

Herpetology of the Coronado National Forest: Managing Our Natural Heritage

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Abstract—The Coronado National Forest (CNF) is the primary public land management agency for the United States' portion of the Madrean Archipelago. The region has a large diversity of amphibians and reptiles, with approximately 110 native species occurring on the CNF. Management of the CNF's herpetofauna is regulated primarily by environmental laws and policies. Sixteen taxa are variously listed as threatened, endangered, sensitive, and management indicators; potential effects to these taxa must be considered before habitat-disturbing projects can be implemented.

Introduction

The United States' portion of the Madrean Archipelago is situated in southeastern Arizona and southwestern New Mexico, an area that overlaps much of the Coronado National Forest (CNF). Hence, the CNF is the primary public land management agency of the montane and foothill habitats of most of the U.S. Madrean Archipelago. The CNF manages all or part of 17 Madrean Sky Islands—all of the larger U.S. ranges except the Dos Cabezas, Baboquivari, Mule, and Animas Mountains.

The biodiversity of the region's herpetofauna has been discussed elsewhere, including this symposium (Gloyd 1937; Lowe 1964; Jones, this volume; Stitt and others, this volume; Swann and others, this volume). Currently, about 110 native species of amphibians and reptiles are recognized from the Northern Sky Island Realm (Jones, this volume). While it is unknown which species actually occur within the boundaries of the CNF, it seems likely that the great majority are represented. This is due to the spatial coverage and ecological heterogeneity of the CNF. Unlike many National Forests, parts of the CNF include some desert and grassland habitats. The CNF has a legal obligation to manage the public lands it administers, and maintaining the natural heritage is paramount to the success of that mission.

Environmental Laws and Policy

The National Forest System manages public lands using guidance from federal laws and policies, especially those addressing environmental issues. The Endangered Species Act (ESA) is of paramount importance, because it deals with taxa whose survival may be tenuous. Endangered "species" (which may include sub-specific taxa or distinct populations) are those that are or could become extirpated or extinct in the foreseeable future, while Threatened taxa are those that could become Endangered. The ESA carries the heaviest legal weight, and any actions proposed on National Forest lands must adequately address potential and cumulative effects to Threatened or

Endangered (T&E) taxa. Recovery Plans and Critical Habitat designations may accompany ESA listing.

The National Environmental Policy Act (NEPA) and National Forest Management Act (NFMA) have additional language addressing conservation of habitats and populations of flora and fauna. These laws state that the National Forest must maintain viable populations of all species, well-distributed across their administered lands. These three laws, plus language from the Forest Service Handbook, Forest Service Manual, and other documents have been integrated into the Forest Plan. The Forest Plan, which is reviewed internally and externally, determines Forest management during the following 10 years or so.

To ensure compliance with the intent of environmental laws, the Forest Service compiles taxa lists with the aid of external experts. In addition to the USDI Fish and Wildlife Service (FWS) ESA list, the Forest Service maintains a Regional Forester's Sensitive Species list and a Management Indicator Species (MIS) list. The former includes taxa that have no federal ESA status, but these populations or habitats are considered uncommon and could be at risk. MIS include taxa in the following categories: state and federal T&E; having special habitat needs that may be influenced by management; commonly hunted or fished; nongame, of special interest; and indicators of changes due to management practices. Currently listed Threatened, Endangered, Sensitive, and Management Indicator amphibians and reptiles for the CNF are presented in table 1.

Taxa of Concern

The taxa listed in table 1 are considered to be taxa "of concern." Three of the species are listed as T&E: Sonoran tiger salamander (*Ambystoma tigrinum stebbinsi*, E), Chiricahua leopard frog (*Rana chiricahuensis*, T), and New Mexico ridge-nosed rattlesnake (*Crotalus willardi obscurus*, T). These species are legally elevated above all others and must be carefully considered when proposing any habitat-disturbing activities. However, management and mitigation for these species

Table 1—Amphibian and reptile taxa of concern, plus those with Conservation Agreements (completed or in progress), on or near the Coronado National Forest, with their distribution by Ranger District.

Common name	Scientific name	Status ²	Ranger District ¹					Total by species
			D1	D2	D3	D4	D5	
Sonora tiger salamander	<i>Ambystoma tigrinum stebbinsi</i>	E			X			1
Chiricahua leopard frog	<i>Rana chiricahuensis</i>	T	X	X	X	X		4
Lowland leopard frog	<i>R. yavapaiensis</i>	S		X	X	X	X	4
Ramsey Canyon leopard frog	<i>R. subaquavocalis</i>	C			X			1
Tarahumara frog ³	<i>R. tarahumarae</i>	M		X ³				1
Western barking frog	<i>Eleutherodactylus augusti cactorum</i>	S		X	X			2
Mountain treefrog	<i>Hyla wrightorum</i>	M			X			1
Desert tortoise (Sonoran Desert population)	<i>Gopherus agassizi</i>	C		X		X	X	3
Giant spotted whiptail	<i>Aspidoscelis stictogramma</i>	S	X	X	X	X	X	5
Gray checkered whiptail ⁴	<i>A. dixonii</i>	S	X					1
Desert massasauga ⁴	<i>Sistrurus catenatus edwardsi</i>	M	X		X ³			2
Western black kingsnake	<i>Lampropeltis getula nigrita</i>	S	X	X	X			3
Northern Mexican gartersnake	<i>Thamnophis eques megalops</i>	S		X	X		X	3
New Mexico ridge-nosed rattlesnake	<i>Crotalus willardi obscurus</i>	T	X					1
Arizona ridge-nosed rattlesnake	<i>C. w. willardi</i>	S		X	X			2
Twin-spotted rattlesnake	<i>Crotalus pricei</i>	M	X	X	X	X		4
Total by District	----		8	10	12	5	4	----

¹ Known or expected to occur within or near Forest boundary. D1 = Douglas District (Chiricahua, Dragoon, and southern Peloncillo Mountains); D2 = Nogales District (Pajarito, Atascosa, Tumacacori, and Santa Rita Mountains); D3 = Sierra Vista District (Huachuca, Whetstone, and Patagonia Mountains, Canelo Hills); D4 = Safford District (Pinaleño, Galiuro, Santa Teresa, and Winchester Mountains); D5 = Santa Catalina District (Santa Catalina and Rincon Mountains).

² E = endangered, T = threatened, S = Forest Service sensitive, M = Forest Service management indicator, C = conservation agreement.

³ Extirpated in the United States, but plans involve reintroduction.

⁴ Not recorded from within the CNF boundaries

can be beneficial to other species. Both *R. chiricahuensis* and *A. tigrinum stebbinsi* are aquatic obligates, as are five other species in table 1 (the other ranid frogs and *Thamnophis eques*). The aquatic obligates are the taxa of greatest concern to the CNF. Most species are declining, some at an alarming rate (Jones and Sredl, this volume). The Tarahumara frog (*R. tarahumarae*) has been extirpated from the United States and was previously known only from the CNF in the United States.

Similarly, *Crotalus willardi obscurus* and the three other rattlesnakes in table 1 have similar management concerns. The two ridge-nosed rattlesnake subspecies have indirect riparian associations but are not riparian obligates. The Sonoran population of the desert tortoise (*Gopherus agassizi*), found on the western edge of the CNF, has only recently been suggested as declining based on anecdotal data from monitoring plots. The gray checkered whiptail (*Aspidoscelis dixonii*), an all-female parthenogenic species, is only known from the vicinity of the Peloncillo Mountains of New Mexico (but has not been reported from within the boundaries of the CNF) and in a very small area of southwestern Texas.

The other taxa in table 1 have limited distributions and disjunct populations in the United States but are more widespread elsewhere (especially Mexico).

Management Issues

Potential management concerns can be categorized as aquatic or terrestrial issues. As mentioned above, taxa that are closely

associated with an aquatic environment are the greatest concern for the CNF. Native tiger salamanders, ranid frogs, and Mexican gartersnakes, in particular, are in need of immediate conservation measures. Potential threats to these species include pumping and diversion of ground water, water pollution, mining, disease, competition and predation from native and non-native predators, habitat change, overgrazing, compromised meta-population dynamics, and climate change and drought.

Terrestrial ecosystem health has also declined since the appearance of European settlers into the American Southwest. Urbanization, recreation, altered fire regimes (including fire suppression), anthropogenic habitat shifts, and the introduction of invasive, non-native plants and animals have taken their toll on terrestrial environments. Some species, such as Madrean rattlesnakes (*C. willardi*, *C. lepidus*, and *C. pricei*) and gila monsters (*Heloderma suspectum*), are highly sought after by illegal collectors.

Cooperators, Partners, Authorities, and Jurisdictions

The CNF has the authority to manage habitats of amphibians and reptiles within the boundaries of their administered lands. The CNF also manages Special Use Permits, which are required for most activities (exclusive of hunting or fishing) occurring on National Forest lands. However, given the complexities of managing habitats and populations, the CNF relies on numerous cooperating agencies and non-governmental

organizations (NGO's) to assist in amphibian and reptile conservation programs. The FWS oversees issues related to T&E species and their habitats and populations. The New Mexico Department of Game and Fish and the Arizona Game and Fish Department (NMDGF, AGFD) have jurisdiction over the non-federal T&E fauna, as well as game management and wildlife law enforcement. Some amphibians and reptiles are classified as fish and game species, respectively, in Arizona. In both states, there is protection from commercial take without a permit and protection for state T&E (New Mexico designation) and Wildlife Species of Concern in Arizona (Arizona designation). FWS, NMDGF, and AGFD also manage Scientific Collection permits for amphibians and reptiles within their authority. In most cases, these agencies may make decisions about managing populations without going through the NEPA process (but there is an internal NEPA-like checklist); however, proposals are usually reviewed by CNF biologists who can help determine if NEPA documentation is warranted.

Universities, NGOs, tribal governments, and other state and federal agencies play important roles in amphibian and reptile research and conservation. Besides inventory, research, and monitoring (IRM), which are discussed in the next section, these entities have many functions. The Nature Conservancy deals primarily with land exchanges and managing sensitive habitats. Examples on or near the CNF include Ramsey Canyon in the Huachucas and Muleshoe Ranch in the Galiuros; both places have amphibian and reptile species of concern. Environmental organizations such as the Sky Island Alliance, Centers for

Biological Diversity, and National Audubon Society help ensure the interests of the environmental community are met by public land management agencies—a form of checks and balances. The Tucson Herpetological Society and Partners in Amphibian and Reptile Conservation address native herp conservation issues; the CNF works cooperatively with these NGOs.

Inventory, Research, and Monitoring

The National Forest System has authority to conduct inventory and monitoring of habitat and populations under the auspices of administrative studies, but research must be conducted by the research branch of the Forest Service, the Rocky Mountain Research Station (RMRS), or by other agencies or NGOs. The RMRS wildlife program has been involved mostly with studies of raptor ecology to date, although a comparison of the herpetofauna of several Sky Islands has been conducted by the Wildlife Program (W. Block, pers. comm.) and the Borderland Program has contracted studies on montane rattlesnakes. The University of Arizona (UA), Arizona State University (ASU), and Western New Mexico University (WNMU) have carried out most studies of the amphibians and reptiles on the CNF, but numerous other colleges and universities have also been involved. Table 2 summarizes some of the recent IRM activities. The entries in table 2 are not all-inclusive, but reflect responses to an email survey and known special use permits.

Table 2—Examples of some recent inventory, research, and monitoring (IRM) activities on the Coronado National Forest, from an email query sent to numerous herpetologists.

IRM categories	Taxa	Habitats and locations	Agencies, NGOs ¹
Taxa surveys	Ranids, Sonoran tiger salamanders, barking frogs, Mexican gartersnakes, bunch grass lizard, giant spotted whiptails, ornate box turtles, Sky Island rattlesnakes, exotics	Various, Forest-wide	FS, AGFD, NMDGF, ACA,
Road surveys	San Bernardino Valley, Stockton Pass Road, Portal Road, Haekel Rd, Marijilda Canyon	Chiricahuas, Pinaleños	FS, ACA
Genetic studies	Ranids, whiptails, night snakes, spiny lizards, horned lizards	Forest-wide	AGFD, FWS, ACA
Ecological studies	Fire and herps, drought and herps, habitat associations; mountain spiny lizards, Sky Island rattlesnakes, black-tailed rattlesnakes, ranid frogs, horned lizards, Gila monsters, Sonoran mud turtle	Chiricahuas, Pinaleños,	ACA, AGFD, NMDGF
Aquatic surveys	Ranids, Sonoran tiger salamanders, Mexican gartersnakes, explosive-breeding anurans, Sonoran mud turtles	Lotic, lentic, and riparian, Forest-wide	FS, AGFD, NMDGF, ACA,
Local, regional surveys	Whetstones, Pinaleños, Red Rock Canyon, Sky Island comparisons	Whetstones, Chiricahuas, Pinaleños, Huachucas, Santa Ritas, Santa Catalinas, Red Rock Canyon, Rock Creek, Peloncillos	RMRS, ACA

¹ ACA = various academic institutions; other acronyms in text

Managing the Herpetofauna on the CNF

The primary responsibility of CNF biologists is assessing and mitigating effects of proposed actions on flora and fauna, particularly species of concern (for amphibians and reptiles, those in table 1). When the biologist receives a proposal, he or she conducts surveys for species of concern in the proposed project area and does literature evaluations to determine the likely effects of the action on the taxa (and habitat) occurring in the area. This is done by preparing a specialist's report, Biological Assessment and Evaluation, and/or MIS Report. Mitigation is usually built into the documents and helps refine the proposed action. If there is a finding that the action may affect individuals, populations, or habitats of T&E taxa, the CNF must consult with the FWS. The FWS may or may not concur with the findings and may issue a Biological Opinion (BO). The BO may address terms and conditions, a "take" statement, and conservation recommendations for T&E taxa, and may include monitoring requirements. Due to space limitations this is an oversimplification of the NEPA process.

Habitat improvement projects by the CNF and its cooperators include aquatic and terrestrial site renovations. In aquatic habitats, sensitive riparian sites have been fenced or partially fenced to control overgrazing, tanks have been cleaned out, new ponds have been built, and harmful non-natives have been removed from select lentic systems. Fuel reduction projects (removal of excessive woody debris) via fuelwood sales, understory removal, prescribed burns, and forest and woodland restoration projects are becoming increasingly important terrestrial wildlife habitat management practices.

In addition to complying with the requirements of various documents, the CNF may be proactive. Some examples include the 2002 native ranid frog survey, which was done in anticipation of the listing of the Chiricahua leopard frog, and the follow-up 2003 surveys in the Galiuros Mountains (Jones and Sredl, this volume). The CNF has also been proactive by participating on interagency teams for recovery plans, conservation and strategic agreements, and re-introduction plans. These teams have helped set the pace for dynamic conservation plans (some in progress) for *A. tigrinum stebbinsi* (recovery plan), *R. chiricahuensis* (recovery plan), *R. yavapaiensis* (strategic plan), *R. blairi* (strategic plan), *R. subaquavocalis* (conservation agreement), *R. tarahumarae* (re-introduction), and Sonoran Desert population of *G. agassizi* (conservation agreement).

Suggestions for Improving Management of the Amphibians and Reptiles on the CNF

The CNF has room to improve management of their herpetofaunal resources. The current Regional Forester's Sensitive Species and MIS lists are inadequate (particularly the latter) for meeting our conservation objectives. Both lists

are Forest Service-generated, so the Forest Service must be responsible for managing these taxa and ensuring monitoring needs are met. A useful MIS list should 1) be concise, 2) include only taxa that occur across the CNF, 3) have populations that can be logistically and statistically monitored (i.e., with adequate power to detect trends), and 4) be appropriate indicators of management practices across the major biotic communities. Hence, future lists must be more carefully scrutinized than previous iterations before becoming finalized.

One of our greatest challenges is to continue to be effective conservationists in a changing political arena. As an example, the Healthy Forest Restoration Act has led to an increased emphasis on terrestrial fuels reduction projects, while aquatic and riparian projects are currently considered "low priority." However, most of the threatened, endangered, and sensitive species are aquatic dependents. This means that we must be creative in finding additional resources and mechanisms to ensure survival of the aquatic herpetofauna. To that end, increased interagency cooperation and the pursuit of additional grant money may become a critical future direction.

While the CNF addresses the conservation needs of many species, activities are often more re-active than pro-active. Too much time is spent responding to B.O.'s and in litigation, instead of recognizing and addressing wildlife conservation needs up front. However, the CNF is increasingly more proactive with early interagency involvement with conservation and strategic plans. The CNF has a legal obligation to conserve our natural heritage, including its herpetofauna. The challenge lies in keeping focused on environmental laws and policies and conservation issues in a changing social and political environment.

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