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COURSE 7: Ecology and Management of Endangered Species

An Overview of the U.S. Fish and Wildlife Service Endangered Species Act and ESA Petition Process, with a Case Study Presenting the Emergency Petition for Goose Creek Milkvetch (*Astragalus Anserinus*)

ATLANTIC INTERNATIONAL UNIVERSITY

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Introduction

Extinctions of known species and an ever expanding list of plant and animal species designated as endangered in North America and elsewhere around the globe reflect a serious and world-wide biodiversity crisis (Wilson 1985; Noss and Cooperrider 1994; Miller 1995; Nebel and Wright 1996; Costanza and others 1997). E. O. Wilson reports that the modern rate of extinction is nearly 400 times that recorded by recent geologic history, and that the rate is accelerating rapidly. Wilson (1985) implores science and society not to accept the contention that modern extinction is nothing more than a natural process.

Under even the best of conditions, it would now appear that modern reduction of diversity approaches that of the natural catastrophes that occurred at the end of the Paleozoic and Mesozoic eras (Wilson 1985). Wilson (1985) also points out to the world at large that in previous mass extinctions plant diversity survived largely intact, and that for the first time in geologic history plant diversity is being largely destroyed along with animal diversity.

Human activities placing world biodiversity at risk and individual species at risk of extinction include: unsustainable population growth that exceeds global carrying capacity, high entropy technologies that result in rapid resource depletion or degradation, and loss of habitat through land use conversions (Costanza and others 1997; Dombeck

and others 2003). Costanza and others (1997) note that innovative policies and management instruments are now required to address critical environmental issues such as extinction rates and a growing loss of natural biodiversity.

A number of important national and international conventions have resulted in the establishment of treaties and other acts or policies addressing endangered species preservation and protection (Barker 1993; Brewer 1994; Noss and Cooperrider 1994; Miller 1995; Nebel and Wright 1996; Dombeck and others 2003). International steps to protect biodiversity were initiated in the 1970's by the Convention on International Trade in Endangered Species [CITES] and establishment of the CITES treaty (Nebel and Wright 1996). The CITES treaty is an agreement between 118 countries directed at restricting the export and import of endangered species or products of endangered species origin such as elephant ivory (Nebel and Wright 1996).

Another more recent international action has been The Convention on Biodiversity, held as part of the 1992 Earth Summit (Nebel and Wright 1996). This convention resulted in the development and acceptance of a specific Biodiversity Treaty by 158 nations, a treaty intended to address such complex issues as biodiversity values, significance of biodiversity to human welfare, and national sovereignty s it relates to biodiversity (Nebel and Wright 1996).

Formal actions to preserve and protect natural biodiversity in the United States were embodied in the Endangered Species Act [ESA] of 1973 (Nebel and Wright 1996). Under this act, a species is considered endangered if it has declined in population to the point where extinction is imminent (Nebel and Wright 1996). The ESA is also intended to assist in the protection and preservation of threatened species, those species that have

been determined to be at risk of extinction at some point in the near future if intervention is not made on their behalf (Nebel and Wright 1996). Further discussion of the ESA and of the ESA process will be presented in the following report section.

General Analysis

Background

The Endangered Species Act [ESA] marked an important turning point in U.S. environmental history (Brewer 1994). However, this was not the first Congressional effort, nor the sole effort aimed at protecting native biodiversity in the United States (Barker 1993; Noss and Cooperrider 1994; Nebel and Wright 1996; Dombeck and others 2003). The hunting of egrets and other birds to supply feathers for hats and fashionable clothing items resulted in the near extinction of Snowy Egrets (Nebel and Wright 1996). In 1886 the newly formed Audubon Society lobbied for an end to such practices (Nebel and Wright 1996). Florida and Texas passed laws to protect plumed birds such as the egret, followed by Congressional passage of the Lacey Act in 1900. The Lacy Act forbid interstate commerce associated with illegally killed wildlife (Nebel and Wright 1996).

The establishment of numerous wildlife refuges followed passage of the Lacey Act, providing some protection of critical breeding grounds for Snowy Egrets and other birds of marshes and wetlands (Nebel and Wright 1996). Additional legislation followed, directed towards protection of natural resources and of the wildlife they support. The following list provides an example of some of the important legislation (including the

ESA) passed in the United States relating to resource protection and to the protection and conservation of natural biodiversity (Barker 1993; Noss and Cooperrider 1994; Donahue 1999; GAO 2005):

- Taylor Grazing Act (1934)
- Bald and Golden Eagle Protection Act (1940)
- National Environmental Policy Act (1969)
- Clean Air Act (1970)
- Endangered Species Act (1973)
- Forest and Rangeland Renewable Resources Planning Act (1974)
- Federal Land Policy and Management Act (1976)
- National Forest Management Act (1976)
- Migratory Bird Treaty Act (1976)
- Neotropical Migratory Bird conservation Act (2000)

The ESA

Prior to enactment of the ESA in 1973, wildlife and native plants were largely considered as secondary to corporate, Congressional, and agency agendas with little exception (Barker 1993). This condition existed in spite of the fact that in1964 The U.S. Bureau of Sport Fisheries and Wildlife (forerunner to the U.S. Fish and Wildlife Service) had already assembled a list describing 63 plants and animals as endangered (Barker 1993). In 1966 and again in 1969 the Department of Interior called for the Bureau of Sport Fisheries and Wildlife's endangered species list to be made official, and directed that actions be taken to protect these species through habitat acquisition.

The initial endangered species legislation prepared by the Bureau of Sport Fisheries and Wildlife had few enforcement provisions and little conservation action took place (Barker 1993). It required the drafting and passage of the Endangered Species Act in 1973 to jumpstart U.S. endangered species protection and conservation action. Passage of the ESA actually required agencies to ensure that any actions authorized, funded, or otherwise carried out by federal agencies did not jeopardize at risk or "endangered" species (Barker 1993; Bean 1999).

Language in the ESA governing federal actions is detailed in Section 7 of the ESA, and is typically addressed through a process that has come to be referred to as Section 7 consultation (Bean 1999). There are now approximately 1,265 plant and animal species that have been designated as endangered or threatened that occur within the United States (GAO 2005). Many other species have been petitioned for listing under the ESA and are currently undergoing review at one or more levels.

Enforcement responsibilities for ESA species are officially shared by the U.S. Fish and Wildlife Service and the U.S. National Marine Fisheries Service (Bean 1999; GAO 2005). The National Marine Fisheries Service has been charged with the responsibility of protecting ocean-dwelling species and anadromous species (such as salmon) under the ESA, while the U.S. Fish and Wildlife Service deals largely with all other migratory and non-migratory species (Bean 1999; GAO 2005).

The ESA (USFWS 1973) has defined an endangered species as any species that is in danger of extinction throughout all or a significant portion of its range [16 U.S.C § 1532 (6)]. Threatened species are those species that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range [Id. at § 1532 (20)]. Under Section 4 of the ESA, the Secretary of the Interior must determine whether any species petitioned or otherwise under consideration is an endangered species or a threatened species due to one or more of the following conditions:

- the present or threatened destruction, modification, or curtailment of its habitat or range;

- overutilization for commercial, recreational, scientific, or educational purposes;

- disease or predation

- the inadequacy of existing regulatory mechanisms; or

- other natural or manmade factors affecting its continued existence.

[16 U.S.C. § 1533(a)(1)]

Section 4 further requires that the Secretary of the Interior must make such determinations only on the basis of the best scientific and commercial data available following formal review of the species [16 U.S.C. § 1533(b)(1)(A)]. Section 4 of the ESA requires the Secretary of the Interior to designate critical habitat for any species concurrent with the listing of that species [16 U.S.C. § 1533(a)(3)(A)].

The ESA also provides authority for the Secretary of the Interior to issue temporary listing rules in the event of "any emergency posing a significant risk to the well being of any species of fish or wildlife or plants" [16 U.S.C. § 1533 (b)(7)]. The Secretary of the Interior is actually commanded to make "prompt use" of this authority to prevent significant risk to the well being of any species found to be at risk of extinction [16 U.S.C. § 1533(b)(3)(C)(iii)]. A further discussion of the petition and listing process for plants or animals to be declared endangered or threatened under the ESA are further discussed in report subsections below.

The Petition Process

The listing of any plant or animal species as endangered or threatened is generally initiated through the filing of a petition to list the species. Section 4(b)(3) of the ESA allows any interested individual to petition the U.S. Fish and Wildlife Service (USFWS)

or the U.S. National Marine Fisheries Service (USNMFS) not only to list a species, but also to delist a species, to reclassify a species, or to revise critical habitat designations for particular a species (USFWS 1996). Administrative standards for an ESA petition can be found in the Code of Federal Regulations at 50 CFR 424.14.

Documents intended to serve as a petition must be dated and must be clearly identified as a petition (USFWS 1996). Petitions must include the following information: name, signature, address, telephone number, and the association, institution or business affiliation if any of the petitioner(s). The petition document must also clearly state the type of action (e.g. listing of a species, designation of critical habitat) that is being requested of the Department of Interior (USFWS 1996). Petitions may reach the USFWS or USNMFS through a variety of routes, including as letters or documents sent to specific employees within a department, as letters or documents received by local, regional, or national offices of the USFWS or USNMFS, or that may have been sent directly to the Secretary of the Interior.

Once a petition has been received, a lead Region is generally established within the USFWS or USNMFS (USFWS 1996). Exceptions are petitions for species with a widespread distribution across more than one Region, such as the Bald Eagle or Chinook salmon. In instances where a species or subspecies/variety occurs in other than the lead USFWS Region, geographic Regions will assist the lead Region (USFWS 1996). Formal acknowledgement of receipt of a petition by USFWS must be sent to the petitioner(s) within 30 days under the Code of Federal Regulations (USWFS 1996).

According to the statutory requirements of the ESA, the Department of Interior is supposed to provide an administrative finding within 90 days of the receipt of a petition

as to whether or not the petition presents substantial information warranting the requested action (USFWS 1996). This procedure is typically referred to as the "90-day finding" (USFWS 1996). Public notice of the finding must then be published immediately in the Federal Register; if the finding has determined that the petition provided "substantial" evidence, the same Federal Register notice must announce a status review regarding the petitioned species or action (USFWS 1996).

Within 12 months of receipt of a petition that received a "substantial" 90-day finding, a second or 12-month finding is also required under the ESA (USFWS 1996). 90-day findings are intended to be based upon information provided by the original petition and any data currently in USFWS files, while the 12-month finding is intended to allow for review of public comments, the seeking of expert data, and other pertinent information relating to the status of a species or its habitat (USFWS 1996).

A 12-month finding is issued as a "warranted" finding and typically as a "proposed rule" (e.g. proposal to list a species as endangered) in support of the petitioned action (USFWS 1996). Other determinations for a listing petition or petition for another type of action may include "not warranted" (e.g. information shows a listing action or change in critical habitat is not necessary at the present time) or as "warranted but precluded" (e.g. listing is warranted but is not a priority due to one or more factors) (USFWS 1996). Each of the findings or proposed rules must also be immediately published in the Federal Register (USFWS 1996). A copy of any findings or rules that are published within the Federal Register must also be provided to the original petitioner(s) by the Department of the Interior (USFWS 1996).

The above process reflects the basic petition and finding process as set forth in the ESA. However, the timeframes and procedures as set forth by the ESA for the listing and finding process have not been adhered to by the U.S. Fish and Wildlife Service nor adhered to by the U.S. National Marine Fisheries Service. This has resulted not only in a serious backlog of petitions, but in a veritable storm of lawsuits brought by various members of the public, including local and regional conservation organizations. Problems associated with the ESA petition process will be further analyzed in the General Discussion section.

Case Study:

Emergency Listing Petition for Goose Creek Milkvetch (*Astragalus Anserinus*)

Introduction

Goose Creek Milkvetch (*Astragalus anserinus*) is restricted to soils of the Salt Lake Formation and is currently known only from the Goose Creek watershed (situated geographically where the boundaries of Idaho, Nevada, and Utah join in what is referred to locally as the Three Corners area). Current regulatory mechanisms are not adequate to protect Goose Creek Milkvetch (*Astragalus anserinus*) from extinction. Habitat impacts have accelerated and population declines have been precipitous across the past decade. The magnitude of ongoing threats to the existence and persistence of this rare plant and the imminence of threats poised to occur within existing populations requires immediate attention.

Alarmed by a BLM proposal to construct a pipeline through the only known population of *Astragalus anserinus* in Utah, and due to the continued failure of local land management agencies to protect existing populations, Red Willow Research Inc. filed an emergency petition to list Goose Creek Milkvetch (*Astragalus anserinus*) as endangered and to designate critical habitat. Red Willow Research Inc. was joined by an additional 25 petitioners in this request. The emergency petition and request for designation of critical habitat was authored by graduate student Miriam Austin.

The following sections presents the petition (edited for length and clarity) to list Goose Creek Milkvetch (*Astragalus anserinus*) as threatened or endangered under the Endangered Species Act and a request for the designation of critical habitat. The original petition also requested an emergency listing rule due to the immediacy of significant risks to the existence and persistence of this imperiled taxon, formerly a USFWS Category 2 candidate for federal listing.

The original petition was filed on January 30, 2004. The petitioners' request for an emergency rule was denied by the U.S. Fish and Wildlife Service on February 19, 2004 and as a result construction moved forward in the heart of the only known population of Goose Creek Milkvetch (*Astragalus anserinus*) in Utah. The petitioners for Goose Creek Milkvetch (*Astragalus anserinus*) are still awaiting 90-day and 12-month findings more than 18 months after the filing of the original emergency petition Discussion sections following the case study below will further explore the status of the ESA and current USFWS listing backlogs that have prevented conservation action for many imperiled species, including *Astragalus anserinus*.

Petition

> Petition to List *Astragalus anserinus* (Goose Creek milkvetch) as Threatened or Endangered Under the Endangered Species Act, 16 U.S.C. § 1531 et seq. (1973 as Amended) and for the designation of Critical Habitat; and Petition for an Emergency Listing Rule under the Endangered Species Act, 16 U.S.C. §§ 1533 (b)(1)(c)(iii) and 1533 (b)(7) and 50 C.F.R. § 424.20.

Petitioners hereby petition the Secretary of the Interior and U.S. Fish and Wildlife Service to list *Astragalus anserinus* (Goose Creek milkvetch) as threatened or endangered and to designate critical habitat pursuant to the Endangered Species Act. Petitioners file this petition pursuant to the Endangered Species Act (ESA), 16 U.S.C. § 1531, *et seq.* and regulations promulgated thereunder, and the Administrative Procedure Act, 5 U.S.C. § 553 (e).

Pursuant to 16 U.S.C. §§ 1533 (b)(1)(c)(iii) and 1533 (b)(7) and 50 C.F.R. § 424.20, the Petitioners further petition the Secretary and the Fish and Wildlife Service to promulgate a rule listing *Astragalus anserinus* (Goose Creek milkvetch) on an emergency basis due to significant and immediate risks to the well being of this species as is discussed herein.

Background and Supporting Information

The following petition sections provide background information basic to an understanding of *Astragalus anserinus* as an imperiled native plant, and provides information basic to an understanding of the current conservation plight of *Astragalus anserinus.* The following sections also provide information in support of this petition;

including the need for listing, designation of critical habitat, and the need for immediate emergency listing actions for *Astragalus anserinus.*

Part I provides specific background information regarding the known taxonomy, status, and species description for *Astragalus anserinus.* Part I also includes an overview of the known biology, known species distribution, known or suspected factors affecting species distribution, and the known population ecology of *Astragalus anserinus.*

Part II provides a detailed synopsis of past, current, and potential threats imperiling the viability and continued persistence of *Astragalus anserinus* in Idaho, Utah, and Nevada. Part II also provides a synopsis of past and current recommendations and/or management actions/failures regarding *Astragalus anserinus* in Idaho, Nevada, and Utah.

The Part II discussions and the petition conclusion will provide the required and compelling data and arguments in support of this petition for listing, in support of critical habitat designation, and in support of the emergency listing action requested for *Astragalus anserinus* (Goose Creek milkvetch). This imperiled taxon is in imminent danger of extinction due to a deadly combination of anthropogenic *and* natural factors.

PART I

Taxonomy

Astragalus anserinus (Goose Creek milkvetch) was first collected in 1982 from a location in Box Elder County, Utah. This taxon was described by Atwood and Welsh in the Great Basin Naturalist, 1984 (Baird and Tuhy 1991). The species description was based upon collections made within the Goose Creek watershed; with collections taken

from Box Elder County, Utah; Cassia County, Idaho; and from Elko County, Nevada (Baird and Tuhy 1991). These county locations are all within the Goose Creek watershed. The taxon is not known from any other geographic region. The binomial nomenclature for Goose Creek milkvetch is:

Astragalus anserinus Atwood, Goodrich, & Welsh

The common name for *Astragalus anserinus* is Goose Creek milkvetch. There are no known or pertinent synonyms for this taxon. Family synonyms have included the use of Fabaceae, Leguminosae, and Papilionaceae; common family names have included designation as the bean, pea, or legume family (Austin 2002). The taxonomic code employed by the Idaho Department of Fish and Game Conservation Data Center and the Utah Natural Heritage Program has been PDFABOFA10 (Mancuso and Moseley 1991).

Mancuso and Moseley (1991) note the full bibliographic citation as follows:

> Atwood, N. D., S. Goodrich, and S. L. Welsh. 1984. New Astragalus (Leguminosae) from the Goose Creek drainage, Utah-Nevada. Great Basin Naturalist 44(2) : 263-264.

The type specimen or holotype is noted as having been collected 22 km northwest of Lynn, Utah in the Goose Creek drainage (Box Elder County) on 23 June 1982 (Mancuso and Moseley 1991). Mancuso and Moseley (1991) note that Atwood, Goodrich, and Welsh have suggested that *Astragalus anserinus* has a generic affinity within the

Argophylli section. Atwood, Goodrich, and Welsh also suggested that *Astragalus anserinus* may be allied to *Astragalus subvestitus*, a species known from moderate elevations in Tulare and Kern Counties, California (Mancuso and Moseley 1991).

Status

There has been no international designation for *Astragalus anserinus.* The most recent national designation for *Astragalus anserinus* has been as a Category 2 candidate species for federal listing (Mancuso and Moseley 1991). Category 2 designations are no longer utilized as a legal distinction, due to abandonment of this particular designation system by the U.S. Fish and Wildlife Service.

Astragalus anserinus has been ranked as "imperiled throughout its range because of rarity or because of other factors making it vulnerable to extinction" (global rank = G2) by The Nature Conservancy. *Astragalus anserinus* has been assigned an Idaho state ranking of "state rank = S1" as it is "critically imperiled in Idaho because of extreme rarity or because of some other factor in its biology making it extremely vulnerable to extinction" (Mancuso and Moseley 1991).

The USDA Forest Service Region 4 and the USDI Bureau of Land Management have categorized *Astragalus anserinus* as a sensitive plant species. Both the Utah and Nevada Natural Heritage Programs have ranked *Astragalus anserinus* as "State Rank = S1" (Mancuso and Moseley 1991). As of the date of this petition, *Astragalus anserinus* has no existing federal designation or legal protective status.

Species Description

A general or non-technical description of *Astragalus anserinus* is provided by Mancuso and Moseley (1991):

> Goose Creek milkvetch is a low, mat-forming perennial with a slender taproot. The herbage has a soft, bent-to-tangled pubescence, giving the plant a grayish appearance. The leaves are small and divided into 5-15 leaflets. Flowers are pink-purple, only 9-11 mm long and not elevated above the plant. The brownish-red fruit pods are pubescent (but are not hidden by the pubescence), have a noticeable curved shape, and typically appear to be lying under the edge of the low-spreading stems.

A technical description, has also been provided by Mancuso and Moseley (1991):

> Dwarf, tufted or matted, shortly caulescent, perennial herbs from a slender taproot; stems 3-11 cm log, decumbent-spreading; herbage villous-tomentose; stipules all leaves 1-4 cm long; leaflets 5-15, 3.2-6.5 mm long, obovate; peduncles 1.1-2.4 cm long; racemes with 3-7 flowers, the axis 1-5 mm little if at all elongating in fruit; bracteoles lacking; bracts ca 2 mm long, lance-subulate; pedicels 0.6-4.8 mm long, the teeth 1.1-1.8 mm long, subulate; flowers 9-11.2 mm long, pink-purple; pods sessile 9-12 mm long, 5-7 mm wide, deciduous from within calyx; dorsiventrally compressed, falcately curved, conspicuously trigonous-beaked, thinly

> villous; ovules 16-20; seeds 1.2 mm long (Atwood, Goodrich & Welsh 1984).

The Idaho and Wyoming Endangered and Sensitive Plant Field Guide (USFS 1989) provides a line drawing with the following descriptive notations:

> Dwarf, matted, tomentose perennials; leaves, villous-tomentose, 1-4 cm long; corolla pink-purple, 9-11 mm long; racemes with 3-7 flowers; pods dorsiventrally compressed, 1-celled, thinly villous, curved.

Field characteristics of *Astragalus anserinus* are very important, as at least eight other *Astragalus* species may be found sympatric with or otherwise overlapping the distribution of *Astragalus anserinus* (Mancuso and Moseley 1991; Baird and Tuhy 1991; RWR 2000). Five of these species are not mat forming and may be more readily distinguished from *Astragalus anserinus*: *Astragalus beckwithii var. beckwithii* (Beckwith's milkvetch), *Astragalus filipes* (Basalt milkvetch), *Astragalus toanus* (Toano milkvetch), *Astragalus cibarius* (Browse milkvetch), and *Astragalus lentiginosus* (Freckled milkvetch).

The other three species of *Astragalus* are mat forming, and may be confused with *Astragalus anserinus*: *Astragalus newberryi* (Newberry's milkvetch), *Astragalus calycosus* (Torrey's milkvetch), and *Astragalus purshii* (Pursh's milkvetch). Although these species are generally more widespread and typically occur in a wider range of habitats, distinguishing between young seedlings or vegetative states may be difficult in the field.

Distinctions between these species may be most readily made by a comparison of fruits and/or flowers. Both Newberry's and Pursh's milkvetch may be distinguished by larger leaves and leaflets with seedpods concealed by dense, silky, whitish hairs that are leathery at maturity, and by flowers typically much longer than 11 mm; Torrey's milkvetch also has larger leaves, leaflets, and larger white-purple flowers (Mancuso and Moseley 1991).

Species Habitat

The general climate classification for *Astragalus anserinus* habitat is middle latitude steppe with average annual temperatures under 64.4 ºF (Koppen's unit BSk). The general climate for the region is arid to semi-arid with wide temperature variations. Winters may see lows of –16 ºF or less, and summer highs may range over 100 ºF during the day- yet drop as low as 50 ºF the same night (Mancuso and Moseley 1991; Piper 1923).

A majority of the region receives less than 12 inches of annual precipitation. Exceptions are small areas of higher elevation and isolated accumulation points (Piper 1923). Mean precipitation generally peaks during the spring months, while the late fall and winter months are typically the driest. The slopes, knolls, and in some instances dry drainages where *Astragalus anserinus* occurs remain dry for much of the year. Snow does not typically linger on the southern aspects where a majority of the *Astragalus anserinus* populations occur (Mancuso and Moseley 1991).

Astragalus anserinus appears to be edaphically restricted only to Tertiary-aged ashy sand/sandy tuffaceous substrates of the Salt Lake Formation. These soils tend to be dry, and white or gray to light brown colored. Salt Lake Formation outcrops that weather to a hard surface or are composed of large, fractured rock are apparently unsuitable (Mancuso and Moseley 1991). Plants are much less common on northerly aspects. Populations have been documented at elevations ranging between 4900 feet and 5480 feet (Mancuso and Moseley 1991).

Astragalus anserinus is frequently associated with other species that show a preference for sandy sites (Baird and Tuhy 1991). Baird (1991) notes that in Utah, most *Astragalus anserinus* sites were open and lacked large woody shrubs or trees; although plants were found in direct association with sagebrush and/or juniper. Baird (1991) also notes that while *Astragalus anserinus* occurs within the range of and on the same substrate as *Penstemon idahoensis; Astragalus anserinus* appears to prefer lower elevations and more open sites.

Astragalus anserinus can occur within open Utah juniper communities, as well as openings within *Artemisia tridentata* communities, which may be co-dominated by *Chrysothamnus viscidiflorus* (Mancuso and Moseley 1991). *Astragalus anserinus* has not been found to be a community dominant for *any* Idaho site, generally occurring in very low densities (Mancuso and Moseley 1991; Baird and Tuhy 1991; Mancuso and others 2000, field observations, unreferenced; Franklin 2004, Hardy 2004).

Other native plant species that have been found to be associated with *Astragalus anserinus* population locations include the following (Mancuso and others 2000, field observations, unreferenced):

Trees and Shrubs

Juniperus osteosperma
Artemisia tridentata tridentata
Artemisia tridentata wyomingensis
Chrysothamnus nauseosus
Chrysothamnus viscidiflorus
Leptodactylon pungens
Ribes aureum
Tetradymia canescens

Grasses

Agropyron cristatum
Agropyron spicatum
Elymus cinereus
Oryzopsis hymenoides
Poa nevadensis
Stipa comata

Forbs

Alyssum desertorum
Arabis holboellii
Astragalus purshii
Commandra umbellata
Eriogonum microthecum
Eriogonum ovalifolium
Gayophytum diffusum
Gilia aggregata
Lupinus lepidus
Lygodesmia spinosa
Mentzelia albicaulis
Opuntia polyacantha
Pediocactus simpsonii
Senecio multilobatus

Species Biology

Although many details of the life history characteristics of *Astragalus anserinus* are not well described, flowering generally occurs from late May to early June. Fruit develops as pods, with seedpods containing 12-14 ovules (Mancuso and Moseley 1991). It is unknown how many seeds actually reach maturity. Dehiscence of pods occurs *after* falling from the plant. Seed dispersal mechanisms, if any, are unknown; although it has been hypothesized that wind or animal (insect or bird) vectors may play a part (Mancuso and Moseley 1991).

Baird notes that reproduction of *Astragalus anserinus* is by sexual means, and most likely is facilitated by open pollination with insects assumed to be the likely primary pollinators. As noted by Taylor (1992), flowers of the Leguminosae family typify a bee pollination design. No evidence of asexual reproduction has been found; nor has any evidence of hybridization ever been observed (Baird and Tuhy 1991; Mancuso and Moseley 1991).

Available literature has indicated no known predators, pests, parasites, or diseases of *Astragalus anserinus.* Herbivory of *Astragalus anserinus* was documented in late 2000 during field surveys following the wildfires that had occurred within *Astragalus anserinus* habitat earlier in the season (Austin 2000, field observations, unreferenced).. It is highly likely that a number of native and introduced species utilize *Astragalus* as a food resource; see discussion of threats in Part II below for further discussion of herbivory.

Species Distribution

Astragalus anserinus is very narrowly endemic to the Goose Creek watershed, with the only known populations existing in the southeast corner of Cassia County, Idaho; the adjoining northwest corner of Box Elder County, Utah; and from a closely adjoining location in Elko County, Nevada along the Utah border. This taxon is entirely restricted to specific ash outcrops and immediately associated ash soils in juniper-sagebrush openings of the above-described Salt Lake Formation (Mancuso and Moseley 1991; Red Willow Research 2000; Mancuso 2001).

As of 2003, there were still only seven identified population locations in Idaho located primarily on BLM lands (partial populations on private), only eight identified population locations in Utah- partly on BLM and largely on State/private lands, and one area with what is reported as four loosely connected population locations for Nevada. The fact that *Astragalus anserinus* is missing from what appears to be suitable sites may indicate additional controlling factors in its biology or site requirements (Mancuso and Moseley 1991; RWR2000; Austin 2002).

Factors Affecting Species Distribution

The full historic range of *Astragalus anserinus* will likely never be known. Natural plant community succession and natural catastrophic events have altered many Goose Creek watershed area habitats outside of the characteristics apparently required by *Astragalus anserinus*; such impacts have likely occurred throughout recent as well as

historic geologic time. The narrow edaphic restrictions of *Astragalus anserinus* ensure not only its rarity, but intensify its vulnerability to extinction.

Human or anthropogenic impacts such as the conversion of large tracts of land for agricultural crops and pastures in the Goose Creek Basin; the loss of habitat due to construction of irrigation diversions; county highways, utility line construction, public roads, home and ranch construction; stock water developments; and alteration or loss of habitats/populations due to other anthropogenic impacts such as landscape-level crested wheatgrass seedings can be estimated but not realistically measured.

It would be similarly impossible to estimate historic habitat or population impacts and any resultant population losses due to the high levels of livestock grazing and disturbance initiated regionally at the end of the 1800's. Livestock grazing impacts have continued at varying intensities in the Goose Creek watershed up until the present day, and have resulted in what are, for all intents and purposes, permanent changes in the landscape.

Baird and Tuhy (1991) assumed that since the plants that existed in Utah were exposed to livestock grazing and likely had been over time [petition author's note- this represents approximately the last 100-125 years], that livestock grazing must not therefore be significantly impacting persistence of the species. However, Baird and Tuhy (1991) did observe (as did Mancuso and Moseley in 1991) that the species was missing from much of what appeared to be suitable habitat.

Red Willow Research believes it would therefore seem more reasonable to assume that *Astragalus anserinus* populations are occurring within those few remaining sites that have been less desirable for anthropogenic use such as heavy livestock grazing

or agriculture (the ash outcrop sites are not very productive, and thus not as attractive to livestock as surrounding habitat and/or are not useful for crop production). This issue and related threats to persistence are more fully discussed in Part II below.

Numerous surveys of likely habitat for *Astragalus anserinus* in locations immediately joining known populations, as well as regionally within likely habitat represented by the Salt Formation, have been carried out in both Utah and Idaho by agency, contract, and independent researchers. These surveys, largely carried out between 1991 and 2003 have not resulted in any new range extensions or of any widely separated populations or individuals from previously identified locations (Mancuso and Moseley 1991; Baird and Tuhy 1991; RWR 2000; Franklin 2003).

The only localized population expansion at any disjunct distance, discovered by Red Willow Research Inc. personnel to the north of known populations in Cassia County (Idaho), was extirpated by a road project approved by the Burley BLM Field Office before taxonomic confirmation could be obtained (Red Willow Research 2000).

Other factors likely to alter natural distribution of *Astragalus anserinus* or any future recovery efforts include changes in preferred site nutrients; and competition- which includes invasion by exotic annuals or perennials, and which also represents a change in site litter accumulation or site organic matter (OM). Any other introduction of volume nutrients (such as livestock wastes) might also be likely to change site characteristics beyond the tolerance of *Astragalus anserinus*, as well as facilitate competition or invasion by other plant species. These impacts are closely tied to a number of identified or potential threats, and are further discussed in Part II below.

Additional factors known to affect the population distribution of any plant species include herbivory, native pollinator presence/absence, presence or lack of seed dispersal mechanisms such as caching by small mammals or movement by other vectors, associated watershed conditions (e.g. changes in nutrient or hydrologic cycling), ability to artificially propagate a species, genetic variability, and reproductive viability. These issues are more extensively discussed in Part II, as these specific types of impacts or ecosystem relationships are intricately related to known and/or potential threats to the continued persistence of *Astragalus anserinus* and provide substantial evidence for listing need.

Population Ecology

Seven *Astragalus anserinus* populations are known from Idaho. Mancuso and Moseley (1991) note that all are restricted to substrates of the Salt Lake Formation of southernmost Cassia County. First collected in Idaho in 1982, only four Idaho populations had been discovered prior to 1991. In revisiting the known sites in 1991, Mancuso and Moseley were able to locate three additional population sites. Although no population data was collected for one of the new sites (described as supporting some scattered plants), Mancuso and Moseley (1991) noted the following information for the other six known Idaho locations:

> It is estimated that the other six populations supported less than 1000 individuals in 1991.Two populations supported between 300 and 400

plants each, one supported approximately 200 individuals, one less than 50 plants, and at two populations less than ten plants were found.

Numerous surveys from 1991 and beyond, by a variety of researchers, have *not* revealed any new populations despite the fact that thousands of acres of Salt Lake Formation habitats have been searched by various methods (Mancuso and Moseley 1991; Frisbee 2001, personal communications, unreferenced; Mancuso 2001a, 2001b; Pierson 2003, personal communications, unreferenced). Nearly all occurrences visited in 2000 and 2001 have substantially fewer plants than estimates made in the late 1980's and early 1990's. Conservation concerns for Goose Creek milkvetch are focused on the apparent sharp decline in the number of plants over the past decade and possible habitat degradation problems related to recent wildfires and ongoing livestock use impacts.

Mancuso (2001) notes specific changes in individual populations in Idaho, exemplified by the following year/data excerpts:

Occurrence 001:

1988-	no data
1991-	2 plants
2000-	12 plants counted
2001-	1 plant

Occurrence 002

1989-	Ca 1000 plants
1990-	Ca 200 plants
2000-	no data
2001-	14 plants

Occurrence 003

1985- no data
1991- Ca 325 plants
2000- 28 plants
2001- no count made

Occurrence 004

1989- est. 1001-10,000 plants
1991- 30 plants seen
2000- 24 plants
2001- 41 plants

Occurrence 005

1991- unknown number of scattered plants
2000- not counted

Occurrence 006

1991- 300-400 plants
2000- 32 plants
2001- 47 plants

Occurrence 007

1991- 7 plants
2000- 5 plants

While first understanding that monitoring efforts have been sporadic, when viewed statistically, the above information exhibits mean individual population declines between 1985 and 2001 of 74.80%. Overall, between 1985 and 2001, the Idaho population of *Astragalus anserinus* has gone from an estimated 2635 plants to 136 plants.

Statistically, the overall Idaho population decline between 1985 and 2001 has been 94.84%. This result has been obtained utilizing Moseley's lower population estimate of 1001 for Occurrence 004 as the "10,000" he originally reported has never been able to be substantiated as an actual count.

Eight populations are known from Utah. Three populations were found circa 1982; with five additional populations, supposedly comprised of several sub-populations, being located by 1990. Mancuso and Moseley (1991), relying on Baird and Tuhy (1991), reported the following:

> Five of these populations were discovered during field investigation completed under the auspices of the Utah Natural Heritage Program in 1990. Sites supporting Goose Creek milkvetch ranged in size from a few plants to populations of approximately 1500 individuals. Sites were usually small, most estimated to be less than one acre. A total of approximately 7000 individuals were documented during the 1990 survey.

Unfortunately, some discrepancy exists regarding the actual original population numbers in Idaho and Utah, most particularly for Utah. Personal conversations with Tuhy (2000, unreferenced) and Atwood (2000, unreferenced) by Red Willow Research revealed that population estimates were *not* obtained by actual counts, but by projecting numbers for the few plants observed across what appeared to be potential habitat. While frequently employed by researchers in the field to save time and effort, these types of estimates may not provide accurate population data. This is particularly true when only a few actual plants have been located. Knowing now that *Astragalus anserinus* is simply

missing from many expected habitat locations, original population counts (particularly for Utah) may have been much lower than estimated- significantly increasing the rarity and inherent vulnerability of *Astragalus anserinus.*

According to the Salt Lake BLM Field Office (Hardy 2004, personal communications, unreferenced) no additional inventories, monitoring, counts, surveys, or other management specific to *Astragalus anserinus* has been carried out in the vicinity of the known populations since 1991. Rare plant surveys carried out 2002-2003 on Salt Lake Formation habitats in the Grouse Creek region did not reveal any new *Astragalus anserinus* populations (Franklin 2004). As funding was for an area specifically selected by the BLM, and did not include the Goose Creek basin populations, no return visits to the original *Astragalus anserinus* populations were carried out in either 2002 or 2003 (Franklin 2004, personal communications, unreferenced).

In 1991, Mancuso and Moseley noted that four small populations were known from nearby Elko County (close to the Utah border) for which survey work was incomplete. Conversations with Morefield (2004, unreferenced), the original surveying botanist with the Nevada Natural Heritage Program, revealed that no return visits have been made to the *Astragalus anserinus* site since surveys were carried out in 1993.

Morefield (2004, personal communications, unreferenced) indicated that an approximate total of 800 plants were originally observed for the Nevada populations. Communications with the Elko BLM Field Office (2004) indicate that no survey, monitoring, inventory or other efforts have been carried out since Morefield was on site in 1993. Staff in the Elko BLM Field Office indicated no one has observed the population site(s) in the recent past. Land use levels have been heavy to very severe in northeastern

Elko County; just as they have been in adjoining Box Elder County, Utah and Cassia County, Idaho for the past several years; with some of the worst land use levels/conditions recorded within these areas for 2003 (Austin 2003, field observations, unreferenced; Carter 2003, personal communications, unreferenced; Fothergill 2003, personal communications, unreferenced). Hardy (2004, personal communications, unreferenced) also acknowledged that the Utah population areas have been "used very hard."

Fires have swept through population areas in Idaho, and possibly through the Utah and Nevada populations in recent years- followed by cheat grass invasions. Water developments have also been proposed for and/or constructed within known population areas. Sporadic monitoring of populations in Idaho shows relatively precipitous declines over time. If declines have been similar for adjacent *Astragalus anserinus* populations in Utah and Nevada, there may be few if any plants remaining.

If the overall population decline rate for Idaho is applied to the original Utah and Nevada populations, as of 2001 there were potentially only 542 individual plants remaining for Idaho, Utah, and Nevada together. If these 542 theoretical plants (assuming Utah and Nevada actually had any left in 2001; Idaho only had 136 in 2001), and if these plants could be placed in a single geographic location- they would potentially occupy 200 square feet or less if all plants were mature, with the potential of occupying only 5 square feet or less if all remaining plants were only of seedling size. In other words, likely not even a full acre of physically occupied habitat remains at this point. In reality the remaining individuals are widely scattered, posing additional threats to persistence in the form of access to pollinators and loss of genetic variability.

The Petitioners note that if the same rate of decline experienced by Idaho's overall population, 98.84 % (based upon a 10 yr period) is applied to this potential remnant population, calculations reveal that there would be approximately 28 plants extant in 2011, and there would be only 1-2 plants extant in 2021. Statistically, and for all intents and purposes, if conditions and land uses were to remain similar to those experienced during the past decade**,** *Astragalus anserinus* is likely to become extinct- forever lost from the Goose Creek watershed- in 16 years or less.

Part II

Requirements of the ESA

The ESA has defined "endangered species" as "any species which is in danger of extinction throughout all or a significant portion of its range" [16 U.S.C § 1532 (6)]. "Threatened species" are those which are "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" [Id. at § 1532 (20)]. Under Section 4 of the ESA, the "Secretary shall by regulation promulgated in accordance with subsection (b)…determine whether any species is an endangered species or a threatened species because of any of the following:

> (A) the present or threatened destruction, modification, or curtailment of its habitat or range;

(B) overutilization for commercial, recreational, scientific, or educational purposes;

(C) disease or predation

(D) the inadequacy of existing regulatory mechanisms; or

(E) other natural or manmade factors affecting its continued existence."

[16 U.S.C. § 1533(a)(1)]

Section 4 further requires that the Secretary make such determinations "solely on the basis of the best scientific and commercial data available to him after conducting a review of the species" [16 U.S.C. § 1533(b)(1)(A)]. Section 4 of the ESA also requires the Secretary to designate critical habitat for any species concurrently with listing that species [16 U.S.C. § 1533(a)(3)(A)].

The ESA provides authority for the Secretary to issue temporary listing rules in the event of "any emergency posing a significant risk to the well being of any species of fish or wildlife or plants" [16 U.S.C. § 1533 (b)(7)]. Indeed, the Secretary is commanded to make "prompt use" of this authority to "prevent a significant risk to the well being of any species" [16 U.S.C. § 1533(b)(3)(C)(iii)].

A) Astragalus anserinus: summary of present or threatened destruction, modification, or curtailment of its habitat or range

There are only 16-19 known extant population occurrences of *Astragalus anserinus* in Idaho, Nevada, and Utah. There are 7 known occurrence sites in Idaho, 8 known occurrence sites in Utah, while Nevada occurrences consist of 4 loosely connected known populations- sometimes referred to or shown on maps as a single location.

Many thousands of acres of public and private land within the existing range of *Astragalus anserinus* have already been substantially altered, converted, or lost entirely due to agriculture, range seedings, road construction, livestock water developments, trash dumping, livestock grazing, mining, and other human activities (Mancuso and Moseley 1991; Baird and Tuhy 1991; Red Willow Research 2000).

Under the ESA listing criteria, two major forms of human impacts that pose destruction, modification, or that pose curtailment of habitat for extant populations include 1) livestock grazing and water developments, and 2) proposed changes for public lands management of Cassia County, Idaho. Existing and potential impacts also include 3) road construction and maintenance, 4) firefighting tactics, 5) ORV use, and 6) mining.

1) Livestock grazing and water developments

Livestock grazing and associated range improvements now represent the major landscape-level threat for public lands within the Goose Creek watershed still supporting the remaining small populations of *Astragalus anserinus.* It is important to recognize that existing use levels and existing range developments have seriously impacted not only general habitat values within the vicinity and range of extant *Astragalus anserinus* populations, but have been and will continue to substantially impact occurrence sites if

listing actions do not take place immediately. Livestock grazing and its impacts on native plant community and other ecosystem values are now widely recognized and discussed by the public as well as by the scientific community. Numerous literature is available detailing livestock impacts in arid western lands including but not limited to Jones (1981).

As *Astragalus anserinus* is very narrowly and edaphically restricted to specific substrates within the Salt Lake Formation, this plant is inherently at risk of extinction from land-disturbing activities. There were potentially (statistically calculated based on the Idaho declines, as no recent counts exist for UT or NV) 542 or fewer individual plants remaining within the known habitats represented by Idaho, Nevada, and Utah as of 2001.

An emergency need for listing exists for *Astragalus anserinus* in direct relation to habitat disturbing activities. Extensive and ground-disturbing livestock-related construction projects are planned to occur in known population occurrences in both Utah and Idaho. If an emergency rule is not issued immediately, pipeline construction for the installation of multiple water developments will occur within habitat supporting extant populations in Utah in the spring of 2004 (Hardy 2004).

Additional pipeline and water development construction is also planned to occur within Idaho habitat supporting extant populations in spite of ongoing public protests- and on top of road and pipeline construction or related impacts that were allowed to take place within extant population occurrences in Idaho in 2001 and 2002.

Furthermore, not only will pipeline and water development construction take place within occupied *Astragalus anserinus* habitat- resulting in ground disturbance, it will likely result in the take of individual plants, will destroy seed bank values, will result

in permanent alteration of habitat features, and will severely increase the potential for further noxious and exotic weed introductions.

A major danger to this imperiled taxon that land management agencies are refusing to address, is that the placement of *water* within the occupied occurrences (or even within the immediate vicinity)- will result in deliberately enticing livestock to repeatedly trail through extant populations; to trample, graze, or otherwise loaf in extant populations; may result in incidental and/or deliberate herbivory of the rare plants; will change site characteristics through the introduction of volume nutrients (animal wastes), and will facilitate the spread of exotic species into the already threatened environment occupied by the "critically imperiled" *Astragalus anserinus.*

As has been noted by Mancuso (2004) and numerous other concerned individuals, the introduction of increased livestock presence and utilization effects (inherent trailing trampling, disturbance, compaction, and even the potential for herbivory) represents the most serious immediate (as well as insidious over time) dangers to the continued persistence of *Astragalus anserinus.*

Another impact inherent to livestock grazing in *Astragalus anserinus* is actual consumption of the ash soils by livestock. Literally wheelbarrow loads of soils from within and adjacent to *Astragalus anserinus* populations are regularly consumed and removed by livestock in attempts to alleviate mineral and salt shortages resulting from consumption of low quality rangeland forage (Red Willow Research 2000; Austin 2000a; Austin 2002). This phenomenon has been observed throughout the Goose Creek basin, and provides an additional source of concern for trampling, terracing, and otherwise disturbing the already narrowly restricted habitats of Astragalus anserinus. Water

development construction and attraction of livestock into these sites will only exacerbate this particular form of livestock disturbance within occupied *Astragalus anserinus* habitats.

Although Utah and Nevada have never carried out any monitoring studies or other inventory efforts post-discovery for *Astragalus anserinus*, land uses and impact levels have been similar in severity to those observed for Idaho (Hardy 2004, Carter 2004, Austin 2000-2002, Austin 2003, Prunty 2003, Fothergill 2003) throughout the past decade. As was included above in Part I, Mancuso (2001) notes in relation to Idaho *Astragalus anserinus* populations:

> Nearly all occurrences visited in 2000 and 2001 have substantially fewer plants than estimates made in the late 1980's and early 1990's… Conservation concerns for Goose Creek milkvetch are focused on the apparent sharp decline in the number of plants over the past decade and possible habitat degradation problems related to recent wildfires and ongoing livestock use impacts.

2) Proposed management scheme would affect *Astragalus anserinus* habitats

The Twin Falls/Cassia Resource Enhancement Trust has submitted management proposals to the Idaho Federal Lands Task Force Working Group that would include significant alteration of Cassia County and adjoining regional habitats, <u>including for habitats currently supporting the *Astragalus anserinus* population occurrences</u>. In fact, major proponents of this land management proposal include the public lands permittees

currently grazing within the extant Idaho populations and/or with close ties to those individual(s) grazing within Utah's extant populations- as well as within adjacent northeastern Nevada habitats.

The Idaho Federal Lands Task Force proposes in general that public lands management (USFS and BLM) be turned over to state and/or private groups. The Twin Falls/Cassia Resource Enhancement Trust proposes that management of federal public lands in Cassia, portions of Oneida and Power, and Twin Falls Counties be turned over to a private trust.

While these proposals are onerous to many members of the public and are being viewed by many as an attempt by consumptive public lands users to escape environmental responsibilities, Petitioners are particularly alarmed by the Twin Falls/Cassia Resource Enhancement Trust management proposal for habitats such as those currently supporting *Astragalus anserinus.*

Twin Falls/Cassia Resource Enhancement Trust states within documents presented to the Idaho Federal Lands Task Force (web download is undated- apparently created in 2000) that one of its management goals is to "control noxious weed invasion and all other undesirable plants, such as juniper, rabbit brush, medusahead, and cheatgrass…"

Ignorance of regional as well as local habitat values is apparent in the above statement, as well as throughout this supposed management document. Also alarming are statements in the document hinting at re-instituting season-long grazing on federal public lands. *Astragalus anserinus* is found in close association with juniper, as well as in sagebrush sites that may be dominated or co-dominated by rabbit brush. Season long

grazing would intensify the already severe watershed and landscape-level impacts to an impossibly devastating level. Such use would eventually preclude even livestock grazing. The institution of such management schemes, based on announced or intended actions, would result for all intents and purposes in the short-term if not *immediate* extinction of the remaining *Astragalus anserinus* populations in Idaho.

Due to continued lobbying pressure for the Public Lands Task Force concept by many in the political arena, as well as by many consumptive public lands users (including by individuals currently utilizing habitats with extant *Astragalus anserinus* populations for livestock grazing), such schemes represent a substantial potential threat to the continued persistence of *Astragalus anserinus* and must be taken into consideration.

Based upon ESA listing criteria such as the presence of ongoing threats- e.g. impacts will immediately resume in the spring of 2004 or as soon as snow is off private and public land areas; the immediacy and likelihood of disturbances or loss- e.g. projects are already planned for implementation as early as construction can begin in the spring of 2004 in Utah; based upon existing potential threats- e.g. planned developments or proposed management schemes (such as the Idaho pipeline and developments or the management proposed by the Twin Falls/Cassia Resource Enhancement Trust**),** and based upon other existing or potential threats to its habitat, Petitioners believe that *Astragalus anserinus* qualifies as an appropriate species for listing, designation of critical habitat, and for immediate emergency listing under these specific listing criteria.

(B) Over utilization of *Astragalus anserinus* for commercial, recreational, scientific, or educational purposes

At this time, Petitioners are not aware of any specific collection actions occurring with or planned for this species. However, due to the fact that there is calculated to have been only about 542 plants in existence for Idaho, Nevada, and Utah as of 2001 any collection for any purpose could pose an additional and substantial risk to this imperiled species.

Most plants have been found during recent surveys in Idaho to be in a vegetative state. Seeds have been professionally collected and seed banked in the past (Cheney 2000). However, Brigham Young University attempts to germinate *Astragalus anserinus* in the lab were *not* successful according to Cheney (2000). Assuming any new seeds produced are still reproductively viable, any collection of seeds could imperil current as well as any future persistence of *Astragalus anserinus* in the field. Collection has been maintained as a potential threat in a number of sources for these reasons (Mancuso and Moseley 1991, Red Willow Research 2000, Austin 2002).

Vulnerability of this species, due to low numbers of individuals and apparent lack of germination/persistence, could be critically impacted by even minimal collection efforts. Upon this basis, Petitioners again believe that *Astragalus anserinus* qualifies as an appropriate species for listing, designation of critical habitat, and for immediate emergency listing under this specific listing criterion

(C) *Astragalus anserinus:* disease or predation

Existing reports for *Astragalus anserinus* have noted that there are no *known* disease or predators of this taxon (Mancuso and Moseley 1991). However, disease has

also been listed as a *potential* threat in various reports (Mancuso and Moseley 1991; Baird and Tuhy 1991; Red Willow Research 2000).

Baird and Tuhy (1991) note:

> It is possible that natural predation and disease have greater impacts on *Astragalus anserinus* than those caused by livestock. In addition, the restricted distribution, both geographically and edaphically, is of concern for the existence of this species.

Leguminous plants such as *Astragalus anserinus* may provide protein-rich foliage or seeds for a variety of animal life. Predation, or herbivory, is an important factor and *must* be considered as a real threat to the persistence of *Astragalus anserinus*- particularly in light of the fact that very few individuals are now extant. Herbivory of *seeds* may be contributing to an observed and apparent widespread lack of reproductive success in Idaho. Herbivory may also be the answer as to why a great many observed *seedlings* appear to be unable to persist. For example, even with repeat visits to known plants in consecutive years, numerous small individual plants are reported as entirely missing the second year, or as not persisting (Mancuso 2001).

Red Willow Research has documented natural herbivory of *Astragalus anserinus* in Idaho (Austin 2000a). Regional fires have left much of the habitat encompassing *Astragalus anserinus* without adjacent, previously existing native plant resources. This correspondingly intensifies the likelihood of herbivory by wildlife through time, including by invertebrates.

Livestock herbivory of *Astragalus anserinus* is potential, and could certainly become a major threat if planned water developments and pipeline construction within existing *Astragalus anserinus* populations are carried out in 2004. Milkvetch are not noted in literature as being poisonous to livestock (USFS 1937); livestock are also known to consume many small compact or matted plants such as prickly phlox as well as a wide variety of other plants (including toxic plants) when stressed by hunger or other nutritional needs. In many cases these are plants that would not normally even be considered as palatable forage or calculated as part of the available forage base.

Another source of herbivory that is of major concern for the persistence of *Astragalus anserinus* is herbivory by *introduced* wildlife species. California quail and Gray (Hungarian) Partridge, and Wild Turkey already exist within occupied *Astragalus anserinus* habitats. Quail, partridge, and turkeys are known to consume large quantities of seeds- including those of wild legumes (Martin, Zim, and Nelson 1951).

"Natural" and planned increases of these species (IDFG is considering plans to release additional wild turkeys in the Goose Creek basin) within *Astragalus anserinus* habitats may exert a profound influence through herbivory, and may be in part responsible for an observed lack of reproductive success.

Petitioners recognize that herbivory, along with the potential for other forms of predation or disease, poses a significant threat to the persistence of Astragalus anserinus. This may be critical now, as very few individual plants remain in existence. Petitioners believe that *Astragalus anserinus* qualifies as an appropriate species for listing, designation of critical habitat, and for immediate emergency listing under this specific listing criterion.

D) *Astragalus anserinus:* inadequacy of existing regulatory mechanisms

Astragalus anserinus, formerly a Category 2 candidate for federal listing as threatened or endangered, has apparently received absolutely no management or monitoring attention in either Nevada since initial discovery of the known occurrences, and since 1991 in Utah (Hardy 2004; Morefield 2004; Franklin 2004).

Sporadic monitoring and related survey efforts have been carried out in Idaho by the Conservation Data Center (Mancuso and Moseley 1991; Mancuso 2001, 2001). Some additional reporting and recommendations were provided to the Bureau of Land Management, U.S. Forest Service, and State of Idaho by Red Willow Research (2000). However, none of the survey-based recommendations, and none of the otherwise agency-solicited or generated management recommendations and draft management/conservation strategies have *ever* been implemented for this critically imperiled taxon.

Although Idaho BLM and USFS Region 4 have maintained *Astragalus anserinus* as a sensitive species, land management has continued on a "business as usual" manner for the more than 2 decades since this plant was discovered. In fact, federal *and* state agency management (or the lack thereof) is specifically what has pushed *Astragalus anserinus* to the brink of extinction. The following subsections specifically detail BLM failures to adhere to their respective agency guidelines in relation to *Astragalus anserinus:*

1) BLM management responsibilities, failures

The Bureau of Land Management stated at the national level in 2000 that:

> The Bureau of Land Management is responsible for the balanced management of the public lands and resources and their various values so that they are considered in a combination that will best serve the needs of the American people. Management is based upon the principles of multiple use and sustained yield; a combination of uses that take into account the long-term needs of future generations for renewable and non-renewable resources. These resources include recreation, range, timber, minerals, watershed, fish and wildlife, wilderness and natural, scenic, scientific, and cultural values.

National Fundamentals of Rangeland Health (1995) indicates that the BLM must ensure that:

> Habitats are, or are making significant progress toward being, restored or maintained for Federal threatened and endangered species, Federal Proposed, Category 1 and 2 Federal candidate and other special status species.

It is very obvious to the Petitioners that in the case of *Astragalus anserinus*, the BLM has utterly failed to adhere to its own National standards.

Each state has its own set of State BLM Standards and Guidelines, the policies under which livestock grazing is supposedly being managed to avoid permanent

impairment to America's natural resources. The following paragraphs present and discuss rangeland standards covering management of native plants, including TES/sensitive species, for BLM lands in Idaho, Nevada, and Utah.

Idaho Standards:

Standard 4 (Native Plant Communities)

Healthy, productive and diverse native animal habitat and populations of native plants are maintained or promoted as appropriate to soil type, climate, and landform to provide for proper nutrient cycling, hydrologic cycling, and energy flow.

Indicators may include, but are not limited to, the following:

1. Native plant communities (flora and microbiotic crusts) are maintained or improved to ensure the proper functioning of ecological processes and continued productivity and diversity of native plant species.

2. The diversity of native species is maintained.

3. Plant vigor (total production, seed and seedstalk production, cover, etc.) is adequate to enable reproduction and recruitment of native plants when favorable climatic events occur.

4. Noxious seeds are not increasing.

5. Adequate litter and standing dead plant material are present for site protection and for decomposition to replenish soil nutrients relative to site potential.

Standard 8 (Threatened and Endangered Plants and Animals)

Habitats are suitable to maintain viable populations of threatened and endangered, sensitive, and other special status species.

Based upon existing survey information and based upon ongoing habitat impacts, *Astragalus anserinus* is at the brink of extinction. BLM management in Idaho has failed this imperiled taxon and has brought it to the brink of extinction. Idaho BLM intentions, with the approval of the NRCS and the USFS, include bulldozing pipelines through and/or placing livestock watering troughs in or near extant populations of *Astragalus anserinus.* Such actions will deliberately further imperil this rare taxon.

Landscape-wide failures of the BLM to enforce even minimal compliance with Idaho Standards and Guides, in addition to nearly 2 decades of poor management within

Astragalus anserinus habitat provide the compelling testimony needed for ESA listing of this imperiled taxon (Austin 2000-2002, 2003; Prunty 2003, Fothergill 2003).

Some BLM allotment areas in Idaho supporting *Astragalus anserinus* (west of Goose Creek) have been under USFS, governed by an MOU with the Burley BLM Field Office- with the stipulation that BLM management standards would still apply on BLM lands. Obviously, based on current *Astragalus anserinus* habitat conditions and on conditions for the region in general- the USFS Sawtooth National Forest, Minidoka Ranger District (formerly the Burley Ranger District) has utterly failed to adhere to either its own management requirements under NFMA and the Sawtooth Forest Plan, not to mention utterly failing to uphold Idaho BLM Standards and Guides on behalf of the BLM.

Petitioners believe that there is absolutely no existing regulatory mechanism operating for BLM public lands in Idaho that would assist this plant short of an emergency listing action, listing, and designation of critical habitat. There is no State mechanism for protection of rare plants in Idaho on state or private lands.

Nevada Standards

Standard 3 (Habitat)

Habitats exhibit a healthy, productive and diverse population of native and/or desirable plant species, appropriate to the site characteristics, to provide suitable feed, water, cover, and living space for animal species and maintain ecological

processes. Habitat conditions meet the life cycle requirements of threatened and endangered species.

Guidelines

3.1 Management practices will promote the conservation , restoration and maintenance of habitat for threatened and endangered species, and other special status species as may be appropriate.

Petitioners believe that the regulatory mechanisms of the BLM in Nevada are completely inadequate for the protection or perpetuation of *Astragalus anserinus.* Nothing short of an emergency listing, and listing and designation of critical habitat will assist this imperiled plant. Current habitat conditions in Northeastern Nevada are mute testimony to this fact, along with the fact that the BLM has exerted zero monitoring or inventory efforts on behalf of *Astragalus anserinus* in the decade since its discovery (Carter 2004, Morefield 2004, BLM 2004).

Utah Standards

Standard 3

Desired species, including native, threatened, endangered and special-status species, are maintained at a level appropriate for the site and species involved.

Guideline C

e) Provide or improve, within the limits of site potentials, habitats for Threatened or Endangered Species

f) Avoid grazing management conflicts with other species that have the potential of becoming protected or special status species.

The Utah State BLM Office even issued the following statement through its public web site in 2001:

> It is time for change, and BLM is changing to meet the challenge. BLM is now giving management priority to maintaining *functioning ecosystems.* This simply means that the needs of the land and its living and nonliving components (soil, air water, flora, and fauna) are to be considered first. Only when ecosystems are functioning properly can the consumptive, economic, political, and spiritual needs of man be attained in a sustainable way…

It is obvious to the Petitioners that the BLM has failed dismally to achieve its management objectives in relation to *Astragalus anserinus.* Two decades of poor management and failure to upgrade management with the institution of State and National Standards are readily evident in the sadly degraded habitats of northwestern Utah (Carter 2004, Austin 2000-2002, 2003).

Apparently, no one has ever returned to the population site for purposes of inventory/monitoring since 1991 (Hardy 2004, Franklin 2004). The Salt Lake Field Office states it intends to approve and construct water developments without carrying out any site-specific clearances. In fact, the project is slated to occur in extant populations of *Astragalus anserinus* without anyone ever even having looked for the plants at the project site. BLM claims that the plants only exist on hills are completely inadequate- they have never even looked for the plants. In Idaho, *Astragalus anserinus* are often found as young plants along dry drainages associated with soils from the Salt Lake Formation (Mancuso and Moseley 1991; Mancuso, Davis, and Austin 2000).

Indeed, the Utah BLM, just as the Idaho BLM, also appears bent on a destructive path in relation to this critically imperiled taxon. Utah BLM is now planning to bulldoze a pipeline and set up numerous troughs in and/or near the Utah populations of *Astragalus anserinus* in the early spring of 2004. Nothing short of an immediate emergency listing is going to help improve management of this imperiled species. Nor is there any state mechanism in Utah to protect rare plants on state or private lands; portions of the known populations exist on these lands.

There is very obviously no regulatory mechanism in place in Idaho, Nevada, or Utah suitable for achieving *any* substantial measure of protection for *Astragalus anserinus.* Two decades of failures by federal land managers in all three states to even attempt to address the needs of this plant have placed this critically imperiled taxon at the brink of extinction.

The interested public has brought the peril of *Astragalus anserinus* to the local attention of the BLM and USFS in Idaho and Utah in relation to ground-disturbing

projects and in relation to obvious management failures for many years. Red Willow Research and Western Watersheds Project personnel have written numerous letters of protest and held audiences with BLM and USFS administrators in Idaho and Utah regarding this taxon numerous times- all to no avail. Red Willow Research Inc. was even hired by the USFS to report on the status of *Astragalus anserinus* and to provide management and conservation strategy recommendations.

No management or conservation recommendations made by the Conservation Data Center or Red Willow Research have ever been carried out on behalf of *Astragalus anserinus* (Mancuso and Moseley 1991; Red Willow Research 2000; Mancuso 2001). This petition represents the final step within a series of public actions taken by Red Willow Research and Western Watersheds Project for 5 years and more during which absolutely no management changes have been able to be obtained on behalf of *Astragalus anserinus.* In quite an opposite reaction- land uses have intensified and projects proposed that will likely result in extinction if immediate protection is not afforded this species.

Petitioners believe that *Astragalus anserinus* qualifies as an appropriate species for listing, designation of critical habitat, and for immediate emergency listing under this specific listing criterion (inadequate regulatory mechanisms), and that without such listing actions the final demise of *Astragalus anserinus* will be inevitable.

E) *Astragalus anserinus:* other natural or manmade factors affecting its continued existence."

Biological factors affecting the continued existence of *Astragalus anserinus* include:

1) Natural constraints inherent to the edaphically restricted habitat

An important consideration as to whether or not a species has the potential to expand (or to be recovered should it suffer an all-inclusive catastrophic event) is that of artificial seed banking and the potential for germinating and transplanting the species back into suitable habitat. Towards this end, seed collection of both *Astragalus anserinus* and *Penstemon idahoensis* (another rare endemic occasionally sympatric with *Astragalus anserinus*) was carried out by Brigham Young University graduate student Brian Cheney (2000).

While seed collection, laboratory germination, and eventual successful transplant of *Penstemon idahoensis* into what appeared to be suitable Goose Creek watershed habitats achieved some success, Cheney (2000) reported that he was unable to successfully germinate seeds collected from *Astragalus anserinus.* Although Cheney (2000) has also reported that seeds were collected and will remain in long-term herbarium storage, this method *did not* appear to represent a viable option for future species enhancement or recovery.

Based upon the failure of Cheney to obtain successful transplant results for all of his random *Penstemon idahoensis* sites (*Penstemon idahoensis* is occasionally sympatric with *Astragalus anserinus*), Red Willow Research Inc. undertook soil testing in 2001 and 2002 of known *Astragalus anserinus* and *Penstemon idahoensis* sites, as well as of transplant sites and likely-appearing local and regional habitats from within the Salt Lake Formation. These efforts were carried out in order to determine if specific soil attributes appeared to be limiting or crucial to the germination and establishment of *Astragalus*

anserinus seedlings. Soil test results indicated that *all* occupied sites were extremely low in nutrients, but did not generate a specific or readily observable cause to answer presence/absence based on soil characteristics. Consultation with the testing professional laboratory (Austin 2002) provided the following crucial considerations for future or continued viability of *Astragalus anserinus:*

- over time, eroding ash soils leach; leaving soils in "worse" condition. This may preclude successful reproduction from remaining plants. An older plant, while continuing to tolerate existing conditions, may never be able to successfully reproduce. In the case of successful PEID transplants, the seedlings may have passed critical life stages, allowing them to grow successfully once returned to native sites.

- based on nutrients in the ash soils revealed by testing, the historic establishment of *Astragalus anserinus* and the fact that the species has exhibited any persistence over time represents an amazing natural achievement

- based upon the current poor nutritional values of the occupied sites (as well as for most if not all unoccupied sites) it is unlikely that populations will ever expand within known habitats; or to colonize, or re-colonize, unoccupied habitat.

- the existing rare plants are likely to remain slow growing, never attain substantial size, and are likely to reproduce very slowly, if at all

- plants such as *Astragalus anserinus* appear to be able to exist based on low to no competition and extremely low nutrient requirements. Any encroachment or establishment of other plants would likely eliminate the rare plants if changes in site conditions result

- soil amendments might change the viability of a transplant or native location; but based upon the very low levels of most if not all nutrients for potential as well as known sites, which nutrient or to what level would substantially change germination or production for *Astragalus anserinus* would likely remain impractical outside of a controlled laboratory or similar setting.

Based upon the 2001 and 2002 soil testing results, the narrowly restricted and extant populations of *Astragalus anserinus* are likely to be even more locally restricted than was previously thought. Based upon soil testing of adjacent and regional soils, and based upon the opinion of an experienced local soil testing and agronomic professional scientific lab, it appears that it would be unlikely to expect this imperiled taxon to re-colonize vacant habitats, significantly expand its current occurrence boundaries , or otherwise achieve significantly higher population numbers.

Occupied but eroding sites, while still supporting some plants, may continue to develop those characteristics over time that will eventually preclude successful reproduction as noted by the soil lab above. Some of the above soil considerations may also explain why Mancuso (2001) reports that while young seedlings have been observed at some population locations- they do not seem to be able to persist.

While it is widely assumed that drought is responsible for observed lack of production or reproduction in a rangeland setting such as the Goose Creek watershed, as *Astragalus anserinus* have evolved within extremely nutrient limited sites to begin with, desert-like or relatively dry conditions typical of Great Basin desert cycles may actually provide the more *ideal* or natural conditions over time. This could also explain the slight increase in extant individuals between 2001 and 2002- as 2002 was even drier than 2001.

Wet years or high precipitation levels may actually precipitate additional leaching of soil nutrients- and may actually hasten loss of reproductive viability over time from the most highly erodible locations. For other sites- additions of nutrients through livestock wastes and organic material contributed by exotic weeds may push the characteristics too far as well, eliminating the rare *Astragalus anserinus* through competition or through an overabundance of nutrients developing in relation to the presence of encroaching species.

Each of the above factors make protection of the existing or extant populations and their occupied habitats even more critical. If the species would be unlikely to expand over time- extinction will be the likely end result from any additional substantial losses of individual plants and/or from the loss or damage of any occupied *Astragalus anserinus* habitat. The fact that plants appear to be emerging and then shortly disappearing, with new plants still appearing in other nearby locations may also indicate: 1) that the remaining natural seed bank is being depleted on an annual basis; and 2) that remaining plants/emerging plants are no longer viably reproductive (due to lack of pollinators and/or distances between individuals; lack of genetic variability, etc.)

2) Loss or lack of native plant pollinators harms *Astragalus anserinus*

The potential loss or lack of native plant pollinators has been noted as a threat to the persistence of *Astragalus anserinus* (Mancuso and Moseley 1991, Red Willow Research 2000.) Many native plant pollinators, potentially including bees that would be the most likely pollinators for *Astragalus anserinus* (Taylor 1992; Pierson 2002) are adversely impacted by habitat degradation. As noted by the Xerces Society (2003), when pollinators are lacking plants may produce only a fraction of their potential seed crops. Many native pollinators are out-competed by non-native species that may make use of the plant but not actually pollinate it. In relation to such problems, Xerces Society states:

> This alarming pattern is being repeated around the globe. As the insects that many native plants require for adequate pollination disappear, the effect on the health and viability of these native plant populations can be disastrous…Pollinators are keystone species, that is, species upon which the persistence of a large number of other species depends: they are essential to the reproductive cycles of most flowering plants, and thus to the ecosystem itself…

Major threats to pollinators, and in turn to the plants they pollinate, include loss or fragmentation of habitat, habitat degradation, and pesticide poisoning (Xerces Society 1993). Many native plant pollinators, such as ground-nesting bees are subject to trampling by livestock or damage from ORV use (Xerces Society 1993). Habitat

degradation often results from land management practices and from invasion by non-native species. Both limit the presence or reproductive success of a native pollinator, which in turn limits the success of any native plants dependent on a pollinator (Xerces Society 1993.)

As some native pollinators may only pollinate a single species of plant, any disruption of the intricate relationship between native plants and native plant pollinators may have disastrous results. There is a marked absence in the Goose Creek watershed of many plants and invertebrate species and/or in the numbers of individual species expected for the natural climate and landform. A lack of area pollinators as a result of degraded watershed conditions may well be impacting *Astragalus anserinus* (Mancuso and Moseley 1991; Mancuso 2001; Red Willow Research 2000; Austin 2003).

Mancuso and Moseley (1991) note:

> Several populations of Goose Creek milkvetch occur in areas subject to very heavy cattle grazing. Sugden (1985) studied the effects of intensive sheep grazing on the pollinators (bees) of a rare milkvetch in California that is also restricted to sandy, sparsely vegetated sites. Sugden found that sheep grazing practices endanger pollinators by destroying potential nest sites, destroying existing nests, trampling of adult bees, and the removal of food resources…Sugden concludes that the long-term effects of these impacts… need further investigation ,but that if pollination becomes limited seed set may decline.

A loss or lack of native plant pollinators may have left the imperiled *Astragalus anserinus* without adequate reproductive assistance. Indeed- as one

entomologist/biologist has suggested, hand pollination of remaining plants might possibly be utilized as a recovery option; at least until changes in land management achieved through an emergency listing and ESA listing could assist in recovering minimal native pollinator populations.

3) Failures to germinate may preclude transplanting, restoration efforts

An important consideration as to whether or not a species has the potential to expand (or to be recovered should it suffer an all-inclusive catastrophic event) is that of artificial seed banking and the potential for germinating and transplanting the species back into suitable habitat. Towards this end, seed collection of both *Astragalus anserinus* and *Penstemon idahoensis* (another rare endemic occasionally sympatric with ASAN) was carried out by Brigham Young University graduate student Brian Cheney (2000). While seed collection, laboratory germination, and eventual successful transplant of *Penstemon idahoensis* into what appeared to be suitable Goose Creek watershed habitat achieved some success, Cheney (2000) reported that he was unable to successfully germinate seeds collected from *Astragalus anserinus.*

Although Cheney (2000) has also reported that seeds were collected and will remain in long-term herbarium storage, this method *did not* appear to represent a viable option for future species enhancement or recovery. More recent research and germination research for other *Astragalus* may hold promise for artificial propagation of *Astragalus anserinus* (Painter 2004). Such efforts are not likely to become a priority for *Astragalus anserinus* without an ESA listing.

4) Loss of genetic variability is a distinct possibility for *Astragalus anserinus*

There are so few plants left, and the remaining individuals are so widely scattered, that loss of genetic variability is likely already well underway. The only hope at this point would be that individuals emerging from the seed bank, if any, are viable and would assist in avoiding a complete "genetic bottleneck" for this declining species. If individuals could be germinated in an artificial setting and returned to different occupied sites some alleviation might be achieved; however, without an ESA listing it is doubtful that any priority will be given to saving *Astragalus anserinus* from final extinction.

5) Fires of any origin, and firefighting tactics can impact *Astragalus anserinus*

Mancuso and Moseley (1991) indicated that fire was an unlikely impact as the open ash sites rarely burned. However, Mancuso (2001) later indicates that fires have had an apparent impact on Idaho populations of *Astragalus anserinus.* Fires can result in additional herbivory of native plants, and in accelerated weed invasions- particularly for species such as cheat grass. Mancuso (2001) states:

> Nearly all occurrences visited in 2000 and 2001 have substantially fewer plants than estimates made in the late 1980's and early 1990's… Conservation concerns for Goose Creek milkvetch are focused on the apparent sharp decline in the number of plants over the past decade and possible habitat degradation problems related to recent wildfires and ongoing livestock use impacts.

While wildfire and arson fires (both have been common in the Goose Creek basin across the past decade) may be beyond management control, prescribed fires are generally within management control. However, BLM prescribed fires have been allowed to escape and burn rare plant habitats in the Goose Creek watershed. ESA listing would afford *Astragalus anserinus* with some measure of protection- at least from prescribed fire or from sloppy fire-fighting tactics. For example, wildfires in 2000 resulted in indiscriminate blading of fire lines and roads through occupied *Astragalus anserinus* habitats (Red Willow Research 2000).

Apparently the open ash habitats were considered to be useful for firebreaks and substantial damage was done to area rare plant habitats in 2000 - even though individual fire lines were largely ineffective in respect to the advance of the large fires. Lines and suppression efforts could have been effected in less damaging, more defensible locations. During other area wildfires, engines have driven through rare plant habitats without regard to (and likely without any knowledge of) the rare plant species present (Austin 2000).

ESA listing would afford new administrative protection to *Astragalus anserinus;* hopefully giving it some priority in area habitat management- including consideration during prescribed fires or fire suppression efforts and for other fire related management activities such as fire retardant use in native habitats.

6). Exotic and noxious weed invasions are already impacting *Astragalus anserinus*

Exotic and noxious weed populations are now impacting and/or threatening *Astragalus anserinus* populations. Mancuso and Moseley (1991) indicated that while

leafy spurge was seen in the region, it was not found within any of the *Astragalus anserinus* sites. As Mancuso notes for 2001, leafy spurge is now found within four of the *Astragalus anserinus* occurrences, and near two of the occurrences. Leafy spurge is extremely difficult to control. In addition- chemical control efforts pose additional risks to *Astragalus anserinus* (Red Willow Research 2000).

Halogeton is now present within one occurrence. Halogeton has been extremely successful in maintaining populations in ashy soils of the Salt Lake Formation throughout southern Idaho- in many instances forming complete monocultures in livestock-disturbed areas (Austin 2003).

Mancuso (2001) notes that cheat grass was present in four Idaho occurrences in 2001, while it had been absent from those same occurrences the year before. It had also increased in abundance at another occurrence. Salsify is also now present within one occurrence (Mancuso 2001) and is capable of increasing to levels of conservation concern for *Astragalus anserinus.* As was discussed previously, exotic species have a potential to alter site conditions outside of the characteristics required by *Astragalus anserinus*; posing both short- and long-term risks to persistence.

Another concern in relation to request for an emergency listing is the Idaho BLM/USFS pipeline and water development projects proposed to occur within *Astragalus anserinus* habitat. Leafy spurge is present throughout the Goose Creek drainage, particularly on private lands upstream of the potential diversion point near the Coal Banks crossing. Pumping leafy spurge-laden waters onto BLM and USFS lands will only exacerbate the existing weed problems. Failures of permittees to maintain past water developments make it unlikely that proposals to screen out weed seeds and other actions

requiring constant supervision and maintenance would actually be carried out- failures that would further imperil *Astragalus anserinus* and its restricted habitat.

7) Poor watershed conditions are likely affecting *Astragalus anserinus*

Poor land management practices over time have severely degraded natural watershed and ecosystem values of the uplands and other habitats generally associated with *Astragalus anserinus* occurrences. There is an unfortunate tendency for researchers as well as land managers to assume that if a few plants are still extant- all is well. However, natural populations and ecosystems do not function as isolated units.

The overall health of the watershed will affect the health of its individual components and vice versa. Changes in nutrient or hydrological cycling, loss or damage of soil crusts, loss of pollinators, trampling and compaction, erosion- all have an impact on the various interrelated species and systems that make up the larger watershed or ecosystem. Ecosystem-wide impacts such as fires, pesticide applications, etc. have impacts that may trickle down to the smallest microorganisms.

Overall watershed health has dramatically declined on most of the public lands in the Goose Creek watershed. Impacts occurring as a result of excessive livestock grazing during drought and from fires (wildfires, arson fires, and an escaped controlled burn) have permanently altered the region. Repeat livestock trespass of area habitats, even following burn closures, have led to additional impacts. For a number of past years livestock have simply allowed to remain in area habitats, including within *Astragalus*

anserinus habitats year-round in flagrant trespass of public lands grazing permit terms (Austin 1998-2003).

Heavy annual grazing of much of the Goose Creek basin and watershed region occurs on lands that under the C.F.R. policies for capability/suitability are excluded as grazing lands. This would include much of the Salt Lake Formation outcrops and soils inhabited by rare plants such as *Astragalus anserinus.* As noted by Gilman (2003), much of the entire southern Cassia County/Twin Falls County region is comprised of highly erodible soils and is inappropriate for livestock grazing use. Erosion and loss of native plant community and wildlife values has been high throughout much of the region- including for Idaho, Utah, and Nevada. Such ecosystem impacts affect all species- from native plant pollinators to native plants and wildlife species.

Other anthropogenic factors not discussed in above sections and affecting continued existence of *Astragalus anserinus* include:

8) Road construction and maintenance impacts Astragalus anserinus

Astragalus anserinus habitat has likely been lost during construction of area county maintained roads, through the construction of private roads, and through the construction of other roads and trails on public lands. Widening of area roads, culvert and water bar construction, and other associated maintenance has a potential to disturb or destroy extant populations close to existing roads (Mancuso and Moseley 1991, Red Willow Research 2000).

Widening of the Coal Banks road through an extant Idaho population in 2001 likely resulted in take or loss of some of the plants. While some researchers may have

noted (or hypothesized) that seedlings may establish more readily in disturbed soils- as of 2001 very few plants remained in existence overall for any of the Idaho occurrences.

Furthermore, annual or otherwise scheduled road maintenance would preclude such plants from any long-term persistence. Additional road construction or maintenance associated or required by planned water developments has a potential to seriously impact and/or destroy extant populations in both Utah and Idaho.

9) Other range improvements or vegetative "treatments" create impacts

Any range improvements within extant *Astragalus anserinus* habitat or even in the immediate vicinity such as exotic seedings, fencing, or vegetative treatments have the potential to directly and/or indirectly harm *Astragalus anserinus* occurrences and required habitat characteristics. Extant population occurrences are likely to decline or disappear altogether if the open community structure of *Astragalus anserinus* habitat is altered through activities such as vegetation treatments (chaining, fire) or range seedings (Mancuso and Moseley 1991, Red Willow Research 2000).

Large-scale habitat alterations in the Goose Creek watershed have already been carried out on area federal, state, and even private lands. Crested wheatgrass is now growing within occupied *Astragalus anserinus* habitat and is assisting in creating habitat changes that may eventually entirely preclude the rare taxon (Red Willow Research 2000).

Activities such as fencing create short-term disturbances such as through use of motorized vehicles in areas that might not normally be accessed . Visible tracks and trails

tend to attract additional use of off-road areas. Both short- and long-term impacts may result from forced changes in livestock movements- including trampling, trailing, or even utilization within formerly unused or minimally used habitat areas. Trailing and trampling has become an increasing concern within extant *Astragalus anserinus* populations (Mancuso 2001).

10) ORV use has the potential to harm *Astragalus anserinus*

DeBolt (1989) first noted off-road vehicles as a potential threat to *Astragalus anserinus.* Mancuso (2001) reports the first observed incidence of off-road vehicles having accessed an occurrence. As off-road use is increasing dramatically throughout Idaho, Nevada, and Utah- the likelihood of impacts to rare plant habitats is ever increasing. Newer, more powerful vehicles now get to sites previous vehicles were less likely to access. Damages to plants, soil crusts, native plant pollinators, and other ecosystem of site values are increasingly at risk from this type of human activity. As *Astragalus anserinus* occupies a number of lower to mid-elevation sites, as well as roadside sites it has a higher inherent risk for damage from ORV and other motorized traffic than rare species in less accessible locations.

11) Mining has the potential to harm *Astragalus anserinus*

Historic mining has occurred within and/or near occupied *Astragalus anserinus* habitat. If demand for products associated with the Salt Lake Formation were to increase or otherwise increase in economic value, mining and related activities such as road

construction could pose substantial threats to *Astragalus anserinus.* Those mineral products occurring within the outcrops and soils supporting *Astragalus anserinus* include but are not limited to the following (Red Willow Research 2000):

a. Uranium
b. Diatomite
c. Montmorillonite
d. Bentonite
e. Zeolite
f. Soft building stone
g. Coal

12) Trash Dumping may harm *Astragalus anserinus*

Illegal trash dumping on public lands and trash dumping on private lands that support *Astragalus anserinus* is somewhat limited in scope. However, as extant population occurrences and occupied habitats are extremely limited, the potential for damage from this observed human impact is still important to mention. Dumping of dead livestock, agricultural trash, and household rubbish has been observed in (on tope of) or near *Astragalus anserinus* occurrences on private as well as public lands in Idaho and Utah (Baird and Tuhy 1991; Red Willow Research 2000).

The above threats in the "other" listing category are many and varied; with some leading to more imminent danger or substantial impacts than others. However, the cumulative array of threats facing *Astragalus anserinus* is staggering- particularly in light of the extremely limited amount of occupied habitat and the inherent vulnerability of the typically small occurrences. In light of the fact that there is likely only a few hundred

plants remaining among the populations in Idaho, Nevada, and Utah- even a seemingly simple or very limited impact may have enormous implications for *Astragalus anserinus.*

. Petitioners believe that *Astragalus anserinus* qualifies as an appropriate species for listing, designation of critical habitat, and for immediate emergency listing under the above specific listing criteria (other natural or manmade factors affecting continued existence). The fact that *Astragalus anserinus* is extremely limited in number of remaining plants, and is extremely edaphically restricted to a few extant sites, increase the species risks to persistence and vulnerability to extinction.

Already considered to be critically imperiled, and currently without any legal protective status, *Astragalus anserinus* certainly appears to qualify for ESA protection and designation of critical habitat based upon all ESA listing criteria. Based upon the imminence of actions likely to occur within the next few months, impacts that will result in permanent habitat loss and potential take of some of the few remaining plants, *Astragalus anserinus* certainly appears to qualify for emergency listing. Without immediate protective actions- it is likely that final extinction of this imperiled species will quickly become inevitable.

Petition Summary, Concluding Remarks

Astragalus anserinus (Goose Creek milkvetch) is very narrowly endemic to volcanic ash soils of the Salt Lake Formation within the Goose Creek watershed. The only known *Astragalus anserinus* populations exist in the southeast corner of Cassia County, Idaho; the adjoining northwest corner of Box Elder County, Utah; and from a closely adjoining location in northeastern Elko County, Nevada.

Astragalus anserinus was first collected in 1982, and was officially described in 1984. As of 2004, there are still only seven identified population locations in Idaho, only eight identified population locations in Utah, and only one site with 4 loosely connected population locations in Nevada. The most recent national designation for *Astragalus anserinus* has been as a Category 2 candidate species for federal listing. *Astragalus anserinus* has been assigned an Idaho state ranking of "state rank = S1" as it is "critically imperiled in Idaho because of extreme rarity or because of some other factor in its biology making it extremely vulnerable to extinction." The USDA Forest Service Region 4 and the USDI Bureau of Land Management have only categorized *Astragalus anserinus* as a sensitive plant species. Both the Utah and Nevada Natural Heritage Programs have maintained *Astragalus anserinus* as "State Rank = S1."

Astragalus anserinus faces a wide range of identified threats- including but not limited to natural events (drought, landslides, fire effects, disease, predation or herbivory), as well as threats relating to domestic livestock grazing, exotic and noxious weed invasions, weed control programs, loss of native plant pollinators, prescribed fire/firefighting tactics, water developments, range improvements (such as fencing or seedings), road construction or maintenance, scientific collections, off-road recreation, illegal/private trash disposal, and mining operations.

Population declines have become demonstrably precipitous across the past decade; resulting in extirpations at some sites, leaving some population locations with as little as one plant; and leaving sites once reported as supporting thousands of individual plants with only a few hundred remaining plants. Cumulative impacts, coupled with ongoing and publicly announced or planned impacts may well push this plant (already

existing well below even minimally optimal conditions needed to ensure genetic variability and population viability) over the brink to final extinction.

As of the date of this petition, *Astragalus anserinus* has no existing federal designation or protective status. Idaho populations have declined at an overall 94.84 %, from 2635 plants in 1991 to only 136 plants in 2001. The calculated potential number of plants for all three states in 2001 would have been approximately 542 plants. These plants would occupy a geographical area of 200 square feet or less if all placed together. This represents far less than one acre of occupied habitat- in reality scattered widely across the ashy soils and outcrops of a now highly degraded Great Basin desert watershed. If current population declines hold steady for remaining populations, Astragalus anserinus faces final extinction in 16 years or less.

The end may come sooner however- due to BLM intentions to bulldoze pipelines and place troughs directly within occupied habitats in both Utah and Idaho within just a couple of months. Proposed political management schemes threaten to turn *Astragalus anserinus* habitats over to private managers- whose stated goals are to rid Idaho habitats of vital community components such as juniper and rabbit brush and who apparently intend to re-introduce harmful practices such as season-long grazing. The threats are essentially limitless in scope- including natural factors that may preclude any potential for expansion of the remaining populations.

Petitioners have provided a large volume of data, both of background information regarding *Astragalus anserinus* as a species, and as supporting information documenting threats in support of the petition requests. The data included within this petition is by no means exhaustive- yet it is intended to illustrate the daunting array of threats facing this

species, to illustrate the increasingly dire plight of this rare taxon, and to illustrate the need for emergency action..

Every effort has been made to correctly transmit the data found or referenced within this petition. Petitioners hereby incorporate by reference every document cited within this petition and/or cited below. Petitioners (Red Willow Research Inc. as petition author and lead petitioner) will be happy to provide copies of any of these documents upon written request.

Petitioners have not sought this listing action frivolously or without cause; nor without having first expended many years of public and private efforts in attempts to obtain protective management consideration for *Astragalus anserinus*.

Petitioners have herein petitioned the Secretary of the Interior and U.S. Fish and Wildlife Service to list *Astragalus anserinus* (Goose Creek milkvetch) as threatened or endangered and to designate critical habitat pursuant to the Endangered Species Act. Petitioners have filed this petition pursuant to the Endangered Species Act (ESA), 16 U.S.C. § 1531, *et seq.* and regulations promulgated thereunder, and the Administrative Procedure Act, 5 U.S.C. § 553 (e).

Pursuant to 16 U.S.C. §§ 1533 (b)(1)(c)(iii) and 1533 (b)(7) and 50 C.F.R. § 424.20, the Petitioners have further petitioned the Secretary and the Fish and Wildlife Service to promulgate a rule listing *Astragalus anserinus* (Goose Creek milkvetch) on an emergency basis due to significant and immediate risks to the well being of this species as has been discussed herein.

Current regulatory mechanisms are *not* adequate to protect *Astragalus anserinus* from extinction. The magnitude of ongoing threats to the existence and persistence of this

rare plant and the imminence of threats poised to occur within existing populations requires immediate attention. Irrevocable harm would occur, including the potential for final extinction of this taxon, in the period of time typically expended for a standard listing process (many years- sometimes a decade or more). Emergency action is imperative. Therefore, in addition to requesting an ESA listing and designation of critical habitat, the Petitioners have requested that an emergency rule be promulgated immediately. Petitioners have provided substantial information indicating that ESA listing for *Astragalus anserinus* may be warranted.

General Discussion

Like Goose Creek Milkvetch (*Astragalus anserinus*) introduced in the case study above, many species are currently considered to be at risk worldwide. Miller (1995) and Wilcove (2006) note that risk factors may include low reproductive rates (e.g. California Condor, polar bear), specialized feeding habitats (e.g. black-footed ferret, giant panda), feeding at high trophic levels (e.g. Bengal tiger, timber wolf), large size (e.g. American bison, elephant), limited/specialized breeding or nesting (e.g. Kirtland's Warbler, Whooping Crane), exists only in one location or region (e.g. woodland caribou, Goose Creek milkvetch), uses fixed migratory patterns (e.g. blue whale, Bachman's Warbler), preys on livestock or humans (e.g. timber wolf, crocodile), risky behavioral patterns (e.g. Passenger Pigeon, Townsend's Big-eared Bat).

The complete loss of a particular species or extinction generally occurs from deterministic or stochastic causes, or from a combination of such causes at one or more scales (Brewer 1994; Hartley and Kunin 2003). Deterministic causes are defined by Brewer (1994) as fixed or directional changes that destroy an organism or its habitat. Stochastic causes can be loosely described as random or chance causes, and includes causes that are likely to be encountered or "probable" such as a late spring snowstorm experienced by a migratory bird population (Brewer 1994). Stochastic events may be further classified as representing either demographic, genetic, or environmental stochasticity.

Demographic stochasticity includes those features that vary within populations such as age, dispersal rates, survivorship, and sex ratios (Brewer 1994; Waits 2005). Genetic stochasticity relates to the success or failure of genetic processes including genetic drift, inbreeding depression, genetic bottlenecks, and evolutionary potential (Brewer 1994; Waits 2005). Environmental stochasticity may interact with demographic and genetic stochasticity, and includes the range of environmental variability likely to be encountered by populations (e.g. drought, wildfire, hurricane).

An example of deterministic extinction is provided by the relatively recent loss of the Great Auk. A flightless colony nester, Great Auks were herded into groups and clubbed to death unremittingly for their meat, oil and feathers (Brewer 1994). Quickly decimated by human hunting pressure, the last Great Auk was reportedly killed in 1844 rendering the species extinct. However, not all deterministic agents are of human origin.

Long-term climate change is a deterministic event that controls species distribution and persistence through control of vegetation resources (Brewer 1994).

Extinction through deterministic causes for one species also represents deterministic causes for species that are obligate dependents on the first species (e.g. a parasite obligate to a particular species of plant or animal, a plant reliant upon pollination by a specific organism). In many cases extinction or the risk of extinction can be described as the result of both deterministic and stochastic events, in what is essentially a two-stage process (Brewer 1994). Deterministic events (e.g. hunting pressure) may reduce a species to small or otherwise isolated populations; a consequent stochastic event (e.g. severe hurricane) may result in pushing an at-risk species below the threshold necessary for recovery (Brewer 1994).

ESA Listing

Options for recovery of a plant or animal species recognized to be at risk for extinction in the United States include the formal petition and listing process embodied within the Endangered Species Act [ESA]. A number of U.S. species have been successfully petitioned and listed as either endangered or threatened. There are now approximately 1,265 plant and animal species that have been designated as endangered or threatened that occur within the United States (GAO 2005). Listed species include the following sample of ESA listed plants and animals known for Idaho:

ESA Listed Plants in Idaho

Howellia aquatilis	Water Howellia

Mirabilis macfarlanei	MacFarlane's Four-O'clock
Spiranthes diluvialis	Ute Ladies'- tresses

ESA Listed Invertebrates in Idaho

Lanx sp.	Banbury Springs Limpet
Taylorconcha serpenticola	Bliss Rapids Snail
Physa natricina	Snake River Physa Snail
Pyrgulopsis bruneauensis	Bruneau Hot Springsnail

ESA Listed Vertebrates in Idaho

Lynx canadensis	Canada Lynx
Spermophilus brunneus brunneus	Northern Idaho Ground Squirrel
Canis lupus	Gray Wolf
Halieaeetus leucocephalus	Bald Eagle
Grus americana	Whooping Crane
Oncorhynchus tshawytscha	Chinook Salmon
Oncorhynchus mykiss	Steelhead
Acipenser transmontanus	White Sturgeon
Salvelinus confluentus	Bull Trout

Many imperiled species, including species known for Idaho, have been petitioned for ESA listing and either remain under agency review or have been formally denied listing by USFWS. Other species have been determined to be "warranted but precluded" due to a backlog of cases, a lack of funding, or similar roadblocks (USFWS 2003). Species denied protection under the ESA may or may not be subjected to the public appeal process. Examples of recently petitioned species that have not been listed as requested include Goose Creek Milkvetch (still undergoing 90-day and 12-month review process after 18 months), Yellowstone Cutthroat Trout (petition denied and first public appeals denied), and Pygmy Rabbit (undergoing review and public appeal process).

The ESA requires that recovery plans be drafted for protected species (Miller 1995; Nebel and Wright 1996; USFWS 1996). However, by 1995, recovery plans had been drafted for only about 55% of listed species, with less than half of those plans actually under any type of field implementation (Miller 1995).

Out of the more than 1200 species now listed as threatened or endangered, only five species have ever recovered to sufficient levels to be considered eligible for delisting (Miller 1995; Nebel and Wright 1996). Seven listed species have become extinct while protected under the ESA (Miller 1995). Approximately 235 of 775 listed species in 1995 were considered to be stable and exhibiting some level of recovery (Miller 1995).

As of 1995 over 7,500 species (including over 500 considered to be critically imperiled) had been proposed for listing. As of 2006 many more petitioned species are now languishing in the backlog of listing petitions; due largely to a reported lack of funding (Miller 1995; Nebel and Wright 1996). 34 species on the ESA petition waiting list became extinct between 1980 and 1990 before protection could be secured (Miller

1995). Scientists have estimated that at least 400 of the more than 7,500 species on the ESA waiting list in 1995 will likely become extinct before ESA protection can ever be considered (Miller 1995).

The very limited examples of ESA listing and subsequent recovery success in the United States include the Peregrine Falcon (considered recovered and now delisted), the Bald Eagle (considered recovered and proposed for delisting), and the Gray Wolf (considered sufficiently re-introduced and now proposed for delisting in Montana and Idaho) (Miller 1995; Nebel and Wright 1996; Times News 2006).

Critical Habitat

It was recognized by Congress at the time of the Enactment of the ESA that the greatest threats facing endangered species would not be hunting or commercial exploitation, but would be habitat related (Bean 1999). Costanza and others (1997, p. 3) state that the basic problems upon which our need for "innovative policies and management instruments" include the following issues:

- Unsustainably large and growing human populations that exceed the carrying capacity of the earth;

- Highly entropy-increasing technologies that deplete the earth of its resources and whose unassimilated wastes poison the air, water, and land;

- Land conversion that destroys habitat, increases soil erosion, and accelerates loss of species diversity.

Dombeck and others (2003, p. 181) further note:

> The development that gives us homes in the woods, strip malls, and harvest of old-growth forests simultaneously dismantles our genetic library piece by piece. Once extinct, these species and the role they play in the whole community of life are gone forever. Aldo Leopold put it this way: To keep every cog and wheel is the first precaution of intelligent thinking."

Recovery plan language did not appear in the original ESA; language regarding recovery plans was amended to the ESA in 1978. However, the designation of critical habitat has not necessarily been successful in reversing the endangered status of plants and animals. As a result, critical habitat designations have lagged behind or have not even been carried out for many if not most federally listed species (Bean 1999).

In many instances, recovery plan language identifying critical habitat is too vague to be of use fro conservation planning (Bean 1999). As Bean (1999) also notes, this tends to be the case for many species for which we simply do not have adequate biological and ecological information relating to habitat requirements or preferences. For some species, the initial goal of obtaining public cooperation by designating populations as "Experimental, Non-Essential" has resulted in some roadblocks to long-term recovery

(e.g. gray wolf, Whooping Crane, California Condor), although these species have also enjoyed some of the best success due to the potential for wider reintroduction programs under the Experimental, Non-essential designation (Bean 1999).

The application of the ESA to populations of threatened or endangered species on private lands has always been the proverbial "Achilles heel" (Bean 1999). Improving conservation efforts on private lands, habitats utilized in many cases exclusively by imperiled species, is critical to conservation success under the ESA (Bean 1999).

A good example of the failure or inability of USFWS or others to carry out ESA protection on private land is provided by *Howellia aquatilis*, a rare aquatic plant that occurs in northern Idaho. Located almost entirely on private land, little has been done to ensure the healthy persistence of the wetland in which this rare plant exists. Landowner leasing of meadows for livestock grazing has further imperiled the small amount of area actually inhabited by the rare plants.

Some discussion has occurred at Idaho Rare Plant Conferences across the past five years regarding conservation planning and potential acquisition of land or conservation easements to benefit *Howellia aquatilis*. However, no physical action has ever been undertaken on behalf of protecting this ESA species and its habitat. (INPS 2000-2005, personal communications, unreferenced.)

Ongoing Controversy

The ESA has been embroiled in controversy since it became law in 1973. Many critics believe that the ESA simply does not go far enough, and that environmental

policies can be easily evaded (Miller 1995; Bean 1999; Costanza and others 2002). Federal protection is not provided until a species is officially listed as threatened or endangered and a recovery plan has been established (Miller 1995). However, as Miller (1995) also points out, simply listing a species under the ESA does not guarantee either physical protection or species recovery. The slow pace at which species are being added to the existing list has led many ecologists to forecast the extinction of species currently languishing at the petition stage (Miller 1995; Bean 1999).

Species recovery may entail many decades, if not a century or more (Miller 1995). Enforcement of protection provisions for currently listed species has been sporadic to date, focusing largely on species of major national interest such as the Bald Eagle (Miller 1995). As a result, protection of many if not most of the more obscure or controversial species has frequently fallen victim to local politics, to a perceived or actual lack of funding and personnel, and to other administrative roadblocks.

On the other hand, many critics of the ESA believe that even the existing, relatively non-functional tenets of the ESA have gone too far (Miller 1995; Bean 1999). One of the most famous listing cases, the Northern Spotted Owl, has been a rallying point for critics of ESA policy (Miller 1995; Bean 1999). ESA critics typically point to potential limitations on development, including on private lands (Miller 1995). Some critics also question the taxonomic status of many petitioned or listed species, such as occurred with the Northern Spotted Owl (Miller 1999; Allendorf and others 2004).

Many critics also hope to "undo" or otherwise severely hamper what they perceive to be the ESA's limitations. The interests of critics hoping to remove all or a large part of the powers inherent in the current ESA are often closely allied to real estate

and other types of human development; or are closely allied with resource-extractive industries, including mining and livestock grazing.

Recommendations

The biological wealth that exists on the earth sustains natural systems as well as human life and economy (Miller 1995). As Costanza and others (2002, p. 3) note, the problems that abound in the natural and managed world around us provide strong evidence that the "material scale of human activity exceeds the sustainable carrying capacity of the earth." As Costanza and others (2002, p. 2) further note, "remedial responses to date have been local, partial, and inadequate."

In light of the unsustainable practices occurring worldwide, an increasing interest in the conservation and preservation of natural biodiversity has emerged (Miller 1995). A number of recommendations have been made at a variety of scales to address not only conservation and management of ESA species, but to address the accelerating, worldwide biodiversity loss. One of the areas receiving increased modern attention is that of establishing biological value.

Costanza and others (2002, p. 40) provide the following analysis:

> Clearly, if we knew the value of biological resources, we would be in a better position to manage them more effectively. And, to the extent these values could be included in the market system, markets themselves could

> assist in the conservation of biodiversity…Even when species cannot be better conserved through the market, knowing their economic value can help convince people and their political representatives that the species deserves protection. Environmental valuation can also improve how we analyze the benefits and costs of development projects that affect biodiversity.

As noted by Williams (2006) the United States is willing to spend up to $40,000,000 per year to protect and manage introduced feral horses and burros on western lands, while expending just under $75,000 per year on protecting endangered species. Obviously, the priorities of the American public and of United States politics are incompatible with the spirit and intent of the Endangered Species Act. Current priorities of the United States are also out of balance with other existing legislation intended to protect natural biodiversity and to protect the basic quality of our natural environments.

Cultural evolution encompasses technical evolution, and has provided humans with an unsurpassed ability for mass appropriation of natural resources (Costanza and others 2002). As noted by Costanza and others (2002, p. 31), "humans now directly control from 25 to 40% of the total primary production of the planet's biosphere… and is beginning to have significant changes…" Costanza and others (2002) also note that the risks associated with cultural evolution are much like the increased danger of a car running off a cliff and into an abyss if it continues to accelerate indefinitely. Costanza and others (2002, p. 31) further note that, as in the case of our accelerating loss of natural biodiversity, if "society can see the cliff, perhaps it can be avoided."

Dombeck and others (2003) note:

> That public lands harbor such a large percentage of our remaining wild heritage is of significant value, something to be nurtured rather than a problem to be worked around or viewed as an impediment to the extraction of natural resources. Restoring biodiversity, like other forms of public land and water conservation, is the mark of a mature and forward-looking nation. Congress should make clear that the conservation of biodiversity and water quality are the central objectives of all public land management.

Societal and governmental change of the magnitude required to conserve and protect endangered species within the United States alone is staggering in scope. However, there are a number of actions that have been proposed or that are underway at one or more scales that may help to conserve and protect many of our imperiled species. The following recommendations provide a sample of programs or goals that have been publicly presented or discussed in relation to conservation of natural biodiversity the conservation of endangered species:

- Conservation actions in general based on economic incentives rather regulatory control (Costanza and others 2002; Wilcove and Lee 2004)

- Encouragement and economic incentives for stakeholder cooperation in protecting imperiled species (Bean 1999; Maestas and others 2003; Wilcove and Lee 2004)

- Landowner incentive programs to restore or manage private lands for conservation and protection of imperiled species (Bean 1999; Maestas and others 2003; Wilcove and Lee 2004)

- Establish national programs for conservation education (Noss and Cooperrider 1994; Orr 2004; Trewhella and others 2005)

- Revitalize and enhance the Natural Heritage Program (responsible for tracking rare species in each state) (Noss and Cooperrider 1994)

- Designate conservation of biodiversity as a central objective of public land management (Dombeck and others 2003; Czech 2005)

- Protection of multiple use habitats specifically for endangered species during critical periods such as nesting season (Nebel and Wright 1996)

- Education programs addressing the instrumental as well as intrinsic value of wildlife and other ecosystem components (Nebel and Wright 1996; Orr 2004; Trewhella and others 2005)

- Development of ecotourism programs in place of consumptive or extractive activities, particularly in relation to sensitive/imperiled systems and species (Nebel and Wright 1996)

- Control and eradication of exotic floral and faunal species from within natural ecosystems where possible (Miller 1995; Nebel and Wright 1996; Dombeck and others 2003; Weigle and others 2005)

- Captive breeding programs leading to re-introduction of rare species into suitable habitats, including historic habitats where possible (Brewer 1994)

- Preservation of natural ecosystems, landscapes, and natural areas (Brewer 1994; Miller 1995; Czech 2005)

- Land-use planning that avoids unnecessary habitat fragmentation and addresses connectivity issues (Brewer 1994; Miller 1995; Maestas and others 2003; Dixon and others 2006)

- Tax incentives for donations of land used by imperiled species or containing imperiled habitat types such as wetlands (Noss and Cooperrider 1994; Wilcove and Lee 2004)

- Development of reserve networks and management plans that transcend state, regional, and national/international borders (Noss and Cooperrider 1994; Czech 2005)

- Require assessment of direct, indirect, and cumulative effects of federal actions on biodiversity (Noss and Cooperrider 1994)

- Establish incentive programs for conservation leadership in public service (Noss and Cooperrider 1994)

- Provide incentives for landowners, educators, and others involved in maintaining or promoting biodiversity and responsible resource management (Noss and Cooperrider 1994; Maestas and others 2003; Orr 2004; Wilcove and Lee 2004)

- Increasing the use of recyclables, including paper, to avoid unnecessary impacts to natural and managed ecosystems (Miller 1995; Capra 2002)

- Preservation of old-growth timber (Miller 1995)

- Encourage and facilitate conservation easements in critical habitats, including old-growth timber (Miller 1995)

- Develop and fund landscape and habitat restoration projects; utilize such projects to provide employment for displaced workers from extractive industries (e.g. logging) (Miller 1995)

- Reduce/eliminate unnecessary road construction on public land (Miller 1995)

- Concentrate human development and agriculture to avoid sprawl into undeveloped or rural areas; avoid expansion of rural areas into wildlands in order to help preserve habitat and habitat connectivity (Miller 1995; Capra 2002; Maestas and others 2003;)

- Control pollution and protect water quality (Miller 1995; Dombeck and others 2003)

- Minimize depletion of non-renewable resources (Miller 1995)

- Preserve species diversity and genetic diversity, including protection of critical habitats and habitat corridors necessary for genetic exchange (Miller 1995; Waits 2005; Dixon and others 2006)

- Identification and management of vulnerable species prior to their approaching the brink of extinction (Noss and Cooperrider 1994)

- Move beyond the concept of "endangered" and develop programs intended to inventory and protect entire assemblages of species and their habitats (Noss and Cooperrider 1994)

- Reintroduction and protective management for large predators and other keystone species, including pollinators (Noss and Cooperrider 1994; Lawler and others 2003; Xerces Society 2003; Dixon and others 2006)

- Pursue purposeful treaties, legislation, and refuge development worldwide (Miller 1995)

- Encourage participation in Citizen Science Projects, such as Cornell University's eBird reporting, Great Backyard Bird Count, Project Feederwatch, and other programs (Wood 2006)

- Use of gene banks, botanical gardens, captive breeding programs, and zoos to protect genetic variability and persistence for critically endangered species (Miller 1995)

- Develop and carry out conservation education, including for indigenous peoples (Miller 1995; Orr 2004; Trewhella and others 2005)

- Development of conservation strategies to address the needs of imperiled species before they reach critical threshold stages (Miller 1995)

- Work to develop sustainable communities, agriculture, and industries that minimize human footprints in imperiled regions or within critical habitats (Costanza and others 2002; Capra 2002; Maestas and others 2003)

Some of the above recommendations are obviously more short-term in nature, while others are more likely to require long-term implementation and/or to result in long-term benefits towards conservation and protection of endangered species. Only a conscientious and combined effort on behalf of endangered species within the United States and elsewhere in the world will be likely to significantly reverse current extinction trends for any of our endangered or otherwise imperiled species. Such efforts will also be required to adequately address overall conservation and protection of the earth's natural biodiversity and of our remaining natural resources.

Conclusion

Extinctions of known species and an expanding list of species designated as endangered in North America and elsewhere around the globe reflect a serious and world-wide biodiversity crisis (Wilson 1985; Noss and Cooperrider 1994; Miller 1995; Nebel and Wright 1996; Costanza and others 1997). E. O. Wilson reports that the modern

rate of extinction is nearly 400 times that recorded by recent geologic history, and that the rate is accelerating rapidly. Wilson (1985) implores science and society not to accept the contention that modern extinction is nothing more than a natural process.

The biological wealth that exists on the earth sustains natural systems as well as human life and economy (Miller 1995). Human activities placing world biodiversity at risk and individual species at risk of extinction include: unsustainable population growth that exceeds global carrying capacity, high entropy technologies that result in rapid resource depletion or degradation, and loss of habitat through land use conversions (Costanza and others 1997; Dombeck and others 2003). Costanza and others (1997) note that innovative policies and management instruments are now required to address critical environmental issues such as extinction rates and a growing loss of natural biodiversity.

Formal actions to preserve and protect natural biodiversity in the United States were embodied in the Endangered Species Act [ESA] of 1973 (Nebel and Wright 1996). The ESA was intended to assist in the protection and preservation of threatened species, those species that have been determined to be at risk of extinction at some point in the near future if intervention is not made on their behalf (Nebel and Wright 1996).

The ESA has been embroiled in controversy since it became law in 1973. Many critics believe that the ESA simply does not go far enough, and that environmental policies can be easily evaded (Miller 1995; Bean 1999; Costanza and others 2002). Federal protection is not provided until a species is officially listed as threatened or endangered and a recovery plan has been established, and as Miller (1995) points out, simply listing a species under the ESA does not guarantee either physical protection or species recovery.

Of the more than 1200 species now listed as threatened or endangered, only five species have ever recovered to sufficient levels to be considered eligible for delisting (Miller 1995; Nebel and Wright 1996). Seven listed species have become extinct while protected under the ESA (Miller 1995). As of 1995 over 7,500 species (including over 500 considered to be critically imperiled) had been proposed for ESA listing. 34 species on the ESA petition waiting list became extinct between 1980 and 1990 before protection could be secured (Miller 1995). Scientists have estimated that at least 400 of the more than 7,500 species now on the ESA waiting list will likely become extinct before ESA protection can ever be considered (Miller 1995).

As noted by Williams (2006) the United States is willing to spend up to $40,000,000 per year to protect and manage introduced feral horses and burros on western lands, while expending just under $75,000 per year on protecting endangered species. Obviously, the priorities of the American public and of United States politics in general are incompatible with the spirit and intent of the Endangered Species Act. Current priorities of the United States are also out of balance with other existing legislation intended to protect natural biodiversity and to protect the basic quality of our natural environments.

Cultural evolution encompasses technical evolution, and has provided humans with an unsurpassed ability for mass appropriation of natural resources (Costanza and others 2002). As noted by Costanza and others (2002, p. 31), “humans now directly control from 25 to 40% of the total primary production of the planet’s biosphere…” Costanza and others (2002) also note that the risks associated with cultural evolution are much like the increased danger of a car running off a cliff and into an abyss if it continues

to accelerate indefinitely. Costanza and others (2002, p. 31) further note that, as in the case of our accelerating loss of natural biodiversity, if "society can see the cliff, perhaps it can be avoided."

As Noss and Cooperrider (1994, p. 63) point out, "Species extinction is only the last and most obvious stage of biotic impoverishment." It is sincerely hoped that the United States, as well as the other cultures and governments of the world, will recognize the virtual biological "cliff" humankind is facing and begin to make a concerted effort towards the protection and conservation of our biological heritage here on earth. Protection and conservation of that biological heritage includes the protection and conservation of those species that are currently imperiled around the globe.

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