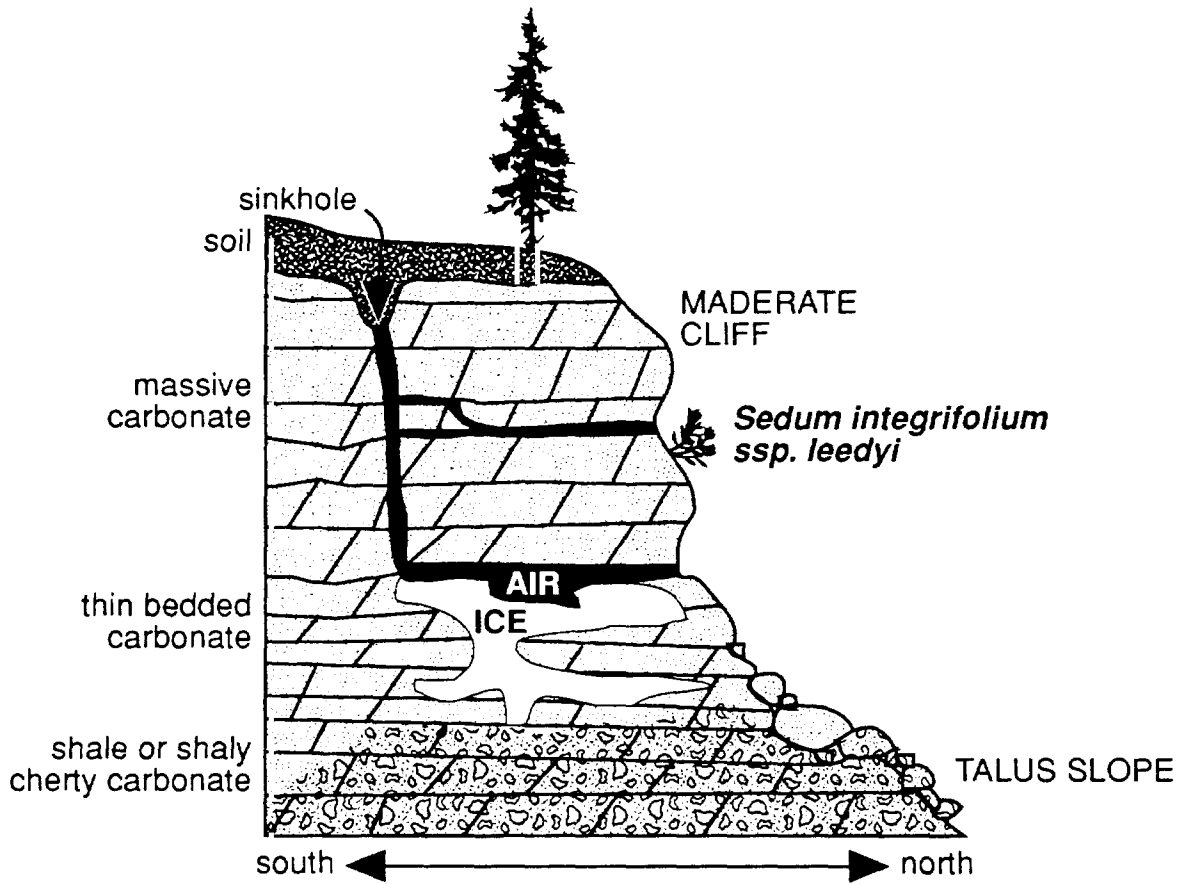


Figure 3. Cross sectional diagram of an idealized moderate cliff, based on information in Frest (1986).



V. TABLE

Table 1. Extant occurrences of *Sedum integrifolium* ssp. *leedyi* (Leedy's roseroot).

STATE	COUNTY	SITE NAME	NUMBER OF RAMETS	DATE FIRST OBSERVED	DATE LAST OBSERVED	OWNERSHIP
MINNESOTA	Fillmore	Bear Creek	1,000-3,000	1985	1992	Private
MINNESOTA	Fillmore	Deer Creek	1,000-3,000	1985	1992	Private
MINNESOTA	Olmsted	Simpson Cliff	1,000-3,000	1936	1992	Private
MINNESOTA	Olmsted	Whitewater Wildlife Management Area	> 500	1989	1992	State wildlife management area
NEW YORK	Schuyler	Watkins Glen	1	1918	1993	State park
NEW YORK	Yates	Glenora Falls	40	1994	1994	Private
NEW YORK	Yates	Glenora Cliff	6,000	1918	1993	Private

VI. APPENDICES

APPENDIX A

PRINCIPLE INTERNATIONAL TREATY AND FEDERAL AND STATE LAWS APPLICABLE TO THE PROTECTION OF *SEDUM INTEGRIFOLIUM* SSP. *LEEDYI* (LEEDY'S ROSEROOT) AND ITS HABITAT

International Treaty

Convention on International Trade in Endangered Species of Wild Fauna and Flora. 27 U.S.C. 108. (CITES)

Federal (United States) Laws

Endangered Species Act of 1973. PL 93-205, 81 Stat.884, Dec. 28, 1973; current version at 16 U.S.C. 1531-1543, as amended.

Federal Environmental Pesticide Control Act of 1972. 7 USC 136 to 136y, P.L. 92-516, October 21, 1972, 86 Stat. 973, as amended.

International Environment Protection Act of 1983. 22 USC 3151q; 97 Stat. 1045.

National Environmental Policy Act of 1969. P.L. 91-190, 42 USC 4321 to 4347, January 1, 1970, 83 Stat. 853, as amended.

National Wildlife Refuge System Administration Act of 1966. 16 USC 668dd to 668ee.

Tax Deductions for Conservation Easements. 26 USC 170.

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). 7 U.S.C. through P.L. 100-460, 100-464 to 100-526, and 100-532.

Fish and Wildlife Coordination Act. 48 Stat. 401, as amended; U.S.C. 661 *et seq.*

State Laws

Minnesota Endangered Species Act. 1984. Minnesota Statute 84.0895, Protection of Threatened and Endangered Species.

New York State Environmental Conservation Law. 1989. Section 9-1503. Regulation 6 NYCRR Part 193.3.

APPENDIX B

PEER REVIEW AND PEER CONTRIBUTORS

The U.S. Fish and Wildlife Service extends special thanks to various experts, in addition to botanist Nancy Sather, the preparer of this plan, who reviewed drafts and/or provided their information or expert recommendations for the *Sedum integrifolium* spp. *Leedyi* (*Leedy's Roseroot*) *Recovery Plan*. This peer input was invaluable in bringing to the plan current biological information on the species and current population genetics concepts and information.

The following expert peers provided review and/or scientific information for the plan:

Dr. Glenn R. Furnier, University of Minnesota, St. Paul

Dr. Joel Olfelt, University of Minnesota, St. Paul

Mr. Steve Young, New York State Department of Environmental Conservation, Natural Heritage Program, Latham

Mr. Wayne Ostlie, Midwest Regional Office, The Nature Conservancy, Minneapolis, Minnesota

Appendix C

Comments Received During Draft Plan Review and Comment Period

The Service gratefully acknowledges the constructive suggestions it received during the 1993 (and 1994 reopened) draft plan review and public comment periods.

In response to suggestions received, the Service made substantive changes to the plan:

1. Added information about new New York population (Glenora Falls) in appropriate places in the plan.
2. Added information based on review provided by Walnut Grove, New York, (Homeowners) Association.
3. Included information concerning the Service's Driftless Area National Wildlife Refuge, in southeastern Minnesota.
4. Changed the names of the two *Novisuccinea* land snails and deleted *Vertigo hubrechtii* (it does not occur at Minnesota Leedy's roseroot sites).