MONITORING PLAN FOR SNAKE RIVER GOLDENWEED (*HAPLOPAPPUS RADIATUS*) ON THE PAYETTE NATIONAL FOREST

by

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INTRODUCTION

Haplopappus radiatus (Snake River goldenweed) is narrowly-distributed, found only in steppe and shrub-steppe communities at the southern end of Hells Canyon. Its distribution includes Washington County, Idaho, and Baker and Malheur counties, Oregon (Kaye et al. 1990; Mancuso 1991; Mancuso and Moseley 1993). Snake River goldenweed is a category 1 candidate for federal listing under the Endangered Species Act (U.S. Fish and Wildlife Service 1993), as well as a U.S. Forest Service Sensitive Species for the Payette National Forest (Spahr et al. 1991), and a Bureau of Land Management Sensitive Species in both Idaho (Conservation Data Center 1994) and Oregon. Oregon also has a state Threatened and Endangered Plant law, under which Snake River goldenweed is listed as Endangered (Oregon Natural Heritage Program 1993).

The endangered status of Snake River goldenweed is directly related to the loss and ecological decline of its habitat, high quality shrub-steppe habitat, specifically the *Agropyron spicatum*-series grasslands habitat types and *Artemisia tridentata* (sensu lato)/*Agropyron spicatum* shrub-steppe habitat types (Kaye et al. 1990; Mancuso and Moseley 1993). Habitat was lost by the flooding of Brownlee Reservoir, and to a lesser extent by mining operations, agricultural conversion, and possibly the flooding of Barton Reservoir. The proximate cause of past and ongoing habitat decline is heavy cattle grazing, which is responsible for changes in the composition, structure and function of the shrub-steppe habitat through herbivory, weed invasion, and increased fire frequencies. Habitat decline associated with cattle grazing has been identified as the greatest long-term threat to the species (Kaye et al. 1990; Mancuso and Moseley 1993).

In Idaho, Snake River goldenweed is known from 21 occurrences, roughly from between the town of Weiser on the south and Brownlee Creek on the north. Eight of these occurrences are partially or entirely managed by the Payette NF. The National Forest Management Act and Forest Service Policy require that Forest Service land be managed to maintain populations of all existing native plant and animal species at or above the minimum viable population level. A minimum viable population consists of the number of individuals, adequately distributed throughout their range, necessary to perpetuate the existence of the species in natural, genetically stable, self-sustaining populations.

The Forest Service, along with other Federal and State agencies recognize the need for special planning considerations in order to protect the flora and fauna on the lands in public ownership. Species recognized as needing such considerations are those that (1) are designated under the Endangered Species Act as endangered or threatened, (2) are under consideration for such designation, or (3) appear on a regional Forest Service Sensitive Species list. Snake River goldenweed meets the latter two criteria.

The primary goal of most rare plant management is to maintain viable populations of rare species, yet the management of natural communities containing rare plant populations poses several basic questions for land managers: Are current land management practices adequate to maintain the community or the species? What effect will specific management activities have on the rare

plant on a site? What is necessary to ensure the survival of a species? Most of these questions cannot be answered by casual observation and, therefore, some level of monitoring is needed (Sutter 1986). In its simplest form, monitoring may entail periodic estimates of population size. This level of information, however, may not provide enough information to make management decisions and a deeper understanding of population dynamics may be needed (Lesica 1987).

Previous studies have determined that Snake River goldenweed is rare and threatened enough to warrant some level of monitoring effort by land management agencies (Kaye et al. 1990; Mancuso 1991; Kaye and Meinke 1992; Kaye and Kirkland 1993; Mancuso and Moseley 1993; Kaye et al. 1994). Objectives of the this monitoring plan are to:

1. Review the life history characteristics of Snake River goldenweed.

2. Review the status and distribution of Snake River goldenweed populations on the Payette NF.

3. Review Snake River goldenweed monitoring programs of other agencies.

4. Develop a monitoring strategy appropriate for management of Payette NF populations.

DESCRIPTION AND LIFE HISTORY CHARACTERISTICS OF SNAKE RIVER GOLDENWEED

General description

Snake River goldenweed is an erect, herbaceous perennial in the sunflower family. Most individuals are greater than 40 cm tall. Basal leaves are large, mostly greater than 5 cm wide, while the stem leaves are smaller and usually sessile. The leaves are typically entire, but may be serrated to varying degrees. Upper portions of the flowering stems are light, with a yellow-green, tawny color. The plants are often without any pubescence except for a few scattered, small, light-colored hairs that sometimes can be found along the upper stem and/or on the involucre (bracts below the flower head). Occasionally this pubescence will be quite noticeable, but does not obscure the light color of the stem. The involucre is large and herbaceous-looking. Plants have 1-several flowering heads each, these heads with yellow rays. Snake River goldenweed is green and flowers later in the season than most other species in the grassland habitats where it typically occurs, and is therefore quite easy to spot surrounded by the brown, dormant vegetation of these grasslands.

It should be noted that most populations in Idaho contain individuals that fall outside the species previously published range of variability for several morphological characteristics. This is likely due to the relative paucity of material earlier descriptions were based upon. The characters include: 1) ray florets up to 17 mm long; 2) basal leaves less than 5 cm wide; 3) upper portions of the flowering stem can sometimes be more than just sparingly pubescent; this is less common

towards the basal portion of the stem; and 4) flowering plants less than 40 cm tall, to as short as 20 cm in height.

The smaller stature plants are often, but not always associated with rockier, shallow soil sites or higher elevations. There is some speculation that the smaller stature of many individuals may be a response to drought conditions. In most populations, robust, more typical-sized plants occur sympatric with the smaller plants to help with identification.

Field Identification

Snake River goldenweed is most similar to the closely related species, *Haplopappus carthamoides* (Columbia goldenweed), especially var. *carthamoides*. Differences in several morphological characteristics usually allow for field differentiation of these two species and are noted in the key below. Although Columbia goldenweed is known to occur within the range of Snake River goldenweed, the two were never found to be sympatric in Idaho. Two other common, yellow-flowered composites that can be in flower at the same time and superficially look like Snake River goldenweed, at least from a distance, are *Grindelia squarrosa* (curly-cup gumweed) and *Helianthella uniflora* (little-sunflower). The very glandular involucre and smaller foliage of *Grindelia*, and the generally taller stature, larger flower head and very hirsute and scabrous foliage of *Helianthella* make both species readily distinguishable upon closer inspection. The following key, modified from Kaye et al. (1990) should help distinguish Snake River goldenweed from the two varieties of Columbia goldenweed. The generally more pubescent stems and involucre bracts of var. *carthamoides* will help differentiate the more robust-sized individuals/populations that may otherwise key to *H. radiatus*. This key will prove most helpful when at least several plants are looked at in a given population.

1. Plants usually robust, mostly 35-95 cm tall; basal leaves mostly 5-19 cm wide; stems glabrous (without hairs) to rather sparsely pubescent, this generally restricted to the upper stem; upper stem tawny to light brown, involucral bracts glabrous to only slightly pubescent at the base ..... *Haplopappus radiatus*

1. Plants usually smaller, mostly 6.5-50 cm tall; basal leaves 1-4.2 cm wide; stems rather pubescent, often villous (long, soft, mostly bent hairs), especially above; upper stem usually red-tinged to brown, involucral bracts puberulent (minutely pubescent), often ciliate ..... *Haplopappus carthamoides*

    a. Involucral bracts oblong, strongly imbricate; heads hemispheric-campanulate .... var. *carthamoides*

    a. Involucral bracts lanceolate, loosely if at all imbricate; heads campanulate-turbinate ..... var. *cusickii*

See Mancuso and Moseley (1993) for additional information on the taxonomy and identification of Snake River goldenweed.

Reproductive Biology

Much of the following summary is from Kaye and Kirkland (1993), but also see Mancuso and Moseley (1993) for additional information. Snake River goldenweed blooms in June and July, rarely as late as September. The flowers are typically cross-pollinated by a diverse assemblage of bumble bees, solitary bees, flies, and butterflies. Some self-pollination is successful, but insects are required for maximum seed set (Kaye and Meinke 1992). Weevils and other seed predators have been observed at several sites (Kaye et al. 1990). The timing of seed germination is unknown in native habitats, but germination trials at Oregon State University indicate that seeds are germinable within a few weeks of harvest, can germinate at temperatures at least as low as 7^{o}C, and some seeds will continue to germinate through fall, winter, and spring if kept moist (Kaye and Kirkland 1993). Snake River goldenweed is an herbaceous perennial from a woody taproot. Because of the strong taproot habit, there supposedly is no vegetative reproduction in this species, seed production being essential to population growth. However, Ann DeBolt of Boise BLM has observed underground stems trailing off the taproot, making it difficult to identify individual plants in monitoring plots.

SNAKE RIVER GOLDENWEED ON THE PAYETTE NATIONAL FOREST

Habitat

On the Payette NF, Snake River goldenweed is found on dry, rocky, non-forested hillsides, most commonly with a southeast to southwest aspect. Small portions of two populations extend onto slopes with northerly aspects, however. Slopes vary from gentle to very steep and in one case include a flat, saddle area. Plants were most commonly found in grassland habitats within the *Agropyron spicatum/Poa secunda/Balsamorhiza sagittata* habitat type (Tisdale 1986). Shrubs such as *Artemisia tridentata* var. *vaseyana* and *Chrysothamnus nauseosus* are widely scattered if present. Snake River goldenweed is typically absent from adjacent, usually more northerly slopes supporting *Artemisia*-dominated communities. Exceptions to these generalities do occur though. For example, the small Monroe Butte population (007) is located in an opening within an *Artemisia tridentata* var. *vaseyana* community, and the upper Adams Creek population (005) occurs in a rocky opening adjacent to a Douglas-fir woodland where several shrub species also occur. Snake River goldenweed also occurs in the *Festuca idahoensis/Koeleria cristata* habitat type (Tisdale 1986) where small portions of two populations (001, 010) extend onto northerly slopes, and at the high elevation population near Benton Saddle (021). Years of grazing pressure has altered much of these grassland habitats so that to varying degrees, natural communities have been replaced by exotic species, predominately annuals. Snake River goldenweed was inevitably absent where weedy species are dominant.

The Payette NF populations were found between 4700 to 5900 feet and represent the highest elevations known for the species. Kaye et al. (1990) reports all populations visited in his 1988 work were on slightly to very calcareous substrates. Mayes (1976) also notes the species occurs on alkaline sites. The largest populations on the Payette NF also occur on calcareous substrates. The relationship between calcareous substrates and the distribution of Snake River goldenweed is unclear, however, in part because populations on volcanic parent material also occur. In the western Hitt Mountains, calcareous parent material seemed to end just north of Monroe Butte, coinciding with the southern limit of Snake River goldenweed on the Payette NF.

Species associated Snake River goldenweed include *Agropyron spicatum, Poa secunda, Festuca idahoensis, Koeleria cristata, Bromus tectorum, Bromus* sp., *Balsamorhiza sagittata, Tragopogon dubius, Chrysothamnus nauseosus, C. viscidiflorus, Onopordum acanthimum, Achillea millefolium, Crepis acuminatus, Calochortus macrocarpus, Sisymbrium altissimum, Lupinus sericeus, Astragalus cusickii, Amelanchier utahensis,* and *Lomatium* sp.

Populations

Much of this information is from Mancuso (1991), Mancuso and Moseley (1993), and recent survey information provided to the Conservation Data Center by Payette NF botanists. The Payette NF partially or entirely manages eight occurrences, with some occurrences consisting of more than one population. The occurrence, therefore, can be considered the metapopulation. The total number of plants managed by the Forest is approximately 13,000 individuals, based on recent population estimates, varying from 7 in a population to large populations containing up to 5000 plants. Below is a detailed review of the status of each population occurring on the Payette NF (the three digit code following the population name refers to the occurrence number from the Conservation Data Center data base).

Mineral East (001)

a. Location:
b. Monroe Butte 7.5' U.S.G.S. topographic map quadrangle, 1987 - Provisional edition.
c. First observed in 1978.
d. Most recently observed in 1991.
e. Area: >100 acres.
f. Number and size of plants: 1000-10,000 plants in 1989, and 500-1000 in 1991.
g. Density: Low
h. Evidence of reproduction: some plants with maturing fruits in 1991.
i. Threats: Fewer plants reported for 1991 compared to 1989, but this may be due to a less intensive search in the lower elevation parts of the population in 1991.
j. Land ownership: Payette NF and Boise District BLM.

Upper Adams Creek (005)

a. Location:
b. Monroe Butte 7.5' U.S.G.S. topographic map quadrangle, 1987 - Provisional edition.
c. First observed in 1991.
d. Most recently observed in 1994.
e. Area: ca 2 acres.
f. Number and size of plants: 40-50 plants in 1991.
g. Density: Low.
h. Evidence of reproduction: Most plants in flower in 1991.
i. Threats: Portion of population probably destroyed by adjacent gravel pit. Population may be threatened by renewal or expansion of gravel operations at pit and possibly by timber harvest activity in adjacent forest stands. Cattle grazing impacts were visible at site in 1994, with heavy use of existing plants noted.
j. Land ownership: Payette NF.

Monroe Butte (007)

a. Location:
b. Monroe Butte 7.5' U.S.G.S. topographic map quadrangle, 1987 - Provisional edition.
c. First observed in 1991.
d. Most recently observed in 1991.
e. Area: ca 0.1 acre.
f. Number and size of plants: 7 plants in 1991; its possible this population extends further west across Forest Service boundary onto private land.
g. Density: Low.
h. Evidence of reproduction: Most plants in flower in 1991.
i. Threats: There has been livestock use of the area in the past, although evidence was not very recent in 1991. Population may be threatened by increased livestock use.
j. Land ownership: Payette NF.

Middle Fork Dennett Creek (009)

a. Location:
b. Monroe Butte 7.5' U.S.G.S. topographic map quadrangle, 1987 - Provisional edition.
c. First observed in 1991.
d. Most recently observed in 1991.
e. Area: 25+ acres.
f. Number and size of plants: ca 120 plants in 1991 (80 on Payette NF; the population may extend further westward than surveyed.
g. Density: Low.
h. Evidence of reproduction: Some plants with maturing seed in 1991.
i. Threats: There is no evidence of current livestock use (in 1991), but past grazing has resulted in serious weed invasion, especially *Bromus tectorum*. Population may be

threatened by competition from introduced weeds and livestock grazing if it is resumed.

j. Land ownership: Payette NF, Boise District BLM, and private.

Limestone Gulch (010)

a. Location:
b. Sturgill Creek 7.5' U.S.G.S. topographic map quadrangle, 1987 - Provisional edition.
c. First observed in 1991.
d. Most recently observed in 1991.
e. Area: 10-15 acres.
f. Number and size of plants: ca 800 plants in 1991.
g. Density: Medium to low.
h. Evidence of reproduction: Some plants with maturing seeds in 1991.
i. Threats: The area is not currently (1991) grazed by livestock, but past use has resulted in cheatgrass invasion. The population may be threatened by exotic weed competition and resumption in livestock grazing. The grasshopper damage does not seen to be a "fatal" problem. The population may be threatened by high seed predation by insects.
j. Land Ownership: Payette NF.

Monroe Butte (020)

a. Location: .
b. Monroe Butte 7.5' U.S.G.S. topographic map quadrangle, 1987 - Provisional edition.
c. First observed in 1993.
d. Most recently observed in 1993.
e. Area: 830 square yards.
f. Number and size of plants: 35-65 plants in 1993.
g. Density: Low.
h. Evidence of reproduction: Most plants in flower in 1991.
i. Threats: A number of plants were eaten by cattle in 1993. Area is actively grazed and a timber sale is proposed for adjacent forest stands.
j. Land Ownership: Payette NF.

Benton Creek (021)

a. Location:
b. Sturgill Creek and Neil Gulch 7.5' U.S.G.S. topographic map quadrangles, 1987 - Provisional editions.
c. First observed in 1991.
d. Most recently observed in 1993.
e. Area: 45-50 acres.
f. Number and size of plants: 4000-5000 plants in numerous populations in 1993.
g. Density: High to low.
h. Evidence of reproduction: Some plants in flower and immature fruit in 1993.

i. Threats: Livestock grazing currently takes place in the population, which is visibly disturbing plants and responsible for weed invasion in some places. Possible threats include road building and continued overgrazing and weed invasion.
j. Land Ownership: Payette NF.

Upper Sturgill Creek (022)

a. Location: .
b. Sturgill Peak and Monroe Butte 7.5' U.S.G.S. topographic map quadrangles, 1987 - Provisional editions.
c. First observed in 1993.
d. Most recently observed in 1993.
e. Area: 40 acres.
f. Number and size of plants: 1500-2000 plants in 1993.
g. Density: Medium to low.
h. Evidence of reproduction: Plants in flower and fruit in 1993.
i. Threats: Livestock grazing currently takes place in the population, which is visibly disturbing plants. Timber access roads traverse population and have probably destroyed habitat. Possible threats include continued overgrazing and road maintenance and reconstruction.
j. Land Ownership: Payette NF.

Population Ranking

To aid in conservation planning, the Conservation Data Center assigns a rank to each occurrence in the data base. Each extant population is assigned a rank between A and D, while historically-known occurrences and extirpated populations are given ranks of H and X, respectively. For Snake River goldenweed in Idaho, the ranks for extant populations are defined as follows:

A-ranked occurrences -- consist of those with large numbers, generally thousands of plants, occurring mostly in high quality steppe and shrub-steppe. Only a relatively small portion of the area is covered by habitat that has been destroyed or degraded. These occurrences tend to be large in area, consisting of many populations over a contiguous area.

B-ranked occurrences -- consist of several hundred to approximately 2000 individuals. Occurrences at the lower end of this size range occur on high quality habitat in one or more populations, while those at the upper end are generally on more degraded habitats. B-ranked occurrences generally cover between 20 to 40 acres, but may be as large as 100 acres. These occurrences may or may not be isolated in a fragmented landscape.

C-ranked occurrences -- consist of moderately-sized populations, generally ranging from 50 to several hundred individuals or even a couple of thousand if the site is especially poor quality. At least part of the occurrence is on degraded habitat, especially at the upper end of the size range. They occupy an area generally less than one acre, although they can be widely

scattered at low density on up to 20 acres, possibly more.

D-ranked occurrences -- consist of isolated population of generally less than 50 individuals, covering a small area (less than one acre) of degraded habitat.

We've assigned conservation ranks to the eight Payette NF occurrences as follows:

A Occurrences:

Mineral East (001)
Benton Creek (021)

B Occurrences:

Limestone Gulch (010)
Upper Sturgill Creek (022)

C Occurrences:

Middle Fork Dennett Creek (009)
Monroe Butte (020)

D Occurrences:

Upper Adams Creek (005)
Monroe Butte (007)

REVIEW OF ONGOING MONITORING PROGRAMS

Oregon - Vale District BLM

Based on previous inventories and a status review in Oregon (Kaye et al. 1990), the Vale District BLM entered into a cooperative monitoring project with the Plant Conservation Biology Program of the Oregon Department of Agriculture to monitor Snake River goldenweed in permanent plots to determine the long-term population trends and identify factors that influence and control population growth (Kaye and Meinke 1992). Monitoring of permanent plots began on BLM land in 1991, and has continued annually for four years. The monitoring program will continue annually for 10 years (Jean Findley, Vale BLM, personal communication, 1994). Specific objectives of this demographic monitoring project are (Kaye and Kirkland 1993):

1. To monitor populations in sufficient detail to determine the causative agents of population expansion or decline.

2. To compare population dynamics and growth both inside and outside cattle exclosures at four sites on BLM land. Transition matrix models will be used to study population dynamics.

Methods

The monitoring design included the placement of five plots open to cattle grazing being paired with fenced plots at five different locations in the Burnt River valley. The fenced areas were 12 m on a side. The plots provide data on long-term population trends and the effect of cattle grazing on population growth. The sampling procedure is detailed enough to follow individual plants from one year to the next in order to determine the natural life-span of an individual and identify the major reproductive- or size-classes in which plants can be categorized. The data collected are compatible with statistical methods and transition matrix models to determine population growth rates and other measures of population dynamics, and comparisons of grazed and ungrazed plots (Kaye and Kirkland 1993).

All ten plots (five grazed and five ungrazed) are 10 x 10 m square. They found it necessary to incorporate walk-ways into the plot design in order to reach the individual subplots for close inspection. Each plot was composed of five 1-m wide belt transects alternating with 1-m wide walkways. Each transect was broken into ten contiguous 1 x 1 m subplots, for a total of 50 subplots per plot, in which plants were mapped and measured. The ends of the transects were permanently marked with rebar [see Kaye and Kirkland (1993) for more details].

Oregon Department of Agriculture botanists sampled the plots twice a year, first during April or May to maintain the plots and locate seedlings, and second during mid-July to count and remeasure all plants. Monitoring took a crew of several people one week for each of the spring and summer visits to read the plots. In all subplots, Snake River goldenweed plants were mapped onto special map forms and uniquely identified. Data on plant height, length of longest leaf, number of leaves, and number of healthy and aborted flower heads, number of grazed stems, and percentage of herbivory by grasshoppers were collected for each plant in the subplots. To determine seed production and seed predation rates, seed heads (capitula) were randomly collected along temporary transects. The heads were dissected to determine the number of mature seeds (healthy and filled), damaged (eaten by insects), and aborted (Kaye et al. 1994).

Several statistical comparisons were conducted to test for differences between years and between treatments for various attributes. Descriptive statistics were also computed for attributes relating to the demography of each Snake River goldenweed population, and were used to construct population models that predict populations trends in the future under current management. The computer program RAMAS/stage (Ferson 1991) was used to execute a type of population modeling using transition matrices.

Preliminary results

To date, three years of data, representing two transitions (i.e., 1991 to 1992 and 1992 to 1993), have been used to develop a preliminary model of population trends at each population and

under each treatment (Kaye and Meinke 1992; Kaye and Kirkland 1993; Kaye et al. 1994). Three years of data are insufficient to make strong conclusions about projects population changes, but transition matrix models are generally fairly robust to small changes in the matrix components, and are therefore useful for identifying aspects of population dynamics that are crucial to population growth or decline. As additional years of data become available, the model can be updated and its usefulness as a tool in projecting population trends and predicting the effects of various management options will improve.

Preliminary computer models suggest that the Oregon populations of Snake River goldenweed sampled in this study are not viable under current conditions, and will decline faster if grazed (Kaye et al. 1994). Seedling mortality was relatively high and fecundity was low. In 1992 (following one transition), all populations were projected to decline to extinction within ten years if that year's drought continued. In 1993, however, additional precipitation improved growing conditions so that population growth rates improved at all sites, and populations at three sites were projected to increase regardless of grazing treatment.

Idaho - Boise District BLM

Much of the information from this section was obtained from discussions with Nancy Taylor-Grant and Ann DeBolt and from a draft report prepared by Taylor-Grant. During July 1994, botanists from the Boise District BLM established population monitoring plots at two Idaho populations, Barton Reservoir Northeast (012) and Sumac Creek (016).

Barton Reservoir Northeast - located a few miles north of Weiser on a BLM isolated tract. The substrate is volcanic. Vegetation of the area has been overgrazed in the past and now consists largely of medusae-head, with local areas of good- to fair-condition stands of the *Artemisia tridentata wyomingensis/Agropyron spicatum* habitat type. The Snake River goldenweed population was comprised of approximately 1000 individuals in 1994. The population was scheduled to be fenced from cattle grazing in 1994. Elevation of this population is 2500 feet.

Sumac Creek - located on a steep, northerly-facing slope along Brownlee Reservoir, approximately 25 miles north of Weiser. The population largely occurs above the road that runs between Weiser and Mineral. The area ia underlain by a slightly calcareous phyllite substrate. The community consists of the *Artemisia tridentata wyomingensis/ Agropyron spicatum* and the *Agropyron spicatum-Poa secunda/ Balsamorhiza sagittata* habitat types. Although the area is open to cattle grazing, the vegetation is in relatively good ecological condition due to the steep slopes which limits access. The elevation of this populations is 2500 feet.

The objective of the Boise BLM monitoring program is to assess population trends over time of juvenile and mature plants. Monitoring is to be done annually.

Methods

They established a total of 15 permanent plots, ten at Barton Reservoir Northeast and five at Sumac Creek. They intend to put in five additional plots at Sumac Creek. It is estimated that it will take two people one or two days to read the plots at one site.

Three different plot sizes, having 10, 7, and 5 m radii, were tested for efficiency of sampling and recording. They chose the smallest plot, with a 5 m radius, as the most efficient size, capturing enough plants for a good sample size, but not too many so as to limit the number of plots that could be read within their budgeted time. The 5 m-radius plot was then divided into four quadrants for ease of tracking and recording individuals during sampling.

Plots were located randomly at the two study sites. The plot center was permanently marked with a potato digger bar, as were eight points around the perimeter, which delimited not only the circumference, but also the quadrants. Within each plot, a 0.5 x 0.5 m photo plot was placed at the center. In order to characterize the vegetation of the plots, cover estimates were made for all species in the center photo plot.

In their pilot study, DeBolt and Taylor-Grant found that it was difficult to identify individual plants if there were several stems in a cluster. Exploring this further, they dug up a plant outside of the study area and found that some plants were connected under the soil surface by trailing stems. They also found no small plants in the plots that were obviously seedlings, that is, plants with cotyledons still attached. This may be because they sampled in July and the seedlings had lost the cotyledons and grown large enough to be confused with young, non-flowering individuals. In Oregon, Kaye et al. (1994) measured their permanent plots twice a year, in April or May to count seedlings, and again in July to count all plants. Without identifiable seedlings in the Idaho BLM plots then, they classified plants into one of two stage classes, juvenile and mature. Juvenile plants were nonflowering individuals, while mature individuals were flowering.

They plan to use various statistical tests to test for differences between plots, between sites, and between years.

Preliminary Results

The Boise BLM plots were established in 1994, and baseline vegetation and population data were collected. Obviously, no trend can be discerned from these data. A report summarizing methods and baseline results is in preparation. They plan to read the plots annually over enough years to account for long-term variations in the populations.

RECOMMENDED MONITORING STRATEGY FOR THE PAYETTE NATIONAL FOREST

Due to the global rarity of Snake River goldenweed, maintaining the viability of all populations is important. Therefore, the management goal for populations under jurisdiction of the Payette NF

should be to maintain stable population levels of A- and B-ranked occurrences and increase population levels of C- and D-ranked sites over the next ten years. To determine whether or not the Forest is attaining this management goal, some level of monitoring is needed at all eight occurrences.

Two types of monitoring are currently being used to determine long-term trends in Snake River goldenweed populations. The Oregon BLM is conducting intensive demography monitoring and population modelling to project trends through time. The Idaho BLM is taking the less intensive approach of following population levels through time to measure trend.

Demographic monitoring of rare species has become increasing important as the efforts of natural resource agencies has evolved from an emphasis on the inventory and status determination of rare species to active protection efforts (Moseley and Mancuso 1993). Demographic studies and related monitoring methods provide managers with a vastly superior understanding of a species life history and greater ability to predict population trends (Larkin and Salzar 1992). In conservation management for instance, it is necessary to determine the greatest threats to a species' survival. Demographic stochasticity causes population fluctuations and is an important threat to extinction when populations are very small. Since most rare plants occur in small populations, we should assume that demographic variation is a formidable threat (Larkin and Salzar 1992).

Demography is the study of population changes and their causes through the life cycle of a plant. Population attributes such as birth and death rates, growth, size, density and distribution are some of the characteristics measured. Demographic studies of plants have indicated that each population possesses attributes that determine local abundance and/or persistence through time. A thorough analysis of these attributes is of primary importance in the management of rare and endangered plant populations, simply because abundance and persistence are at the center of all conservation efforts (Pavlik and Barbour 1988). Demographic monitoring studies can help determine the factors that control the abundance and distribution of a species and can generate data useful in predicting the future size and age structure of a population. The main drawback of demography monitoring is the time (cost!) involved in designing, establishing, and analyzing the data, as well as for reading the plots for enough years to provide useful prognostications.

Recommendations: Some level of monitoring is needed at all eight known populations occurring on the Payette NF.

> **A- and B-ranked Occurrences:** Although these occurrences are large and overall habitat quality is generally high, portions of some of the populations occur on degraded habitat. A lower level of monitoring is needed for these occurrences, as compared with C- and D-ranked populations, and this monitoring should focus on the habitat instead of the population. A- and B-ranked populations on the Payette NF include Mineral East (001), Limestone Gulch (010), Benton Creek (021), and Upper Sturgill Creek (022).

    o Management Goal: Maintain stable populations at the four A- and B-ranked

occurrences for at least the next ten years by limiting habitat degradation caused by weed expansion.

- o Monitoring: Habitat monitoring is needed annually or biannually to determine whether or not it is declining due to Payette NF management actions, i.e., grazing, weed invasion, etc. Because expansion of existing weed populations is the major concern, we recommend establishing a permanent transect through degraded portions and adjacent areas of the population. The beginning of the transect should be monumented to aid relocation from year to year, with the transect laid out on an azimuth. At a standard interval along the transect, the coverage of vascular species is recorded for a 1 m^2 plot. The interval chosen for measuring must be sensitive enough to detect expansion of the weed populations. It may also be appropriate to establish permanent photo points at the transects and/or other selected areas of the population.

> **Monroe Butte 007 Occurrence:** This occurrence presents a special situation. While it is C-ranked because of low population numbers, suitable habitat in the area is limited and the habitat quality is high. In other words, this was probably always a small population. For monitoring this population, we recommend counting all the individuals and subjectively assessing habitat quality on a bi- or triannual basis.

> **C- and D-ranked Occurrences:** More intensive monitoring is needed to determine the trend of the lower-ranked occurrences, including Upper Adams Creek (005), Middle Fork Dennett Creek (009), and Monroe Butte (020).

- o Management Goal: The management goal for the three C- and D-ranked occurrences should be to assure that livestock grazing is not having a deleterious effect on these populations and that habitat quality and population numbers should be increased in ten years so that they are ranked B or above.

- o Monitoring:

  * The lower ranking of these populations is directly correlated with the degraded habitat in which they occur. This habitat degradation is largely due to livestock grazing. Of interest to the Payette NF, then, should be the level of livestock grazing under which Snake River goldenweed can be maintained in viable populations. One of the aspects being tested by the intensive monitoring program in Oregon, is the effect of cattle grazing on population viability. Our recommendation is that the Payette NF use population trend projections of the Oregon modelling effort to assess the general effects of cattle grazing on the Snake River goldenweed populations that they manage. One potential problem with using the Oregon data is that their study populations are as much as 3000 feet lower in elevation than those on the Forest. The response of the Snake River goldenweed populations to cattle grazing may be different. This aspect should be explored, but given the substantial initial cost of establishing exclosures and paired

permanent plots, as well the long-term monitoring and data analysis costs, it seems that at this time the Payette does not need to duplicate the effort of the Oregon BLM.

* As stated earlier, demographic monitoring provides managers with a vastly superior understanding of a species life history and greater ability to predict population trends. We would recommend the Forest establish a demographic monitoring study for Snake River goldenweed, however, this type of monitoring and modelling is currently being conducted by the Oregon BLM for at least 10 years and there appears to be no need for duplication at this time. The caveat we noted above is valid here also. The Payette populations are significantly higher than the Oregon monitoring sites, and the population dynamics of Snake River goldenweed may be different in the two elevation zones.

* We recommend that the Payette NF establish similar monitoring to that conducted by the Boise BLM in 1994. This is relatively simple and inexpensive to establish and conduct over the long-term, and coupled with the demographic modelling of populations with grazing and no-grazing treatments being conducted in Oregon, will allow the Forest to determine if their livestock management is affecting population viability.

> **Coordination:** Monitoring results should be compared and coordinated with the Boise BLM, Vale BLM, and the U.S. Fish and Wildlife Service a minimum of every three years, preferably sooner.

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