Wyoming Species of Greatest Conservation Need

Element 1 of the Congressional guidelines for State Wildlife Action Plans (SWAPs) specifies that each state must provide "information on the distribution and abundance of species of wildlife, including low and declining populations as the state wildlife agency deems appropriate, that are indicative of the diversity and health of the state's wildlife." These species have been termed Species of Greatest Conservation Needs or SGCN.

Identifying SGCN

Over 800 species of wildlife exist in Wyoming. This figure does not include plants and terrestrial invertebrates, which do not fall within the Wyoming Game and Fish Department's (WGFD) jurisdiction. SGCN designation is intended to identify species whose conservation status warrants increased management attention, and funding, as well as consideration in conservation, land use, and development planning in Wyoming. SGCN designation can be derived from known population or habitat threats or a lack of sufficient information to adequately assess a species' status.

The WGFD's SGCN designation process is based upon its Native Species Status (NSS) classification system. During the early 1980s, the WGFD conducted a series of analyses to identify species of special concern. A system was developed that used a matrix to evaluate a species' status in relation to population (y-axis) and habitat variables (x-axis). In the 2005 Comprehensive Wildlife Conservation Strategy (CWCS),[1] a 16-cell matrix was used for birds and mammals and a 9-cell matrix for fish, reptiles, amphibians, and invertebrates. An NSS rank was assigned for an individual species based on the intersection of the two most appropriate population and habitat conditions. For the purposes of the 2005 CWCS, species identified as NSS1, NSS2, NSS3, or NSS4 were considered to be SGCN.

Since that time, it was determined that using a separate matrix for fish, reptiles, amphibians, and invertebrates was too cumbersome, and a revised approach was created for the 2010 SWAP. The revised NSS matrix has 16 cells (Table 1). The y-axis consists of population variables, which range on a continuum from populations declining with extirpation possible (row A) to populations that are widespread and expanding (row D). After identifying the appropriate row for a species population, the most appropriate limiting factor column is selected from the x-axis, ranging from limiting factors that are severe and worsening (column a) to limiting factors that are moderate and not likely to increase (column d). Limiting factors include habitat, human activity levels, genetics, invasive species, disease, environmental contaminants, and climate change (Table 2). Additional limiting factors may be identified in the future. The matrix cell established by the intersection of the selected row and column identifies the NSS rank for a species. As a species moves from a placement closest to the upper left corner of the matrix (Aa/NSS1) toward the lower right corner (Dd/NSS7) the species' population status in Wyoming is considered more secure. Some combinations of population status and limiting factors are unlikely to occur and are not assigned an NSS rank. Notes on the SGCN designation are included with each species account.

This system cannot be used for classifying some species because necessary information is lacking. These species are placed in a separate status category as NSS Unknown (NSSU) until additional information is obtained. Species that receive an NSS rank of NSS1, NSS2, NSS3, NSS4, or NSSU were recommended to the Wyoming Game and Fish Commission to receive SGCN designation for the 2010 SWAP. NSSU species were recommended to receive the SGCN designation because obtaining a greater understanding regarding population numbers and distributions of these species is necessary in determining their conservation status, including responding to petitions for listing under the

[1] Comprehensive Wildlife Conservation Strategy was the previous name for Wyoming's State Wildlife Action Plan.

Endangered Species Act. Some species with naturally low numbers and limited distributions were not recommended to receive SGCN status if both the following qualifications were met:

1. The species in Wyoming is not experiencing known population declines or increasing threats, and
2. The species' population is abundant and secure throughout its range.

Only species that are legally considered wildlife in Wyoming were evaluated for SGCN status. Wyoming Statute 23-1-101 (a) (xiii) defines "wildlife" as all wild mammals, birds, fish, amphibians, reptiles, crustaceans and mollusks, and wild bison designated by the Wyoming Game and Fish Commission and the Wyoming Livestock Board within Wyoming. Plants and invertebrates (excluding crustaceans and mollusks) are outside the jurisdictional authority of the WGFD and were not considered for SGCN status. To increase understanding about Wyoming's invertebrates, a cooperative agreement was signed between the WGFD and the Wyoming Natural Diversity Database (WYNDD) in May 2010.

SGCN designation was applied at the most appropriate taxonomic level based on current management practices (see Appendix B for a description of taxonomic approach for mammals and birds). This was usually the species level. Examples of exceptions at the subspecies level included the Preble's jumping mouse, four subspecies of cutthroat trout,[2] and a number of reptiles and amphibians. Most mollusks and crustaceans were organized at the genus, family, or order level, based on shared morphology, habitats, threats, and limited information.[3] Basic life history information, population survey methods, and identification techniques for these mollusks and crustaceans is extremely limited. Consequently, addressing the conservation of these species at a lower taxonomic level is impractical until additional information is available.

[2] Bonneville, Yellowstone, Snake River, and Colorado River.
[3] Mollusk groups: aquatic snails, land snails, oreohelix mountain snails, pill clams, and stagnicola pondsnails. Crustacean groups: shrimp.

Table 1. 2010 SWAP Native Species Status Matrix

		Limiting Factors			
		a. EXTREME Limiting factors are severe and continue to increase in severity	**b. SEVERE** Limiting factors are severe and not increasing significantly	**c. MODERATE** Limiting factors are moderate and appear likely to increase in severity	**d. MINIMAL** Limiting factors are moderate and not likely to increase in severity
Population Status	**A. IMPERILED** Population size or distribution is restricted or declining and extirpation is possible	Aa NSS1	Ab NSS2	Ac NOT APPLICABLE	Ad NOT APPLICABLE
	B. VULNERABLE Population size or distribution is restricted or declining but extirpation is not imminent	Ba NSS2	Bb NSS3	Bc NSS4	Bd NOT APPLICABLE
	C. STABLE Population size and distribution is stable and the species is widely distributed	Ca NOT APPLICABLE	Cb NSS4	Cc NSS5	Cd NSS6
	D. EXPANDING Populations are expanding in number and/or distribution and the species is widely distributed	Da NOT APPLICABLE	Db NOT APPLICABLE	Dc NSS6	Dd NSS7

Table 2. Description of SWAP NSS Matrix Limiting Factors

Limiting Factors	a. EXTREME Limiting factors are severe and continue to increase in severity	b. SEVERE Limiting factors are severe and not increasing significantly	c. MODERATE Limiting factors are moderate and appear likely to increase in severity	d. MINIMAL Limiting factors are moderate and not likely to increase in severity
Habitat	Deteriorating Significant ongoing and increasing loss of habitat or extremely limited habitat	Restricted Significant loss of habitat	Vulnerable Habitat is vulnerable but not currently restricted; increases in habitat loss likely	Stable Habitat is secure and/or widespread
Human activity	Highly sensitive Disturbance significantly and increasingly impacting populations	Sensitive Disturbance significantly impacting populations	Adaptive Disturbance currently results in moderate population reductions; additional losses likely	Tolerant Species routinely occupies disturbed environments and habitats closely associated with humans
Genetics	Deteriorating Species significantly declining in genetic purity or ongoing hybridizations	Restricted Unaltered genetic base is severely restricted geographically or genetically	Vulnerable Unaltered genetic base is currently stable but vulnerable to hybridization or loss of genetic diversity	Stable Desired genetic base is secure and widespread
Invasive species	Deteriorating Invasive species causing significant and increasing population impacts and loss of habitat	Restricted Invasive species causing significant population impacts or loss of habitat	Vulnerable Invasive species impacts moderate but expected to increase in severity	Stable No current or expected impacts from invasive species
Others Disease Contaminants Climate change				

Changes in SGCN from 2005

The re-evaluation of SGCN for the revised 2010 SWAP resulted in 180 species receiving SGCN designation (Table 3). This included 56 birds, 46 mammals, 30 fish, 8 amphibians, 21 reptiles, 5 crustaceans, and 14 mollusks.[4] Wyoming's 2005 CWCS included 279 SGCN.[5] Reasons for changes in SGCN status are listed in Appendix B.

SGCN Prioritization

Due to resource limitations, it is not possible to provide equal attention to all of Wyoming's SGCN and achieve quantifiable conservation results. SWAPs are required to be coordinated with federal, state, and local agencies. Increasingly, these entities are looking to the SWAP for guidance in directing wildlife conservation activities.

By itself, the WGFD's NSS ranking system has limitations in conveying conservation priority. First, the NSS system does not take into account the issue of peripheral ranges. A species could be common and secure throughout its range, but receive a high NSS rank solely because Wyoming is on the periphery of its range. The NSS ranking system does not differentiate these species from species that have a substantial portion of their range in Wyoming and are facing increasing threats, or from species that have limited ranges in the state, but for which Wyoming is likely to play a significant role in national or international conservation. Secondly, NSS rank does not take into account science and wildlife management limitations or economic, social, or political factors, which are necessary to consider when designing conservation strategies. Lastly, the new NSSU designation deviates from the numerical designation given to other NSS ranks. No differentiation is made between species where population data is lacking and threat levels are known to be increasing, and species with lacking survey data that are not believed to be facing increasing threats.

To address these shortcomings, an SGCN conservation prioritization system was developed. The system was designed to provide a clear and transparent mechanism to focus internal and external conservation efforts toward species where there is the greatest likelihood of preventing future listings under the Endangered Species Act and for which conservation activities will provide the greatest benefits for native species, natural habitats, and the state.

The following six variables were approved by the Wyoming Game and Fish Commission (1/28/2010) to evaluate the conservation priority of SGCN. Descriptions for each variable are found in Appendix A.

1. WGFD NSS rank.
2. Wyoming's contribution to the species' overall conservation.
3. Regulatory/monetary impacts of the species' listing under the Endangered Species Act.
4. Urgency of conservation action.
5. Ability to implement effective conservation actions.
6. The species' ecological or management role as keystone, indicator, or umbrella species.

Numerical scores were assigned to each of these variables and summed to provide a total score. SGCN were placed into one of three tiers based on their total score: Tier I – highest priority, Tier II – moderate priority, and Tier III – lowest priority. Prioritization scores were assigned by two or more WGFD biologists who have considerable knowledge about the SGCN. If the difference in total scores by any two individuals resulted in a species being placed in different tiers, then the relevant variables were

[4] Includes four groups of mollusks and one group of crustaceans.

[5] The 279 SGCN designated in 2005 included 54 mammals, 60 birds, 26 reptiles, 12 amphibians, 40 fishes, 19 crustaceans, and 68 mollusks Of these species, 235 received the SGCN designation either partly or solely because of a lack of sufficient information to adequately assesses their conservation status.

discussed to reach consensus about the appropriate tier for the species. The tier for any SGCN may be reviewed annually if circumstances change or new data becomes available.

Species ranked NSS1 – NSS4 were treated differently than NSSU species. This was due to the lack of sufficient information about NSSU species to adequately assess some prioritization variables and also because of an absence of a numerical NSS rank. The prioritization system for NSS1 – NSS4 and NSSU is as follows:

NSS1 – NSS4

1. The NSS rank of the species is subtracted from 5 and multiplied by 6: [(5-NSS)×6]. This would result in scores of NSS1=24, NSS2=18, NSS3=12, NSS4=6.
2. The species is assigned a score of 1–10 based on the variable "Wyoming's contribution to the species' overall conservation"; 10 being the highest contribution and 1 being the lowest contribution. The WYNDD G rank (global chance of extinction) and Wyoming Conservation Contribution score were consulted in determining this score.
3. The species is assigned a score of 1–5; 5 being highest and 1 the lowest for each of the following variables:
    a. Regulatory/monetary impacts of the species' listing under the Endangered Species Act.
    b. Urgency of conservation action.
    c. Ability to implement effective conservation actions.
    d. The species' ecological or management role as a keystone, indicator, or umbrella species.

    A species ranked NSS 1 – NSS4 has a maximum of 54 points. Species with a total score of 1–18 are Tier III, 19–36 are Tier II, 37–54 are Tier I.

NSSU

1. NSSU species are assigned a score of 1–12 based on the variable "Wyoming's contribution to the species' overall conservation"; 12 being the highest contribution and 1 being the lowest contribution.
2. Next, a score of 1–6 is assigned for each of the following variables; 6 being the highest and 1 the lowest:
    a. Regulatory/monetary impacts of the species' listing under the Endangered Species Act.
    b. Urgency of conservation action

An NSSU species can have a maximum of 24 points. Species with a total score of 1–8 are Tier III, 9–16 are Tier II, and 17–24 are Tier I.

TABLE 3. – Wyoming 2010 SGCN

(SGCN are organized by taxa, conservation, and priority tier and then alphabetized by common name).

Taxa Group	Common Name	Scientific Name	2010 NSS Cell	Tier
Birds	Common Loon	*Gavia immer*	NSS1 (Aa)	I
	Bald Eagle	*Haliaeetus leucocephalus*	NSS2 (Ba)	I
	Greater Sage-Grouse	*Centrocercus urophasianus*	NSS2 (Ba)	I
	Burrowing Owl	*Athene cunicularia*	NSSU (U)	I
	Ferruginous Hawk	*Buteo regalis*	NSSU (U)	I
	Great Gray Owl	*Strix nebulosa*	NSSU (U)	I
	Mountain Plover	*Charadrius montanus*	NSSU (U)	I
	Northern Goshawk	*Accipiter gentilis*	NSSU (U)	I
	Trumpeter Swan	*Cygnus buccinator*	NSS2 (Ba)	II
	American Bittern	*Botaurus lentiginosus*	NSS3 (Bb)	II
	Ash-throated Flycatcher	*Myiarchus cinerascens*	NSS3 (Bb)	II
	Barrow's Goldeneye	*Bucephala islandica*	NSS3 (Bb)	II
	Black Tern	*Chlidonias niger*	NSS3 (Bb)	II
	Black-crowned Night-heron	*Nycticorax nycticorax*	NSS3 (Bb)	II
	Boreal Owl	*Aegolius funereus*	NSS3 (Bb)	II
	Bushtit	*Psaltriparus minimus*	NSS3 (Bb)	II
	Canvasback	*Aythya valisineria*	NSS3 (Bb)	II
	Caspian Tern	*Hydroprogne caspia*	NSS3 (Bb)	II
	Forster's Tern	*Sterna forsteri*	NSS3 (Bb)	II
	Franklin's Gull	*Larus pipixcan*	NSS3 (Bb)	II
	Harlequin Duck	*Histrionicus histrionicus*	NSS3 (Bb)	II
	Juniper Titmouse	*Baeolophus ridgwayi*	NSS3 (Bb)	II
	Lesser Scaup	*Aythya affinis*	NSS3 (Bb)	II
	Long-billed Curlew	*Numenius americanus*	NSS3 (Bb)	II
	Northern Pintail	*Anas acuta*	NSS3 (Bb)	II
	Peregrine Falcon	*Falco peregrinus*	NSS3 (Bb)	II
	Redhead	*Aythya americana*	NSS3 (Bb)	II
	Snowy Egret	*Egretta thula*	NSS3 (Bb)	II
	Virginia Rail	*Rallus limicola*	NSS3 (Bb)	II
	Western Scrub-jay	*Aphelocoma californica*	NSS3 (Bb)	II
	White-faced Ibis	*Plegadis chihi*	NSS3 (Bb)	II
	Bobolink	*Dolichonyx oryzivorus*	NSS4 (Bc)	II
	Brewer's Sparrow	*Spizella breweri*	NSS4 (Bc)	II
	Chestnut-collared Longspur	*Calcarius ornatus*	NSS4 (Bc)	II

Taxa Group	Common Name	Scientific Name	2010 NSS Cell	Tier
	Columbian Sharp-tailed Grouse	*Tympanuchus phasianellus columbianus*	NSS4 (Bc)	II
	Dickcissel	*Spiza americana*	NSS4 (Bc)	II
	Grasshopper Sparrow	*Ammodramus savannarum*	NSS4 (Bc)	II
	Lark Bunting	*Calamospiza melanocorys*	NSS4 (Bc)	II
	McCown's Longspur	*Calcarius mccownii*	NSS4 (Bc)	II
	Sage Sparrow	*Amphispiza belli*	NSS4 (Bc)	II
	Sage Thrasher	*Oreoscoptes montanus*	NSS4 (Bc)	II
	Short-eared Owl	*Asio flammeus*	NSS4 (Bc)	II
	American Three-toed Woodpecker	*Picoides dorsalis*	NSSU (U)	II
	Black Rosy-Finch	*Leucosticte atrata*	NSSU (U)	II
	Black-backed Woodpecker	*Picoides arcticus*	NSSU (U)	II
	Brown-capped Rosy-Finch	*Leucosticte australis*	NSSU (U)	II
	Clark's Grebe	*Aechmophorus clarkii*	NSSU (U)	II
	Lewis's Woodpecker	*Melanerpes lewis*	NSSU (U)	II
	Northern Pygmy-Owl	*Glaucidium gnoma*	NSSU (U)	II
	Pygmy Nuthatch	*Sitta pygmaea*	NSSU (U)	II
	Swainson's Hawk	*Buteo swainsoni*	NSSU (U)	II
	Upland Sandpiper	*Bartramia longicauda*	NSSU (U)	II
	Greater Sandhill Crane	*Grus canadensis tabida*	NSS4 (Bc)	III
	Willow Flycatcher	*Empidonax traillii*	NSS4 (Cb)	III
	Merlin	*Falco columbarius*	NSSU (U)	III
	Yellow-billed Cuckoo	*Coccyzus americanus*	NSSU (U)	III
Mammals	Black-footed Ferret	*Mustela nigripes*	NSS1 (Aa)	I
	Canada Lynx	*Lynx canadensis*	NSS1 (Aa)	I
	Townsend's Big-eared Bat	*Corynorhinus townsendii*	NSS2 (Ba)	I
	Wyoming Pocket Gopher	*Thomomys clusius*	NSS3 (Bb)	I
	Pygmy Shrew	*Sorex hoyi*	NSS2 (Ab)	II
	Canyon Mouse	*Peromyscus crinitus*	NSS3 (Bb)	II
	Cliff Chipmunk	*Neotamias dorsalis*	NSS3 (Bb)	II
	Dwarf Shrew	*Sorex nanus*	NSS3 (Bb)	II
	Fringed Myotis	*Myotis thysanodes*	NSS3 (Bb)	II
	Great Basin Pocket Mouse	*Perognathus parvus*	NSS3 (Bb)	II
	Hispid Pocket Mouse	*Chaetodipus hispidus*	NSS3 (Bb)	II
	Idaho Pocket Gopher	*Thomomys idahoensis*	NSS3 (Bb)	II
	Long-eared Myotis	*Myotis evotis*	NSS3 (Bb)	II

Taxa Group	Common Name	Scientific Name	2010 NSS Cell	Tier
	Long-legged Myotis	*Myotis volans*	NSS3 (Bb)	II
	Northern Myotis	*Myotis septentrionalis*	NSS3 (Bb)	II
	Piñon Mouse	*Peromyscus truei*	NSS3 (Bb)	II
	Plains Harvest Mouse	*Reithrodontomys montanus*	NSS3 (Bb)	II
	Plains Pocket Gopher	*Geomys bursarius*	NSS3 (Bb)	II
	Preble's Shrew	*Sorex preblei*	NSS3 (Bb)	II
	Pygmy Rabbit	*Brachylagus idahoensis*	NSS3 (Bb)	II
	Silky Pocket Mouse	*Perognathus flavus*	NSS3 (Bb)	II
	Spotted Bat	*Euderma maculatum*	NSS3 (Bb)	II
	Water Vole	*Microtus richardsoni*	NSS3 (Bb)	II
	Wolverine	*Gulo gulo*	NSS3 (Bb)	II
	Bighorn Sheep	*Ovis canadensis*	NSS4 (Bc)	II
	Moose	*Alces alces*	NSS4 (Bc)	II
	Northern Flying Squirrel	*Glaucomys sabrinus*	NSS4 (Bc)	II
	Preble's Meadow Jumping Mouse	*Zapus hudsonius preblei*	NSS4 (Bc)	II
	American Marten	*Martes americana*	NSS4 (Cb)	II
	Big Brown Bat	*Eptesicus fuscus*	NSS4 (Cb)	II
	Little Brown Myotis	*Myotis lucifugus*	NSS4 (Cb)	II
	Olive-backed Pocket Mouse	*Perognathus fasciatus*	NSS4 (Cb)	II
	Swift Fox	*Vulpes velox*	NSS4 (Cb)	II
	Western Small-footed Myotis	*Myotis ciliolabrum*	NSS4 (Cb)	II
	American Pika	*Ochotona princeps*	NSSU (U)	II
	Eastern Red Bat	*Lasiurus borealis*	NSSU (U)	II
	Northern River Otter	*Lontra canadensis*	NSSU (U)	II
	Pallid Bat	*Antrozous pallidus*	NSS3 (Bb)	III
	Plains Pocket Mouse	*Perognathus flavescens*	NSS3 (Bb)	III
	Hayden's Shrew	*Sorex haydeni*	NSS4 (Bc)	III
	Spotted Ground Squirrel	*Spermophilus spilosoma*	NSS4 (Bc)	III
	Uinta Chipmunk	*Neotamias umbrinus*	NSS4 (Bc)	III
	Yellow-pine Chipmunk	*Neotamias amoenus*	NSS4 (Bc)	III
	Vagrant Shrew	*Sorex vagrans*	NSS4 (Cb)	III
	Fisher	*Martes pennanti*	NSSU (U)	III
	Least Weasel	*Mustela nivalis*	NSSU (U)	III
Fish	Bluehead Sucker	*Catostomus discobolus*	NSS1 (Aa)	I
	Flannelmouth Sucker	*Catostomus latipinnis*	NSS1 (Aa)	I

Taxa Group	Common Name	Scientific Name	2010 NSS Cell	Tier
	Kendall Warm Springs Dace	*Rhinichthys osculus thermalis*	NSS1 (Aa)	I
	Roundtail Chub	*Gila robusta*	NSS1 (Aa)	I
	Sturgeon Chub	*Macrhybopsis gelida*	NSS1 (Aa)	I
	Colorado River Cutthroat Trout	*Oncorhynchus clarkii pleuriticus*	NSS2 (Ba)	I
	Yellowstone Cutthroat Trout	*Oncorhynchus clarkii bouvieri*	NSS2 (Ba)	I
	Northern Leatherside Chub	*Gila copei*	NSSU (U)	I
	Finescale Dace	*Phoxinus neogaeus*	NSS2 (Ab)	II
	Hornyhead Chub	*Nocomis biguttatus*	NSS2 (Ab)	II
	Pearl Dace	*Margariscus margarita*	NSS2 (Ab)	II
	Suckermouth Minnow	*Phenacobius mirabilis*	NSS2 (Ab)	II
	Western Silvery Minnow	*Hybognathus argyritis*	NSS2 (Ab)	II
	Bonneville Cutthroat Trout	*Oncorhynchus clarkii utah*	NSS3 (Bb)	II
	Burbot	*Lota lota*	NSS3 (Bb)	II
	Goldeye	*Hiodon alosoides*	NSS3 (Bb)	II
	Iowa Darter	*Etheostoma exile*	NSS3 (Bb)	II
	Plains Minnow	*Hybognathus placitus*	NSS3 (Bb)	II
	Plains Topminnow	*Fundulus sciadicus*	NSS3 (Bb)	II
	Sauger	*Sander canadensis*	NSS3 (Bb)	II
	Shovelnose Sturgeon	*Scaphirhynchus platorynchus*	NSS3 (Bb)	II
	Mountain Whitefish	*Prosopium williamsoni*	NSS4 (Bc)	II
	Snake River Cutthroat Trout	*Oncorhynchus clarkii*	NSS4 (Cb)	II
	Brassy Minnow	*Hybognathus hankinsoni*	NSS4 (Bc)	III
	Common Shiner	*Luxilus cornutus*	NSS4 (Bc)	III
	Flathead Chub	*Platygobio gracilis*	NSS4 (Bc)	III
	Bigmouth Shiner	*Notropis dorsalis*	NSS4 (Cb)	III
	Central Stoneroller	*Campostoma anomalum*	NSS4 (Cb)	III
	Northern Plains Killifish	*Fundulus kansae*	NSS4 (Cb)	III
	Orangethroat Darter	*Etheostoma spectabile*	NSSU (U)	III
Amphibian	Boreal Toad	*Anaxyrus boreas boreas*	NSS1 (Aa)	I
	Wyoming Toad	*Anaxyrus baxteri*	NSS1 (Aa)	I
	Great Basin Spadefoot	*Spea intermontana*	NSSU (U)	I
	Woodfrog	*Lithobates sylvaticus*	NSS2 (Ba)	II
	Columbia Spotted Frog	*Rana luteiventris*	NSS3 (Bb)	II
	Great Plains Toad	*Anaxyrus cognatus*	NSSU (U)	III
	Northern Leopard Frog	*Lithobates pipiens*	NSSU (U)	III

Taxa Group	Common Name	Scientific Name	2010 NSS Cell	Tier
	Plains Spadefoot	*Spea bombifrons*	NSSU (U)	III
Reptile	Midget Faded Rattlesnake	*Crotalus oreganus concolor*	NSS1 (Aa)	I
	Northern Tree Lizard	*Urosaurus ornatus wrighti*	NSS1 (Aa)	II
	Great Basin Gophersnake	*Pituophis catenifer deserticola*	NSS2 (Ba)	II
	Northern Rubber Boa	*Charina bottae*	NSS3 (Bb)	II
	Pale Milksnake	*Lampropeltis triangulum multistriata*	NSS3 (Bb)	II
	Smooth Greensnake	*Opheodrys vernalis*	NSS3 (Bb)	II
	Black Hills Red-bellied Snake	*Storeria occipitomaculata pahasapae*	NSSU (U)	II
	Plains Black-headed Snake	*Tantilla nigriceps*	NSSU (U)	II
	Plains Gartersnake	*Thamnophis radix*	NSSU (U)	II
	Plains Hog-nosed Snake	*Heterodon nasicus*	NSSU (U)	II
	Prairie Lizard	*Sceloporus consobrinus*	NSSU (U)	II
	Prairie Racerunner	*Aspidoscelis sexlineatus viridis*	NSSU (U)	II
	Red-Sided Gartersnake	*Thamnophis sirtalis parietalis*	NSSU (U)	II
	Valley Gartersnake	*Thamnophis sirtalis fitchi*	NSSU (U)	II
	Greater Short-horned Lizard	*Phrynosoma hernandesi*	NSS4 (Bc)	III
	Western Painted Turtle	*Chrysemys picta bellii*	NSS4 (Bc)	III
	Western Spiny Softshell	*Apalone spinifera hartwegi*	NSS4 (Bc)	III
	Great Basin Skink	*Plestiodon skiltonianus utahensis*	NSSU (U)	III
	Great Plains Earless Lizard	*Holbrookia maculata maculata*	NSSU (U)	III
	Northern Many-lined Skink	*Plestiodon multivirgatus multivirgatus*	NSSU (U)	III
	Ornate Box Turtle	*Terrapene ornata ornata*	NSSU (U)	III
Crustaceans	Pilose Crayfish	*Pacifastacus gambelii*	NSSU (U)	II
	Calico Crayfish	*Orconectes immunis*	NSS4 (U)	III
	Devil Crayfish	*Cambarus diogenes*	NSSU (U)	III
	Ringed Crayfish	*Orconectes neglectus*	NSSU (U)	III
	Shrimp	Combined account	NSSU (U)	III
Mollusks	Jackson Lake Springsnail	*Pyrgulopsis robusta*	NSSU (U)	I
	Oreohelix Mountain Snails	Combined account	NSSU (U)	I
	Aquatic Snails	Combined account	NSSU (U)	II
	California Floater	*Anodonta californiensis*	NSSU (U)	II

Taxa Group	Common Name	Scientific Name	2010 NSS Cell	Tier
	Cave Physa	*Physella spelunca*	NSSU (U)	II
	Cylindrical Papershell	*Anodontoides ferussacianus*	NSSU (U)	II
	Fatmucket	*Lampsilis siliquoidea*	NSSU (U)	II
	Giant Floater	*Pyganodon grandis*	NSSU (U)	II
	Land Snails	Combined account	NSSU (U)	II
	Plain Pocketbook	*Lampsilis cardium*	NSSU (U)	II
	Western Pearlshell	*Margaritifera falcata*	NSSU (U)	II
	White Heel Splitter	*Lasmigona complanata*	NSSU (U)	II
	Pill Clams	Combined account	NSSU (U)	III
	Pond snails (Stagnicola)	Combined account	NSSU (U)	III

SGCN Accounts and Database

Each SGCN is included in the SWAP and has a species account that provides information on the species and its conservation needs. A database was created to store this information as part of the 2010 revision of the SWAP. The database is intended to advance SGCN conservation efforts by facilitating the updating, searching, reporting, tracking, and sharing of information. In the future, the database may be expanded to include information on non-SGCN species. Database applications may eventually include an interactive web-based feature to allow other agencies and the public to query information about Wyoming's SGCN.

Information for species accounts was provided by the WGFD biologists who are most familiar with the species. Drafts of mammal and bird species accounts were reviewed by the WGFD's Supervisor of Biological Services; fish, amphibian, and reptile species accounts were reviewed by the Fisheries Management Coordinator. Species accounts were also made available to WYNDD for additional input.

Species Accounts are alphabetized by common name. At present, each species account includes the following information:

- The species' common and scientific name.
- Abundance – Abundant, Common, Uncommon, Unknown.
- Status – WGFD NSS rank with an explanation of matrix row (limiting factor) and column (population status) classification, NatureServe G rank (global chance of extinction), and WYNDD S rank (state chance of extinction).
- Introduction – information on the species' continental and Wyoming distributions and history in Wyoming, including current and past management activities, legal status, and life history information.
- Habitat – habitat locations and characteristics.
- Problems – list of threats to the species or its habitat.
- Conservation Action – actions needed for the long term conservation of the species in Wyoming.
- Monitoring/Research – information on both existing and needed monitoring and research to evaluate the species' population status and the effectiveness of conservation actions.
- Recent developments – recent conservation activities, research, policy direction, or legal decisions that have bearing on the future conservation of the species.
- Reference – literature cited within the species account, as well as leading research and conservation plans.
- Range and Distribution Maps – WYNDD and WGFD worked collaboratively to update range and distribution maps for SGCN.

SGCN Range Maps

For the purposes of the SWAP, range was defined as the best estimate of the total geographic space thought to be occupied by an individual species in Wyoming. The first step in creating SGCN range maps was to reference a set of North American range maps compiled by NatureServe (http://www.natureserve.org/getData/animalData.jsp). These maps were essentially hand-drawn polygons representing a compilation of published continental-scale range maps for each species. These maps were then modified to fit high-resolution, 10-digit watershed (HUC) boundaries from the National Hydrography Dataset (Simley and Carswell 2009). This step provided a common spatial unit—the 10-digit HUC—for all SGCN range maps.

The HUC-based range maps were then reviewed and modified by WYNDD zoologists to accommodate local knowledge and documented occurrences maintained in the

WYNDD Biotics Database and the WGFD Wildlife Observation System (WOS). A series of meetings was then convened to allow state and regional experts to provide detailed comments and modifications. Reptile and amphibian meetings were held May 26 – 27, 2009; bird meetings were held September 14 – 15, 2009; and mammal meetings were held September 15 – 16, 2009. Representatives from the WGFD and WYNDD attended all meetings, and representatives from other organizations (e.g., USDA Forest Service, USDI Bureau of Land Management, regional universities, environmental consultants, and regional non-profit groups) were present at some meetings. The occurrence of a species within each watershed was classified into five categories: Known Recent Resident, Suspected Recent Resident, Accidental Occupant, Historical Resident, or Never a Resident. For SWAP SGCN range mapping purposes, "Known Recent Resident" and "Suspected Recent Resident" HUCs were considered to be within a species' range,[6] while "Accidental Occupant," "Historical Occupant," and "Never a Resident" HUCs were considered outside a species' range. Species ranges were mapped as the combined boundaries of "Known Recent Resident" and "Suspected Recent Resident" HUCs. Additional information about the SGCN range mapping process can be found in Keinath et al. (2010a).

SGCN Distribution Maps

For the purposes of the SWAP, distribution is defined as a spatial subset of range. It refers to environments within a species' range that are suitable for that species' occupation. In contrast to "range," which considers species presence based solely on geographic space, "distribution" considers habitats where species could occur based on measured environmental characteristics. Given incomplete knowledge of species occurrence for most SGCN, species distributions were estimated by modeling suitable environments. The distribution model for a given SGCN was created by first attributing points of known occurrence for that species with multiple environmental measurements (e.g., elevation, mean annual precipitation, vegetation type), then by extrapolating this data to identify similar environments across Wyoming using established statistical techniques (e.g., Beauvais et al. 2006).

Points of known occurrence were obtained from the WYNDD Biotics Database, the WGFD WOS, and several ancillary datasets compiled by WYNDD specifically for this effort. These sources resulted in roughly 270,000 SGCN locations, which were systematically evaluated and filtered for accuracy and consistency following methods developed at WYNDD (Keinath et al. 2010b). Environmental measurements were derived from a variety of publically available sources and generally fell within six major categories: climate, hydrology, land cover, landscape structure, substrate, and terrain. Details on these sources of information and how they were applied to distribution maps can be found in Keinath et al. (2010b).

Maximum Entropy methods were used to select important environmental variables and summarize the environment at points of known SGCN occurrence (Phillips et al. 2006, Phillips and Dudik 2008, Keinath et al. 2010b). The result is a continuous model that estimates, for 30-meter cells across Wyoming, the probability of that cell being suitable habitat for the SGCN in question. To create maps for the SWAP, a binary threshold was specified that divided the continuous output into two categories: predicted presence and predicted absence.

The quality of distribution models was evaluated using multiple methods, both quantitative and qualitative, including prediction accuracy based on ten-fold cross-validation, statistics derived

[6] "Known Recent Resident" indicates that the species is known to occur in a watershed based on recently documented observations and/or the knowledge of expert range mapping participants. Observations made in 1985 or later qualified as recent. "Suspected Recent Resident" indicates that range mapping participants were not aware of any recent (i.e., 1985 or later) observations of a species in a watershed, but they believed the species to occur in the watershed at the time of mapping based on species characteristics and probable suitability of habitat within the watershed.

from receiver-operating characteristic analyses, evaluations of input data quality, and the expert opinion of biologists regarding how well final models reflected their understanding of species' distributions (Fielding and Bell 1997, Freeman and Moisen 2008). Validation statistics are provided for each SGCN by Keinath et al. (2010b).

Range maps tend to overestimate where a species occurs, since range polygons generally include some unsuitable habitat. In contrast, locations of documented occurrence usually drastically underestimate where a species occurs, particularly when systematic survey efforts are lacking, as is the case for most SGCN. For example, some small-mammal and reptile SGCN have ranges encompassing more than half of Wyoming, while there are only a handful of documented occurrences in the state. Distribution models are intended to bridge this gap by using occurrence data to quantify the environments where a species is known to occur and spatially map similar areas within that species' range. Thus, distribution maps identify areas where a species could potentially occur based on current information and should not be interpreted as depicting known occurrence. Models are only as good as the data used to create them, so models with few known occurrences and/or poor validation statistics (Keinath et al. 2010b) should be used with caution. Further, SGCN distribution models were created at the state-level scale and are only suitable for analyses conducted at a similar scale, such as identifying coarsely-defined areas of conservation concern or quantifying state-wide patterns of potential distribution.

SGCN Monitoring

The 2005 CWCS placed the highest priority on completing sufficient inventories on those SGCN whose status could not be adequately documented in Wyoming. Bird and mammal SGCN are reviewed annually by the Terrestrial Nongame Section of the WGFD. Species with sufficient distribution and general abundance data to indicate status are included in the "inventories adequate" ranking total. However, any species that has limiting factors which appear to be increasing in severity, or that has been petitioned for listing under the ESA must have a system implemented for monitoring population trends before it is included in the adequate ranking category. If such a monitoring program is lacking, WGFD develops proposals and solicits needed funding but does not include them in the adequate count.

The WGFD developed a timeline to complete by 2014 sufficient inventories to evaluate, strengthen the current knowledge of, and potentially reclassify the status of, 34 of 40 fishes, 57 of 114 birds and mammals, 8 of 12 amphibians, and 15 of 26 reptiles originally identified as sensitive in Wyoming's 2005 CWCS. All sensitive species inventory work is planned to be completed by 2020. As of July 2010, 24 of 54 (44 percent) of the mammals, 55 of 60 (91 percent) birds, 2 of 26 (8 percent) reptiles, 4 of 10 (33 percent) amphibians, and 25 of 40 (63 percent) fishes,.and none of the 19 crustaceans or 68 mollusks had sufficient inventory data to document their security in Wyoming.

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Appendix A

SGCN Prioritization Variable Descriptions

Descriptions are not intended to be exclusive, but to serve as a guide regarding the type of information that should be considered in providing a prioritization score.

WGFD NSS Rank – the Wyoming Game and Fish Department (WGFD) Native Species Status (NSS) rank is an evaluation of the Wyoming population status of a species, including its size and distribution, versus limiting factors such as habitat availability and intensity of threats. NSS rank also indentifies species where there is a lack of information to adequately assess conservation status.

Regulatory/Monetary Impacts – extent of potential regulatory or monetary impacts of a species' listing under the Endangered Species Act (ESA).

Consideration could include:

1. Size of the species' range and overlap with other land uses.
2. Current economic contribution of the species (both consumptive and non-consumptive).
3. Type of restrictions necessary to address the species' conservation needs.

Urgency of Conservation Action – accounts for issues associated with the immediacy of the need for conservation action. This variable would capture issues that either occurred subsequent to the designation of the species' NSS rank or that were not considered. These issues may include:

1. New threats.
2. Increases in severity of existing threats.
3. New data that show a significant, persistent decline in the species' population, distribution, or habitat.
4. Likelihood and immediacy of potential ESA listing.
5. Funding or partnership opportunities that are time limited.

Wyoming's Contribution to the Species' Overall Conservation – this variable would address the significance of the role that Wyoming would likely play in the species' overall conservation. It would take into consideration:

1. The Wyoming Natural Diversity Database (WYNDD) G rank (global chance of extinction) and Wyoming Conservation Contribution score.
2. The proportion of the species' overall range that is in Wyoming.
3. The health and size of the species' population in Wyoming compared to those in other portions of its range.
4. Population status and level of conservation activity in surrounding states and other portions of the species' range.

Ability to Implement Effective Conservation Actions – the ability to achieve quantifiable beneficial outcomes in stopping or reversing population declines for the species in Wyoming. This variable includes an evaluation of statutory, scientific, or technological limitations in reversing leading population and habitat threats.

The species' ecological or management role as a keystone, indicator species, or umbrella

species. Indicator species are those species whose population status is a good indicator of the overall health of the habitat it occupies. A keystone species is a species that plays a significant role in shaping and defining the habitat in which it lives. Umbrella species are species selected for making conservation-related decisions, typically because protecting these species indirectly protects the many other species that make up the ecological community of its habitat.

Appendix B

Taxonomy of SGCN Bird and Mammals

Mammals

The Wyoming Game and Fish Department uses the Revised Checklist of North American Mammals North of Mexico (Baker et al. 2003) as the taxonomic reference for mammals in Wyoming. The checklist, first published in 1973, undergoes periodic review and summarizes taxonomic changes that have occurred in the recognized mammalian fauna of North America. According to the checklist, the taxonomy of several mammalian groups remains unresolved at the species level; consequently it is difficult to provide support for elevating subspecies to specific status. Therefore, the WGFD gives no consideration to specific subspecies in Wyoming at this time, except for the Preble's meadow jumping mouse (*Zapus hudsonius preblei*). The taxonomy issue was resolved following the publication of the checklist by King et al. (2006); consequently this subspecies warrants specific status in this revised SWAP.

Baker, R.J., L. C. Bradley, R. D. Bradley, J. W. Dragoo, M. D. Engstrom, R. S. Hoffman, C. A. Jones, F. Reid, D. W. Rice, and C. Jones. 2003. Revised checklist of North American mammals north of Mexico, 2003. Museum of Texas Tech University. Occasional papers 229.

King, T.L., M. S. Eackles, and C.C. Young. 2006. Microsatellite DNA markers for assessing phylogeographic and population structure in Preble's meadow jumping mice (*Zapus hudsonius preblei*) and cross-amplification among neighbouring taxa. Molecular Ecology 6:670-673.

Birds

The American Ornithologists' Union (AOU) Check-list of North American Birds, 7th Edition (AOU 1988) is the official source on the taxonomy of the birds of North and Middle America. In addition, AOU Supplements to the Check-list provide annual updates based on the most recent scientific findings, and are published each July in the scientific journal *The Auk*. The Check-list of North American Birds and its supplements are produced by the AOU's North American Classification Committee (NACC), whose mission is to keep abreast of the systematics and distribution of the birds of North and Middle America in order to create a standard classification. The NACC favors using more than one area of evidence over single data sets for taxonomic changes at species and higher levels (e.g., multiple genetic loci, or genes plus other traits), and prefers to act conservatively in its treatments of taxonomy and nomenclature. Thus, without supporting data, the NACC may reject proposals that cause instability or that suggest taxonomic change without strong substantiation.

The Wyoming Game and Fish Department uses the AOU Check-list of North American Birds, along with its annual supplements, as the definitive source for avian scientific and common names, species codes, subspecies delineations, and order in which species appear on the official State list. Currently, there are no occurrences of avian subspecies in Wyoming that would alter the Species of Greatest Conservation Need Tier ranking.

American Ornithologists' Union. 1983. Check-list of North American Birds. 7th edition. American Ornithologists' Union, Washington, D.C.

Appendix B
SGCN Changes from 2005 CWCS

	Birds	Mammals	Fish	Reptiles	Amphibians	Mollusks	Crustaceans
New research or survey information			Added Brassy Minnow Northern Plains Killifish Calico Crayfish Removed Lake Chub Quillback				Added Calico Crayfish Pilose Crayfish Ringed Crayfish Removed Ganbelii Crayfish NeglectusCrayfish
Grouping little known mollusks and crustaceans						Added Aquatic Snails[i] Land Snails[ii] Oreohelix Mountain Snails[iii] Pill Clams Stagnicola Pondsnails[iv]	Added Shrimp[v]
Naturally restricted Wyoming population but regionally secure.	Removed American White Pelican Great Blue Heron Scott's Oriole Western Grebe	Removed Abert's Squirrel Black-tailed Prairie Dog Meadow Jumping Mouse		Removed Plateau Fence Lizard Prairie Rattlesnake	Removed American Bullfrog Tiger Salamander		

	Birds	Mammals	Fish	Reptiles	Amphibians	Mollusks	Crustaceans
NSS rank change resulting from revised matrix		Added American Pika Eastern Red Bat Uinta Chipmunk Yellow-pine Chipmunk Removed Grizzly Bear Hoary Bat Prairie Vole Sagebrush Vole Silver-haired Bat Water Shrew Western-heather Vole White-tailed Prairie Dog	Removed Black Bullhead Channel Catfish Mottled Sculpin Mountain Sucker River Carpsucker Shorthead Redhorse Stonecat Paiute Sculpin	Removed Bullsnake Eastern Yellow-bellied Racer Northern Sagebrush Lizard Wandering Gartersnake	Removed Boreal Chorus Frog Rocky Mountain Toad		
Outside of WGFD jurisdiction			Removed Arctic Grayling Westslope Cutthroat				
Recently discovered undocumented species				Added Great Basin Skink			
Taxonomic change		Added Preble's Meadow Jumping Mouse		Removed Common Gartersnake (split to subspecies Valley Gartersnake and Red-sided Gartersnake) Northern Plateau Lizard Red-lipped Plateau Lizard (Lumped to Plateau Fence Lizard) Added: Prairie Lizard (Originally subspecies of Plateau Fence Lizard and was designated Northern Prairie Lizard in previous species list. This subspecies was elevated to species status and has been separated from the Northern Plateau Lizard).		Removed Physella integra Physella heterostropha Physella virgata Added Pewter Physa (Synonyms of the species above)	

	Birds	Mammals	Fish	Reptiles	Amphibians	Mollusks	Crustaceans
NSS rank change resulting from revised matrix		Added American Pika Eastern Red Bat Uinta Chipmunk Yellow-pine Chipmunk Removed Grizzly Bear Hoary Bat Prairie Vole Sagebrush Vole Silver-haired Bat Water Shrew Western-heather Vole White-tailed Prairie Dog	Removed Black Bullhead Channel Catfish Mottled Sculpin Mountain Sucker River Carpsucker Shorthead Redhorse Stonecat Paiute Sculpin	Removed Bullsnake Eastern Yellow-bellied Racer Northern Sagebrush Lizard Wandering Gartersnake	Removed Boreal Chorus Frog Rocky Mountain Toad		
Not NN1-4, NSSU		Removed Uinta Ground Squirrel Wyoming Ground Squirrel					

[i] Mud Amnicola, Rocky Mountain Duskysnail, Fragile Ancylid, Creeping Ancylid, Green River Pebblesnail, Ashy Pebblesnail, Dusky Fossaria, Rock Fossaria, Golden Fossaria, Pygmy Fossaria, Disc Gyro, Star Gyro, Ash Gyro, Two-ridge Rams-horn, Great Basin Rams-horn, Cloaked Physa, Glass Physa, Pumpkin Physa, Rotund Physa, Olive Physa, Tadpole Physa, Pewter Physa, Protean Physa, Rocky Mountain Physa, Utah Physa, Meadow Rams-horn, Rough Rams-horn, Marsh Rams-horn, Sharp Sprite, Umbilicate Sprite, Ribbed Dagger, Bear Lake Springsnail, Indecisive Vallonia, Glossy Valvata, and Mossy Valvata.

[ii] Lance Aplexa, Sierra Ambersnail, Slope Ambersnail, Striate Disc, Niobrara Ambersnail, Callused Vertigo Snail, and Vertigo Paradoxa (a terrestrial snail).

[iii] Keeled Mountain Snail, Mineral Creek Mountain Snail, Pygmy Mountain Snail, Rocky Mountain Snail, Berry's Mountain Snail, Cooper's Rocky Mountain Snail, a land snail (Hells Canyon), and Morgan Creek Mountain Snail.

[iv] Stagnicola Pondsnails, Abbreviate Pondsnail, Fat-whorled Pondsnail, Wrinkled Marshsnail, Woodland Pondsnail, Marsh Pondsnail, Rustic Pondsnail, Mountain Marshsnail , and Widelip Pondsnail.

[v] San Francisco Brine Shrimp, Pocked Pouch Fairy Shrimp, Colorado Fairy Shrimp, Giant Fairy Shrimp, Versitle Fairy Shrimp, Rock Pool Fairy Shrimp, Circumpolar Fairy Shrimp, Eastern Alkali Fairy, Shrimp, Knobbedlip Fairy Shrimp, Ethologist Fairy Shrimp, Lemon Tadpole Shrimp, New Mexico Fairy Shrimp, Crenatethumb Fairy Shrimp, Greater Plains Fairy Shrimp, Beavertail Fairy Shrimp, and Longtail Tadpole Shrimp.