

CONSERVATION AGREEMENT FOR LAND SNAILS IN THE PINALEÑO MOUNTAINS ON THE CORONADO NATIONAL FOREST IN ARIZONA

Between the

U.S. Fish and Wildlife Service,
Coronado National Forest,
and
Arizona Game and Fish Department

Authored by the Cooperating Agencies of the
Pinaleno Land Snail Working Group



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Cover image: *Sonorella* snails in Twilight Canyon. Photograph by Jeff Sorensen (2013).

ACRONYMS FREQUENTLY USED IN THIS DOCUMENT:

ARS	Arizona Revised Statutes
AGFD	Arizona Game and Fish Department
BMP	Best Management Practice
CA	Conservation Agreement
CCA	Candidate Conservation Agreement
CCAA	Candidate Conservation Agreement with Assurances
CFR	Code of Federal Regulations
CNF	Coronado National Forest
EAC	Environmental Assessment Checklist
ESA	Endangered Species Act of 1973 (as amended)
FOIA	Freedom of Information Act
FSM	Forest Service Manual
FWCA	Fish and Wildlife Coordination Act of 1974
PLSWG	Pinaleno Land Snail Working Group
LRMP	Land and Resource Management Plan
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
PECE	Policy for Evaluation of Conservation Efforts
SSA	Species Status Assessment
USC	United States Code
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service

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DEFINITIONS

Pinaleño Land Snail Working Group

Formal team of biologists and resource managers representing various land/resource management agencies that provide a collaborative approach to the conservation of native land snails of the Pinaleño Mountains, and that will assume responsibility over the ongoing implementation of the Conservation Agreement.

CA Parties

Signatories to the Conservation Agreement that are providing commitments to implement conservation actions for Pinaleño land snails.

COVERED LANDS

This Conservation Agreement covers the Pinaleño Mountains on Coronado National Forest, encompassing 198,411 acres of land, Graham County, Arizona. The legal description of this mountain range is as follows: T7S, R22E, Sections 22-28 and 32- 36; T7S, R23E, Sections 19 and 25-36; T7S, R24E, Sections 31- 35; T8S, R22E, Sections 1- 5, 8-16, 22-26, 35-36, and portions of Sections 6, 7, 17, and 18; T8S, R23E, all sections; T8S, R24E, all sections; T8S, R25E, Sections 7, 16-21, 27- 34, and portions of sections 22 and 35; T9S, R23E, Sections 1-4 and 9-14; T9S, R24E, Sections 1-30 and 33-36; T9S, R25E, all sections; T10S, R24E, Sections 1-4, 10-14, 23-26, 35, and 36; T10S, R25E, all sections; T10S, R26E, Sections 6, 7, 17-20, and 29-32; T11S, R24E, Section 1; T11S, R25E, Sections 1-27; T11S, R26E, Sections 5-7, 18, 19, and 30.

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1. INTRODUCTION AND PURPOSE

In June 2007, Forest Guardians (now WildEarth Guardians) petitioned the U.S. Fish and Wildlife Service (USFWS or Service) to list 475 species in the southwestern United States including the Wet Canyon talussnail (*Sonorella macrophalus*), Pinaleño talussnail (*S. grahamensis*), and Clark Peak talussnail (*S. christenseni*) as threatened or endangered under the Endangered Species Act of 1973, amended (ESA). On December 16, 2009, the USFWS issued a positive 90-day finding that the petition presented substantial scientific information indicating that listing of 67 species included in the petition may be warranted, including the Wet Canyon talussnail and Pinaleño talussnail (USFWS 2009). With these findings, the USFWS initiated a status review of the Wet Canyon talussnail and Pinaleño talussnail to determine if listing is warranted. The USFWS also found that the petition did not present substantial information indicating that listing may be warranted for 125 species, including the Clark Peak talussnail (USFWS 2009). In addition, the USFWS reached a settlement agreement with the plaintiff in 2017 that removed the Wet Canyon talussnail for consideration for listing under the ESA (Cotton 2017). Therefore, the Clark Peak talussnail and Wet Canyon talussnail are currently not being considered for listing under the ESA. The USFWS currently plans to complete a status review of the Pinaleño talussnail to determine if listing is warranted by October 1, 2020 (USFWS 2018).

The USFWS, Arizona Game and Fish Department (AGFD or Department) and Coronado National Forest (CNF or Forest) had previously covered the Wet Canyon talussnail under an earlier Conservation Agreement (CA), which expired in December 2004. This group was assembled to engage the various land/resource management agencies to provide a cooperative and collaborative planning approach to conservation of Pinaleño land snails. From this initial conservation planning group and effort, the Pinaleño Land Snail Working Group (PLSWG) was formally assembled in October 2016. Collaborating members of the PLSWG have developed a cooperative conservation agreement intended to: (1) help reduce or minimize the likelihood of extirpation or extinction of the covered species, and (2) prevent loss and improve quality of land snail habitat in the Pinaleño Mountains. In pursuing these species conservation goals, the PLSWG will be open to participation by other government agencies, private landowners, and non-governmental organizations interested in the conservation of the Pinaleño land snails.

USFWS has established policy and provided guidance to facilitate development of conservation agreements for ESA candidate species (USFWS 2008). This guidance involves combining existing tools under sections 7 and 10 of the ESA to aid partners in developing these agreements. “The primary goal of the plan [conservation agreement] would be to guide the implementation of specific conservation efforts for covered species-at-risk, so that listing them under the ESA will not be necessary. Recognizing that it is not always possible to preclude the need to list a candidate species, the secondary goal would be to integrate processes available under ESA sections 7 and 10 so as to reduce uncertainty about potential changes in land/resources uses that might be necessary if the covered species is listed in the future.” (USFWS 2008). Federal agencies have special obligations for the conservation of listed species, as specified in section 7 of the ESA, and Candidate Conservation Agreements (CCA) are primarily developed by federal agencies to cover species conservation on federal lands.

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The Conservation Agreement for the Pinaleño land snails (Pinaleño Land Snail CA) is intended to complement existing strategic-level conservation and management plans (such as Arizona's State Wildlife Action Plan and Coronado National Forest's Forest Plan) that support the conservation of land snail populations and habitat in the Pinaleño Mountains. The Pinaleño Land Snail CA will serve as the primary mechanism for implementing collaborative conservation among the PLSWG partners for the duration of the agreement. The Pinaleño Land Snail CA has been developed as a cooperative effort among federal and state agencies to provide effective conservation of these covered species in Arizona. Agencies and other entities electing to participate in the Pinaleño Land Snail CA will be referred to as "Parties" to the agreement and will be recognized as cooperating members of the PLSWG. The purpose of the Pinaleño Land Snail CA is to collectively identify practical conservation measures and provide a comprehensive mechanism for implementing proactive land snail conservation measures across the species' range in the Pinaleño Mountains. The Parties (identified in section 3, herein) intend to organize a cooperative, range-wide approach to Pinaleño land snail management and conservation that will provide information that can be considered in the Species Status Assessment (SSA) process for Wet Canyon talussnail and Pinaleño talussnail to inform future USFWS listing decisions on these species. The Pinaleño Land Snail CA will further allow the Parties to leverage knowledge and funding within a comprehensive, range-wide conservation framework. The Pinaleño Land Snail CA is voluntary and flexible in nature, and has been developed to identify and direct effective conservation and management actions among the Parties throughout the species' range in Arizona.

All activities undertaken pursuant to this CA are intended to be in compliance with all applicable state and federal laws and regulations. Consistent with the specific commitments by, and the available resources of, the Parties, conservation actions set forth in the Pinaleño Land Snail CA will be implemented and will remain in effect for the duration of the CA.

2. CA GOALS AND OBJECTIVES

The goals and objectives of the Pinaleño Land Snail CA fall into the following main categories:

1. Achieve effective range-wide conservation and management of the Pinaleño land snails by assessing and directing lasting conservation measures in Arizona. The CA is designed to provide a comprehensive conservation framework for deploying effective land snail conservation and management actions, such that:
 - a. Land snail populations and habitats are more effectively identified, inventoried and conserved through time;
 - b. The Parties can develop and implement conservation measures aimed at maintaining or enhancing land snail habitat and populations; and,
 - c. The ability of the Parties to monitor the response of the species to conservation and management actions is enhanced as a result of the cooperative/comprehensive framework provided through the CA such that the effectiveness of the conservation strategy can be assessed.

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2. Initiate and facilitate ongoing cooperation and collaboration among the various agencies and entities that can potentially serve a productive role in species conservation. The CA is designed to encourage, facilitate and direct effective land snail conservation actions across multiple agencies and entities having the potential to directly influence species conservation in Arizona. Parties to the CA intend to identify existing snail conservation measures and efforts, while sharing conservation expertise and information across a broad range of organizations. This also allows for an organized conservation approach that encourages coordinated actions and uniform reporting, integrates monitoring and research efforts with management, and supports ongoing conservation partnership formation.

The Parties to this CA are committed to striving for and achieving goals and objectives such that the Pinaleño land snails and their distribution of populations and habitat would be conserved in Arizona, and that accompanying threats to the species may be effectively reduced and managed across its Arizona range. Once commitments are secured through this CA, the effectiveness of conservation measures would be considered in any future USFWS determinations relating to species status of Pinaleño land snails and decisions to list any of the snails under the ESA. Accordingly, the Parties involved in the implementation of the Pinaleño Land Snail CA seek to further the conservation status of these covered species. In the event that any of these land snails are listed under the ESA, this CA can form the foundation of a conservation model and framework for future recovery planning and consultations through section 7 of the ESA.

This document is designed to meet USFWS requirements of CAs by providing land/resource management participants in Arizona a mechanism to voluntarily commit to implement specific actions designed to remove or reduce threats to a covered species in an effort to enhance its conservation status. As specified in the USFWS Policy for the Evaluation of Conservation Efforts (PECE) (USFWS 2003), these conservation measures/criteria are designed to ensure the certainty that the conservation efforts will be implemented and that when implemented, the conservation efforts will be effective. To facilitate the USFWS evaluation of PECE in making species listing decisions, USFWS cooperators contributed extensively to the development of the Pinaleño Land Snail CA by both facilitating the development of the agreement and serving as active members of the PLSWG.

3. PARTIES TO THE CA

3.1 Pinaleño Land Snail Working Group Composition

This Pinaleño Land Snail CA has been developed as a collaborative and cooperative effort among land and resource management agencies to facilitate implementation of effective conservation measures for the covered species in Arizona. The PLSWG is an interagency team assembled to engage various land/resource management agencies to provide a comprehensive and collaborative planning approach to Pinaleño land snail conservation. The PLSWG is open to participation by federal, state, tribal or county agencies interested in advancing the conservation

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of land snails in the Pinaleño Mountains. The following subsections outline the various agencies that comprise the PLSWG and that are recognized as Parties to this CA.

3.2 Participating Federal Agencies

- U.S. Fish and Wildlife Service - Arizona Ecological Services Office
- U.S. Forest Service - Coronado National Forest

3.3 Participating State Agencies

- Arizona Game and Fish Department

4. ROLE OF NON-FEDERAL LANDOWNERS

As of September 2016, there are no known localities of the CA-covered species occurring on non-federal lands in the Pinaleño Mountains.

5. CA PARTY AUTHORITIES

The Parties enter into this CA under authority provided by federal and state law. Nothing in this CA is intended to limit the authority of the USFWS and the USFS to fulfill its responsibilities under federal laws, or AGFD under state laws. Furthermore, nothing in this CA is to imply that any Party is in any way abrogating or ceding any responsibility or authority inherent in its sovereign ownership of, jurisdiction over, and control of its property interests or wildlife. All activities undertaken pursuant to this CA must be in compliance with all applicable state and federal laws and regulations. The signatory parties hereto enter into this CA under federal and state laws as applicable, including but not limited to, section 6(c)(1) of the ESA of 1973, as amended, the National Forest Management Act of 1976, the Sikes Act of 1960, as amended, and Arizona Revised Statutes (ARS) 17-231.B-7. This CA is subject to and is intended to be consistent with all applicable federal and state laws and international compacts.

5.1 Federal Agencies

5.1.1 U.S. Fish and Wildlife Service

Sections 2, 6, and 7 of the ESA, as amended, allow the USFWS to enter into this CA. Section 2 of the ESA states that encouraging interested parties, through federal financial assistance and a system of incentives, to develop and maintain conservation programs is a key to safeguarding the Nation's heritage in fish, wildlife, and plants. Section 7(a)(1) of the ESA requires the USFWS to review programs that it administers and to utilize such programs in furtherance of the purposes of the ESA. By entering into this CA, the USFWS is using its Candidate Conservation Programs to further the conservation of the Nation's fish and wildlife.

The ESA recognizes the State's authority to manage resident wildlife and that implementation of the ESA through the cooperative conservation programs between state fish and wildlife agencies and the USFWS is essential:

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Sec. 2.(a) FINDINGS. (5) encouraging the States and other interested parties, through Federal financial assistance and a system of incentives, to develop and maintain conservation programs which meet national and international standards is a key to meeting the Nations international commitments and to better safeguarding, for the benefit of all citizens, the Nation's heritage in fish, wildlife, and plants.

In development of the ESA, Congress realized it was critical that the Secretary of the Interior cooperate to the maximum extent possible with the States in order to effectively implement the provisions and intent of the ESA. Section 6(c)(1) of the ESA provides encouragement to the State and other interested parties, through federal financial assistance and a system of incentives, to develop and maintain conservation programs that meet national and international standards. Section 6(c)(1) of the ESA is key to meeting the United States' international commitments and to better safeguard, for the benefit of all citizens, the Nation's heritage in wildlife and plants. Section 6 of the ESA provides the authority for the Secretary to enter into cooperative agreements with the States which establish and maintain an adequate and active program for the conservation of endangered and threatened species:

Sec. 6.(a) GENERAL. In carrying out the program authorized by this Act, the Secretary shall cooperate to the maximum extent practicable with the States.

Sec. 6.(c). COOPERATIVE AGREEMENTS. In furtherance of the purposes of this Act, the Secretary is authorized to enter into a cooperative agreement in accordance with this section with any State which establishes and maintains an adequate and active program for the conservation of endangered species and threatened species...he shall enter into a cooperative agreement with the State for the purpose of assisting in implementation of the State program.

In addition to the ESA, the Fish and Wildlife Act of 1956 provides that the Secretary shall "...take such steps as may be required for the development, advancement, management, conservation, and protection of fish and wildlife resources..." 16 U.S.C. § 742f(a)(4). The Fish and Wildlife Coordination Act states that the Secretary is authorized "to provide assistance to, and cooperate with, Federal, State, and public or private agencies and organizations in the development, protection, rearing, and stocking of all species of wildlife, resources thereof, and their habitat..." 16 U.S.C. § 661.

5.1.2 U.S. Forest Service

Under the National Forest Management Act (NFMA, 16 U.S.C. §§ 1600-1614), the Sikes Act (SA, 16 U.S.C. §§ 670g – 670h), and U.S. Department of Agriculture Forest Service policy, the USFS is directed to "manage habitats for all existing native and desired nonnative plants, fish, and wildlife species in order to maintain at least viable populations of such species" and to "avoid actions which may cause a species to become threatened or endangered" (Forest Service Manual [FSM] 2670.12, 2670.22). The Regional Forester may designate species as Sensitive as described in the FSM 2670. The objectives of management for such species are to ensure their continued viability throughout their range on National Forest lands, and to ensure that they do not become threatened or endangered because of USFS actions. The *Sonorella* and *Oreohelix*

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species described in this CA are designated Sensitive on the 2013 Regional Forester's Sensitive animal list (USFS 2013).

5.2 State Agencies

5.2.1 Arizona Game and Fish Department

An important component to AGFD's mission, as detailed in Wildlife 20/20 AGFD's Strategic Plan (AGFD 2012a), Nongame Wildlife Program narrative, is to manage rare species to maintain biological diversity and to maintain and restore native species diversity, population numbers and habitats. Additional documents such as the Arizona State Wildlife Action Plan 2012-2022 (SWAP; AGFD 2012b) further support these species conservation objectives. The activities described in this CA are consistent with the objectives outlined in those documents, and will be supported to the extent practicable by the AGFD. ARS 17-231.B.7 authorizes the Arizona Game and Fish Commission to enter into this CA through its administrative agency, the AGFD.

AGFD's authority for managing ESA-listed species resides in Arizona Revised Statute (ARS) Title (17), Section 6 of the ESA, a cooperative agreement between the USFWS and AGFD granting AGFD full authorities under Section 6 of the ESA, and a Memorandum of Understanding (MOU) with Region 2 of the USFWS. The purpose of the MOU is to facilitate joint participation, communication, coordination, and collaboration between the USFWS and AGFD regarding the implementation of the ESA. Through the MOU, AGFD and USFWS share the responsibilities of Candidate, Threatened, and Endangered Species management as is relevant to the ESA.

6. CA MANAGEMENT AND ADMINISTRATION

In order to meet the objectives of this CA, the PLSWG will manage, administer, and periodically review the implementation of species conservation outlined in the Pinaleño Land Snail CA. The responsibility of this team is to coordinate the implementation and administration of the Pinaleño Land Snail CA without superseding the jurisdictional authorities of any party. In addition, the PLSWG will develop and make recommendations for the conservation and research needs of the covered species to improve management/conservation effectiveness, develop a monitoring program based on AGFD talussnail survey protocols, and identify any additional threats to the species so that appropriate conservation measures can be adopted. AGFD talussnail survey protocols are described in Sorensen and Martinez (2016).

6.1 Pinaleño Land Snail Working Group Organization

The PLSWG was formed in October 2016, and will serve as the primary mechanism for facilitating interagency coordination on Pinaleño land snail management, conservation, and research activities in Arizona. Membership of the PLSWG will consist of one or more designated representatives from each Party to this CA. The PLSWG will be chaired by AGFD.

The Parties to this CA will designate a representative to serve on the PLSWG. Designated representatives or their alternates shall participate in a minimum of one meeting of the PLSWG

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annually for the life of this CA to review progress, coordinate management and monitoring, and prioritize conservation actions. The PLSWG will coordinate the implementation of the CA and provide a forum for exchange of information. The PLSWG will in no way make recommendations to or serve as an advisory committee to any federal agency.

6.2 CA Implementation and Management

The PLSWG is responsible for coordination of the conservation activities and monitoring of the conservation actions being conducted by the Parties to encourage all actions to be in accordance with the CA. The PLSWG will conduct an annual assessment of the Parties' progress towards implementing the conservation actions described in this CA. This assessment will result in an annual report that includes recommendations for CA revisions and actions. The annual report will be based on input provided to the PLSWG by the Parties. The PLSWG will develop a standardized reporting format for the Parties to use when providing input. Following the annual assessment, the PLSWG will provide the annual report to agency leaders and interested parties that details the progress made to date on implementation of conservation actions described in the CA. The PLSWG will share information on covered species conservation actions, research, monitoring results, PLSWG meeting notes, and reports by electronic format (that is: emails, PDFs, and Microsoft program files).

6.3 Education and Outreach

The PLSWG will assess the need to develop and/or distribute outreach materials to promote Pinaleño land snail conservation and related CA goals and objectives. Parties that develop new outreach materials related to the covered species and/or its habitat will share the materials with other PLSWG members in an effort to promote consistency and effectiveness of outreach efforts. The PLSWG will coordinate the development and dispersal of public education and outreach materials. Outreach materials include, but are not limited to, pamphlets, newsletter articles and announcements, fact sheets, and other educational materials.

6.4 CCAA Expansion

This section is not applicable—as of September 2016 there are no known occurrences of the CA-covered species on non-federal lands in the Pinaleño Mountains.

7. BACKGROUND AND CURRENT STATUS OF PINALEÑO LAND SNAILS

The following is a summary of information regarding natural history, habitat, distribution, and current status on seven native species of land snails in the Pinaleño Mountains. This summary is derived from a USFWS contract report on land snails in the Pinaleño Mountains (Hoffman 1990), an AGFD technical report on the past 16 years of talussnail surveys in the Pinaleño Mountains (Sorensen and Martinez 2016), and the AGFD Heritage Data Management System (HDMS) species abstracts for Wet Canyon talussnail (*Sonorella macrophallus*), Mimic talussnail (*S. imitator*), Clark Peak talussnail (*S. christenseni*), Pinaleño talussnail (*S. grahamensis*), and Pinaleño mountainsnail (*Oreohelix grahamensis*).

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At the request of CNF, two additional species of minute land snails found in the Pinaleño Mountains are also included as covered species in this CA: the shortneck snaggletooth (*Gastrocopta dalliana*) and the cross snaggletooth (*G. quadrigens*).

7.1 Description and Natural History

Talus snails of the genus *Sonorella* are members of the family Helminthoglyptidae (Phylum Mollusca; Class Gastropoda, Subclass Pulmonata). Members of the genus are very similar, and distinguishing species from one another by casually examining shells in the field is difficult, if not impossible. Non-experts may even confuse members of the genus *Sonorella* with closely related genera including *Eremarionta*, *Mohavelix*, or *Helminthoglypta* (Bequaert and Miller 1973). Positive identification requires examination of reproductive organs by technical experts or genetic confirmation in the laboratory (Fairbanks and Reeder 1980; Weaver *et al.* 2010).

The distribution and diversity of talus snails across the arid southwest are largely products of significant dispersal and vicariance that occurred during the numerous climatic changes of the Pleistocene era (Bequaert and Miller 1973; McCord 1995). These conditions led to profuse speciation and substantial endemism amongst *Sonorella*. For instance, the Santa Rita and Patagonia mountains together contain four endemic talus snails (Bequaert and Miller 1973). Importantly, the conditions of the present-day arid Southwest render dispersal into new territories by *Sonorella* improbable (Bequaert and Miller 1973), including those occurring in the Pinaleño Mountains.

In the Pinaleño Mountains, talus snails, depending on species, occur from about 1,890 to 2,800 m (6,200 to 9,186 ft) above mean sea level. This puts them in Madrean pine-oak woodlands, ponderosa pine forests, mixed evergreen conifer forests, and subalpine (spruce/fir) forests. They are not expected in montane meadows, or lower elevational vegetation communities, including desert, semidesert grassland, or Madrean encinal woodlands (except in more mesic, riparian stringers).

Sonorella is generally considered to be associated with rock, and most references report the snail occupying rockslides and talus slopes composed of volcanic rock and/or limestone (Pilsbry 1939; Naranjo-Garcia 1988; Pearce and Orstan 2006). Most species seemingly prefer steep rock slides with sufficient interstitial spaces that allow crawling to the proper depth for protection from summer heat (Bequaert and Miller 1973; Hoffman 1990). Occupied sites can usually be identified by the presence of dead and bleached shells, which are typically abundant because they disintegrate slowly in arid environs (Pilsbry 1939). However, shells can be washed downslope into river systems (Bequaert and Miller 1973).

Unfortunately, most of the published literature discusses the taxonomy and distribution of *Sonorella*, rather than details on their population status, microhabitat associations, and natural history traits. Because most species are known to inhabit talus slopes, and the fact that they are called talus snails may lead to an overly simplistic view of their habitat associations. Talus, or scree, is defined as rock fragments that break off from the cliffs above on fairly steep mountain

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slopes and aggregate in unstable piles (natural rockslides). However, this does not completely describe occupied habitat of *Sonorella* in the Pinaleño Mountains. For example, Wet Canyon, which is occupied by at least two *Sonorella* species (*S. macrophallus* and *S. imitator*) can better be described as riparian colluvium (i.e., streamside rocks being exposed via water erosion along and upslope from incised channels). This situation has been reported elsewhere (e.g., *Sonorella* sp. in McCleary Canyon of the Santa Rita Mountains [Westland Resources 2009] and riparian areas of Leslie Canyon National Wildlife Refuge [Gilbertson and Radke 2006]). The two common features between talus and riparian colluvia are the mesic microenvironments and rock features. Some species are known to be associated with woody debris for cover (e.g., *S. odorata*, in the Santa Catalina Mountains [Gilbertson 1965]), although rock seems to be a commonly used feature among most species.

In a personal communication (8 July 2010) with Pablo Weaver, one of the researchers that conducted a genetic investigation of talussnails of the Pinaleño Mountains, Pablo offered some insightful observations on where talussnails were found. He concurred that talus slopes were not the only places to find *Sonorella*. In fact he stated, “in our travels in the Pinaleños, we did find them [*Sonorella* and *Oreohelix*] in a few talus/rockslides, but it almost seemed atypical.” Most were found under scattered rocks in partially shaded areas amongst leaf litter, or in open areas at the bottom of small contours, again, with partial shade and rocks. Both limestone and granite rock were used. Snails could be found on any aspect, provided there was a mesic microclimate. Areas that were too moist (e.g., having a dense layer of moss or litter) rarely had talussnails. A common feature was the presence of “nooks and crannies,” where snails could hide or estivate. Logs were also used as cover objects.

Thus, for our purposes, habitat for *Sonorella* and *Oreohelix* includes pine-oak and conifer forests with: (1) talus slopes (e.g., scree, natural rockslides, boulder fields); (2) streamside colluvial rock; or (3) mesic areas on hillsides with partial shade, rock, and leaf litter.

Talussnails spend a lot of time in estivation, perhaps up to three years at a time (Hoffman 1990). To prepare for estivation, talussnails use mucus and calcium to attach the aperture of the shell to the face of a rock to make a waterproof seal. Calcium carbonate from limestone aids in shell deposition and buffers carbonic acid produced by the buildup of respiratory carbon dioxide during estivation. During estivation talussnails survive by mining calcium carbonate from their shells, which is redeposited when active feeding resumes (Hoffman 1990).

Talussnails subsist primarily on fungus and decaying plant matter (Hoffman 1990; Hoffman 1995; Jontz *et al.* 2002). *Sonorella* in the Santa Rita Mountains have been reported foraging on *Xanthoparmelia*, a foliose lichen, during and after rains (Westland Resources 2009).

Weather conditions are the most important factor affecting activity of *Sonorella*, with talussnails only active above ground during or following monsoon rains (Jontz *et al.* 2002; Weaver *et al.* 2010). It is believed that most Pinaleño talussnails mature in 2-3 years with a lifespan of approximately 6 years (Hoffman 1990).

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Pulmonate snails (those that breathe with lungs) are hermaphroditic, meaning an individual snail has both male and female sex organs (Pearce and Orstan 2006). Reproduction in *Sonorella* of the Pinaleño Mountains has not been studied, though Hoffman (1990) believed that they are probably similar to other *Sonorella* species. *Sonorella* mate face-to-face and insemination is simultaneous reciprocal, meaning when two talussnails mate both are usually inseminated (Hoffman 1995; Davison and Mordan 2007).

During or after rain events, talussnails lay a clutch of 30 to 40 eggs once or twice during summer (Hoffman 1990). *Oreohelix*, in contrast, are ovoviviparous—their eggs are hatched within the parent's body—and they give birth to only five or six offspring each summer (Hoffman 1990). Fluctuations in humidity may cause large variations in rates of maturation and life span of land snails.

Slightly smaller in size to the mature *Sonorella* snails, is the Pinaleño mountainsnail, *Oreohelix grahamensis*, a member of the family Oreohelcidae, commonly called mountainsnails. The distribution of these land snails overlaps with *Sonorella* within the Pinaleño Mountains, however, the mountainsnails are more commonly found in the leaf litter within and around talus, rather than within the talus (Hoffman 1990).

Snaggletooth snails (genus *Gastrocopta*) are very small pulmonate gastropods belonging to the family Pupillidae (Turgeon *et al.* 1998). The genus is nearly worldwide in distribution. *Gastrocopta* are associated with rocks, especially limestones, or live under wood or in leaf litter (Pilsbry 1939). As with other land snails, they are somewhat at the mercy of the environment, so they need relatively mesic microhabitats in order to survive. The two species of conservation concern in the Pinaleño Mountains are shortneck snaggletooth (*G. dalliana*) and cross snaggletooth (*G. quadridens*). Possibly because they are small and extremely inconspicuous snaggletooth snails typically do not receive the attention of the larger land snails, so there is not much information published on these animals except for descriptions and distributional information.

PINALEÑO TALUSSNAIL

Species Description

The Pinaleño talussnail (*Sonorella grahamensis*, Pilsbry and Ferris 1919) is a land snail with a globose shell with about 4.5 whorls. This shell has a tan to olive tint and a chestnut-brown shoulder band, which has indistinctly pallid borders. It is approximately 19 mm (0.7 inches) in diameter.

Taxonomy

The Pinaleño talussnail was originally described by Pilsbry and Ferris (1919) from specimens collected from the Pinaleño Mountains, Graham County, Arizona. This species is considered valid by the Integrated Taxonomic Information System, Turgeon *et al.* (1998), and more recently confirmed to be genetically distinct from its congeners by Weaver *et al.* (2010).

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WET CANYON TALUSSNAIL

Species Description

The Wet Canyon talussnail (*Sonorella macrophallus*, Fairbanks and Reeder 1980) is a land snail with a globose shell with about 4.5 whorls. The shell has a tan to olive tint and a chestnut-brown shoulder band that has indistinctly pallid borders. It is approximately 18 mm (0.7 inches) in diameter.

Taxonomy

The Wet Canyon talussnail was originally described by Fairbanks and Reeder (1980) from specimens collected from the Pinaleño Mountains, Graham County, Arizona. This species is considered valid by the Integrated Taxonomic Information System, Turgeon *et al.* (1998), and more recently confirmed to be genetically distinct from its congeners by Weaver *et al.* (2010). However, Weaver *et al.* (2010) presented evidence that suggested monophyly was only weakly supported for *Sonorella macrophallus*.

MIMIC TALUSSNAIL

Species Description

The mimic talussnail (*Sonorella imitator*, Greg and Miller 1974) is a land snail with globose shell with about 4.5 whorls. Shell has tan to olive tint and a chestnut-brown shoulder band which has indistinctly pallid borders. With a diameter of approximately 20 mm (0.8 inches), the Mimic talussnail has a shell that is, on average, slightly larger than that of the Pinaleño talussnail.

Taxonomy

The mimic talussnail was originally described by Greg and Miller (1974) from specimens collected from the Pinaleño Mountains, Graham County, Arizona. This species is considered valid by the Integrated Taxonomic Information System, Turgeon *et al.* (1998), and more recently confirmed to be genetically distinct from its congeners by Weaver *et al.* (2010).

CLARK PEAK TALUSSNAIL

Species Description

The Clark Peak talussnail (*Sonorella christenseni*, Fairbanks and Reeder 1980) is a land snail with shell depressed, heliciform, convex above and below, thin, glossy, tan in color, with one chestnut-brown spiral band just above midline of rounded shoulder of body whorl; umbilicate. The shell measures approximately 20 mm (0.8 inches) in diameter and 11 mm (0.4 inches) in height.

Taxonomy

The Clark Peak talussnail was originally described by Fairbanks and Reeder (1980) from specimens collected from the Pinaleño Mountains, Graham County, Arizona. This species is considered valid by the Integrated Taxonomic Information System, Turgeon *et al.* (1998), and more recently confirmed to be genetically distinct from its congeners by Weaver *et al.* (2010).

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PINALEÑO MOUNTAINSNAIL

Species Description

The Pinaleño mountainsnail (*Oreohelix grahamensis*, Greg and Miller 1974) is a land snail with mottled shell, light brown above and lighter on the base with strong growth lines. The shell is approximately 18 mm (0.7 inches) in diameter, and is the only one in the Pinaleño Mountains that looks like this.” (Hoffman 1990).

Taxonomy

The Pinaleño mountainsnail was originally described by Greg and Miller (1974) from specimens collected from the Pinaleño Mountains, Graham County, Arizona. This species is considered valid by the Integrated Taxonomic Information System (the Forest Service taxonomic standard), Turgeon *et al.* (1998; the malacologists taxonomic standard), and more recently confirmed to be genetically distinct from its congeners by Weaver *et al.* (2010).

SNAGGLETEOTH SNAILS

Species Description

Both species of *Gastrocopta* are minute pulmonate snails, with shells that are oval, having several whorls, an expanded lip, and superficially resemble a fly pupa. Shortneck snaggleteoth (*Gasatrocopta dalliana*) is about 1.8 mm in length and 0.8 mm in width, while cross snaggleteoth (*G. quadridens*) is larger, at about 3.1 mm in length and 1.3 mm in width (Pilsbry 1939).

Taxonomy

The cross snaggleteoth was described by Pilsbry in 1916 and the shortneck snaggleteoth was described by V. Sterki in 1898 (Bequaert and Miller 1973). Both species are considered valid by the Integrated Taxonomic Information System, Turgeon *et al.* (1998) and NatureServe (accessed 13 December 2016).

7.2 Habitat

Talusnails in the Pinaleño Mountains occur from about 1,890 to 2,800 m (6,200 to 9,186 ft) above sea level, which places them in Madrean pine-oak woodlands, ponderosa pine forests, mixed evergreen conifer forests, and subalpine forests. They are not expected in mountain meadows or lower elevational vegetation communities, including desert, semi-desert grassland, or Madrean encinal woodlands (except in more mesic, riparian stringers) (Hoffman 1990).

Sonorella is generally considered to be associated with rock, and most references report the snail occupying rockslides and talus slopes composed of volcanic rock or limestone (Pilsbry 1939; Naranjo-Garcia 1988; Pearce and Orstan 2006). Most species seemingly prefer steep rock slides with sufficient interstitial spaces that allow them to crawl to the proper depth for protection from desiccation in the summer heat (Bequaert and Miller 1973; Hoffman 1990). However, the habitat occupied by *Sonorella* in the Pinaleño Mountains cannot be considered wholly talus, which is

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defined as rock fragments that break off from the cliffs above on steep mountain slopes and aggregate in unstable piles. The Wet Canyon area where two of the species (*S. macrophallus* and *S. imitator*) reside can better be described as riparian colluvium (i.e. streamside rocks exposed via water erosion alongside and upslope from incised channels). The two common features between talus and riparian colluvium are the mesic microenvironments and rock features.

It should also be noted that some species are known to be associated with woody debris for cover, though rock is a commonly used feature among most species (Gilbertson 1965). The mountainsnail (*Oreohelix grahamensis*) is not normally found within the talus and does not seem to seal to the rocks, but is rather found in the leaf litter within and around the talus (Hoffman 1990; AGFD 2016e). For these reasons, this agreement considers the habitat for *Sonorella* and *Oreohelix* as “pine-oak and conifer forests with: (1) talus slopes (e.g., scree, natural rockslides, boulder fields); (2) streamside colluvial rock; or (3) mesic areas on hillsides with partial shade, rock, and leaf litter.”

7.3 Distribution in Arizona

The covered *Sonorella* and *Oreohelix* species are limited to the Pinaleño Mountains in Arizona, and genetic analysis by Weaver *et al.* (2010) has helped identify which regions within these mountains each of the species resides. Previous collections and morphological examinations by Hoffman (1990) provided additional species locality information for these land snails. Figures 1-4 show known localities of these land snails based on collections by Hoffman (1990), Weaver *et al.* (2010), AGFD, and the USFS. Figure 5, from Weaver *et al.* (2010) shows the overlap of species distribution in the area of Heliograph Peak, Turkey Flat, and Wet Canyon.

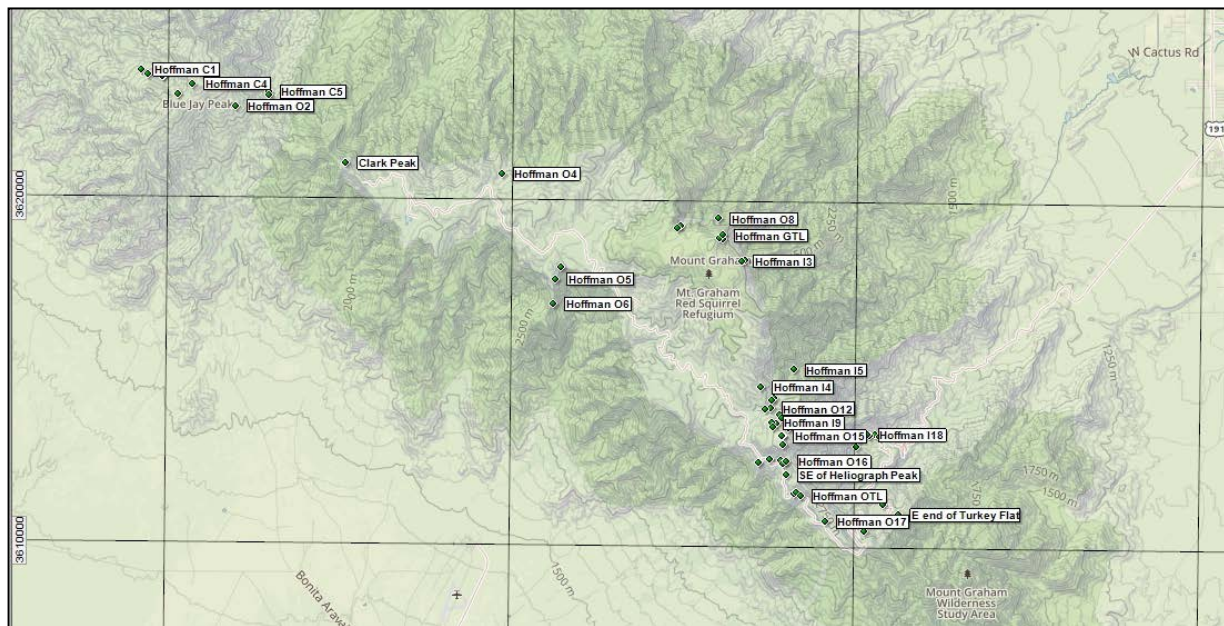


Figure 1. Overview map of Pinaleño land snail localities as of September 2016. All localities are on the Coronado National Forest, Arizona.

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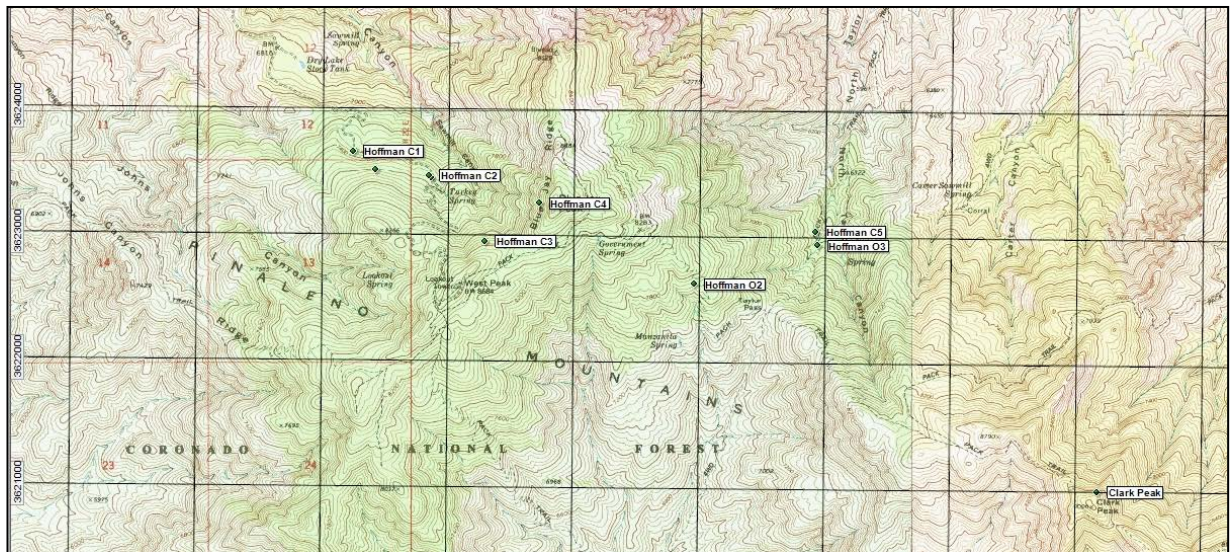


Figure 2. Map of land snail localities in the northwestern part of the Pinaleno Mountains, West Peak to Clark Peak, as of September 2016. In July 2016, a USFS biologist found a *Sonorella* shell at the locality between “Hoffman C1” and “Hoffman C2”, northwest of West Peak.

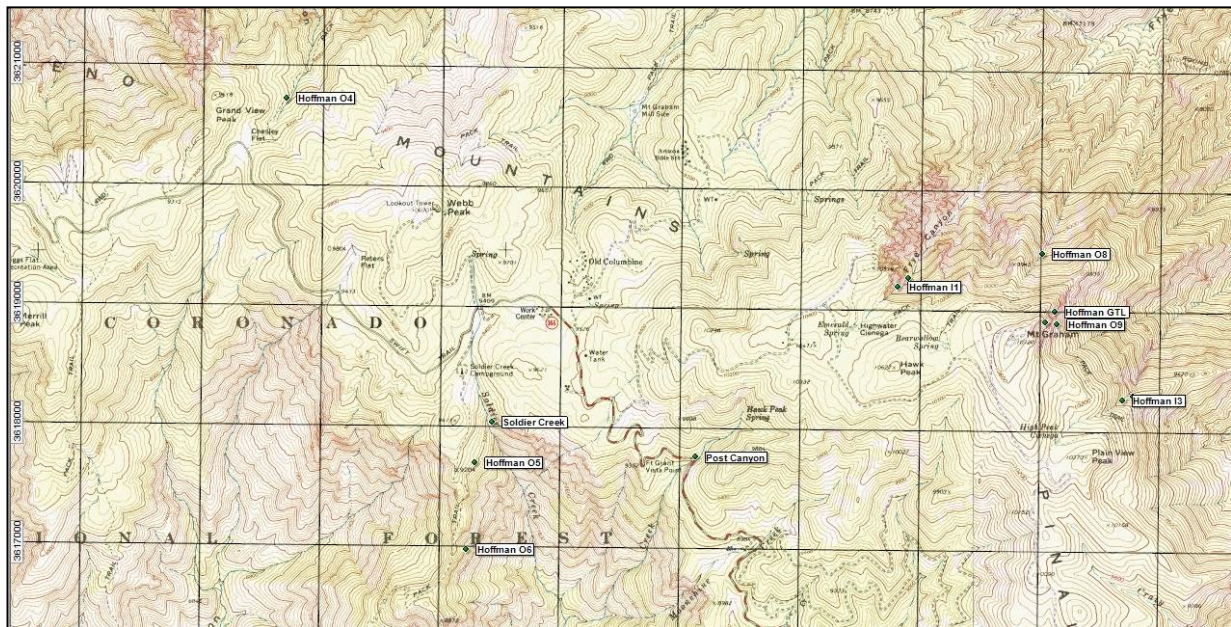


Figure 3. Map of land snail localities in the central part of the Pinaleno Mountains, Grand View Peak to Plain View Peak, including Soldier Creek and Post Canyon, as of September 2016.

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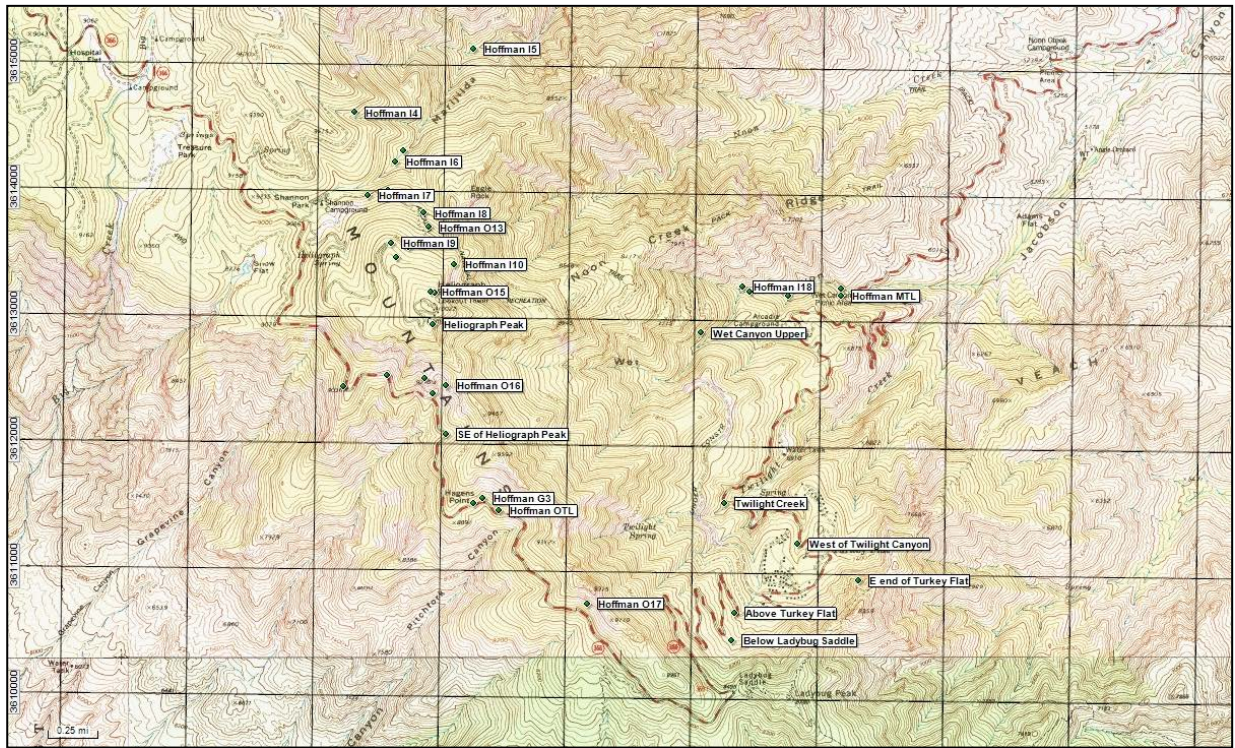


Figure 4. Map of land snail localities in the southeastern part of the Pinaleno Mountains, Marijilda Canyon to Wet Canyon and Turkey Flat, as of September 2016.

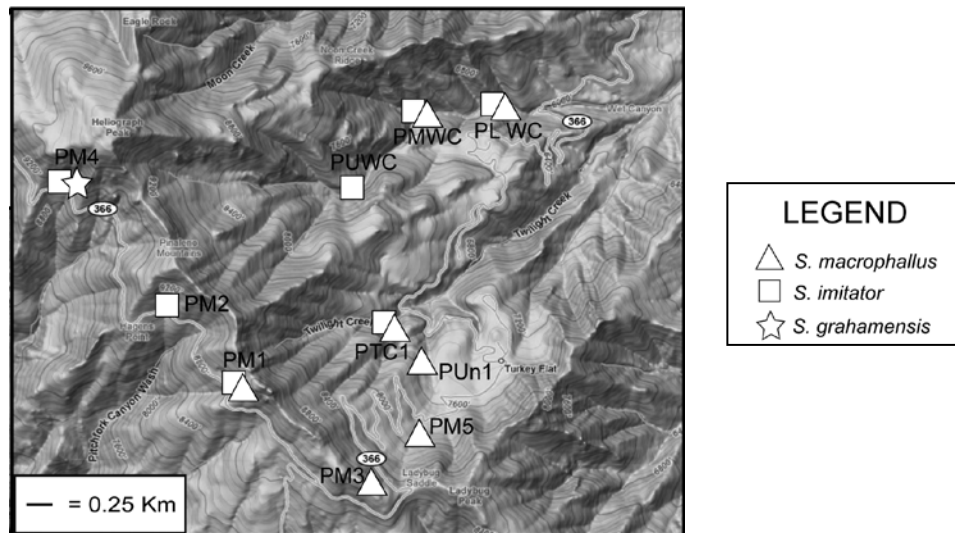


Figure 5. Map of land snail species localities in the southeastern part of the Pinaleno Mountains, Heliograph Peak to Wet Canyon and Turkey Flat; from Weaver *et al.* (2010).

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PINALEÑO TALUSSNAIL

The range of the Pinaleño talussnail is reported as rockslides from the northeast slope of Mount Graham south to the vicinity of Arcadia Campground (AGFD 2016a). Recent genetic work has verified that the Pinaleño talussnail occurs at one location near Heliograph Peak, where it is sympatric with the Mimic talussnail (Weaver *et al.* 2010). Weaver *et al.* (2010) believe the species has declined and its current population may be limited to about a 10 km² area. The Pinaleño talussnail is known from four locations near Heliograph Peak (Hoffman 1990; Sorensen and Martinez 2016).

WET CANYON TALUSSNAIL

The Wet Canyon talussnail type locality is Wet Canyon, under rocks on the south side of the canyon (Fairbanks and Reeder 1980; AGFD 2016b). Hoffman (1990) also found the species in Wet Canyon up to a mile from the type locality on the northeast slope of the Pinaleño Mountains (T9S, R25E, Sections 17 and 18). Historically, the species was known from talus slopes along the canyon bottom to the perennially flowing portion of a stream, between 1,844 and 2,103 m (6,050 and 6,900 ft) in elevation.

Weaver *et al.* (2010) redefined the distribution of *Sonorella* in the Pinaleño Mountains. Based on genetic work, the Wet Canyon talussnail, once thought to be endemic to Wet Canyon, is instead relatively widespread in the southern part of the Pinaleño Mountains (Weaver *et al.* 2010), and now known from about 1,890 to 2,800 m (6,200 to 9,186 ft) above mean sea level. It is largely sympatric with mimic talussnail, and there is no evidence of resource partitioning between the two species (Weaver *et al.* 2010). Wet Canyon talussnail is documented in at least seven locations in the southeastern part of the Pinaleño Mountains (Weaver *et al.* 2010; Sorensen and Martinez 2016).

MIMIC TALUSSNAIL

AGFD (2016c) reports the range of the mimic talussnail as the Mt. Graham area southeast to Wet Canyon area. Recent genetic work verified the mimic talussnail is relatively widespread in the Pinaleño Mountains, is sympatric with all other species, except Clark Peak talussnail (Weaver *et al.* 2010). It is known from about 1,890 to 2,800 m (6,200 to 9,186 ft) above mean sea level, as is Wet Canyon talussnail (Weaver *et al.* 2010). Mimic talussnail is documented from at least 19 localities (Hoffman 1990; Sorensen and Martinez 2016).

CLARK PEAK TALUSSNAIL

AGFD (2016d) reports the range of the Clark Peak talussnail as rockslides on the north slope of Clark Peak and the Blue Jay Ridge area (including West Peak). Recent genetic work has verified that the Clark Peak talussnail is found in the northern part of the Pinaleño Mountains at Clark

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Peak (Weaver *et al.* 2010). Clark Peak talussnail is found in the northwestern part of the Pinaleño Mountains in at least six localities between West Peak and Clark Peak (Hoffman 1990; Sorensen and Martinez 2016).

PINALEÑO MOUNTAINSNAIL

AGFD (2016e) reports the range of the Pinaleño mountainsnail as rockslides from the West Peak and Clark Peak area, the vicinity of Mt. Graham and south to the Heliograph Peak area, Pinaleño Mountains. Recent surveys in the last decade have also found this species in Wet Canyon and Twilight Canyon (N.D. Waters, AGFD contractor, pers. comm. 7/18/2015), near the campground south of Soldier Creek, the north slope of Clark Peak, the spring south of Webb Peak, and the Heliograph Spring area (AGFD 2015; Sorensen and Martinez 2016). The Pinaleño mountainsnail is known from at least 20 localities in the Pinaleño Mountains (Hoffman 1990; Sorensen and Martinez 2016).

SNAGGLETOOTH SNAILS

Cross snaggletooth (*Gastrocopta quadridens*) is similar to most *Sonorella* in that it is restricted to mesic montane habitats between about 2,438 and 3,048 m (8,000 and 10,000 ft) above mean sea level. According to Bequaert and Miller (1973), it ranges from the Capitan Mountains, Lincoln County, New Mexico to the east, west to Coconino and Yavapai counties, Arizona, and north to one locality in Utah (Fish Lake, Sevier County). In the Coronado National Forest, it is known from the Santa Catalina, Huachuca (Miller Peak, the southernmost locality), Chiricahua, and Pinaleño mountains. In the Pinaleño Mountains, it has been recorded from “Hospital Flat, at the S foot of Mt. Graham, 9,000 ft” (Bequaert and Miller 1973). Unfortunately, the habitat was not described by the authors—Hospital Flat, *per se*, is a meadow, whereas the surrounding environs are mixed conifer forest.

Shortneck snaggletooth (*Gastrocopta dalliana*) is a more wide-ranging and generalized species. It is known from Arizona, New Mexico, Texas, Sonora, Chihuahua, and Baja California del Sur (where it may be the result of a human introduction) (Bequaert and Miller 1973; NatureServe, accessed 9 June 2010). On the Coronado National Forest, it occurs on at least the following mountain ranges: Patagonia, Atascosa, Tumacacori, Santa Catalina, Rincon, Whetstone, Santa Rita, Canelo (Hills), Huachuca, Dragoon, Chiricahua, Peloncillo, Pajarito, Galiuro, and Pinaleño. In the Pinaleño Mountains, it has been recorded from the Noon Creek area (1,554 m [5,100 ft]), likely in Madrean encinal woodland and Wet Creek (1,920 m [6,300 ft]), likely in the Madrean pine/oak woodland. The species ranges from near sea level to 2,835 m (9,300 ft) across its range, but is normally found in the 853 to 1,981 m (2,800 to 6,500 ft) elevation range (Bequaert and Miller 1973)—desert to Madrean pine/oak woodland. Bequaert and Miller (1973) reported it from leaf litter, spring-fed marsh, under mesquites, in cliff talus, and in riparian situations (alive and in drift).

7.4 Population Estimates/Status

We are unaware of any information regarding population size estimates for any *Sonorella* or *Oreohelix*, and such information would be difficult to acquire considering the life history of these land snails. However, observations and counts of *Sonorella* and *Oreohelix* during surveys appear to depend on local moisture conditions (Sorensen and Martinez 2016). The CA partners will use AGFD's survey protocol for land snails (AGFD 2016f) and the Pinaleño Land Snail Monitoring Program (PLSWG 2017) to document CA-covered species distributions and population status through timed searches and counts of snails and shells encountered. The timed counts provide an index of relative abundance (expressed as Catch-Per-Unit-Effort estimates) for each population surveyed.

Talusssnails appear locally abundant with fluctuations in their relative abundance dependent upon moisture conditions during the surveys. For example, in August 2001, AGFD biologists observed over 112 live talusssnails in the Wet Canyon drainage, and over 27 live talusssnails in Twilight Canyon and a nearby unnamed drainage during a survey in wet, humid weather (Jontz *et al.* 2002). In September 2002, AGFD and USFS biologists observed 41 live talusssnails in Wet Canyon, also under wet, humid weather. No live talusssnails were observed during surveys conducted in May 2002 and 2003, October 2005, and November 2006 under in drier conditions and no recent rains. All other surveys during wet, summer monsoon weather over the past decade had found live or active land snails. These surveys were not exhaustive in effort from year to year, and search time was estimated in the earlier surveys (Sorensen and Martinez 2016).

Based on observations from AGFD surveys in 2005 and 2016, Pinaleño talusssnail habitat in the Heliograph Peak area did not appear to be degraded. Because so little is known of the habitat requirements of this snail, changes in the environment could be detrimental as well as beneficial. Therefore, more research is required. Weaver *et al.* (2010) believe the species has declined and its current population may be limited to about a 10 km² area.

According to Hoffman (1990), since 1954 it has been observed that mimic talusssnail is becoming more common over the range previously inhabited by Pinaleño talusssnail. The reasons for this are unknown at this time (AGFD 2016c).

The relative abundance of Clark Peak talusssnail is currently unknown (AGFD 2016d), although Hoffman (1990) had documented at least five distinct populations around the West Peak/Blue Jay Ridge area and North Canyon of the northwestern Pinaleño Mountains. A sixth population is found on the north side of Clark Peak (Weaver *et al.* 2010; Sorensen and Martinez 2016).

Population estimates of Pinaleño mountainsnail are unknown, although timed presence/absence surveys have documented live mountainsnails in Wet Canyon and Twilight Canyon, and during the October 2005 collection effort, they appeared to be numerous on the north slope of Clark Peak and next to the campground south of Soldier Creek (Sorensen and Martinez 2016; AGFD 2015).

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Populations of Pinaleño land snails are limited to small sites that can be separated by drainages, or perhaps many miles. Actual or estimated population sizes per species are unknown. AGFD biologists conducted five land snail surveys between 2005 and 2015 where active talussnails and mountainsnails were observed. From this, the mean number of talussnails observed was 53 (SD \pm 38.6) with a maximum of 101 snails observed in 2011, and the mean number of mountainsnails observed was 9 (SD \pm 16.0) with a maximum of 37 Pinaleño mountainsnails observed in 2005 (AGFD 2015). Table 1 provides a summary of Catch-Per-Unit-Effort estimates of Pinaleño land snails in occupied areas for AGFD-led surveys 2001-2016.

Table 1. Catch-Per-Unit-Effort (CPUE) estimates of Pinaleño land snails at occupied sites for AGFD-led surveys 2001-2016. CPUE estimates are numbers of snails per 10 minutes of searching. Estimates are not corrected for observer detection probability. “WC” is the abbreviation for Wet Canyon, and “nc” = not collected. Numbers of snails tallied below represent live snails observed. “*” indicates wet and humid weather during the survey—considered ideal sampling conditions for observing active land snails.

Survey Date	Survey Site	# <i>Sonorella</i> Observed	# <i>Oreohelix</i> Observed	Minutes of Search Effort	CPUE (# snails per 10 min search)
07/27/2016	Upper WC (Above Trail)	13	0	120	1.08
07/27/2016	Upper WC (Below Trail)	23	0	120	1.92
07/27/2016	Lower WC (Bridge Area)	1	0	80	0.12
07/27/2016	Twilight Canyon	7	0	240	0.29
07/27/2016	Heliograph Peak Area	0	(6 possible)	60	1.00
08/05/2015	Upper WC (Above Trail)	9	0	180	0.50
08/05/2015	Upper WC (Below Trail)	12	0	90	1.33
08/05/2015	Lower WC (Bridge Area)	4	0	120	0.33
08/05/2015	Twilight Canyon	1	4	240	0.21
08/05/2015	E end of Turkey Flat	0	0	60	0.0
07/16/2013*	Upper WC (Above Trail)	5	0	180	0.28
07/16/2013*	Upper WC (Below Trail)	6	0	90	0.67
07/17/2013*	Lower WC (Bridge Area)	15	0	160	0.94
07/16/2013*	Twilight Canyon	53	0	150	3.53
07/16/2013*	E end of Turkey Flat	6	0	60	1.00
07/16/2013*	Post Creek	2	0	50	0.40
07/16/2013*	Clark Peak Area	1	0	75	0.13
08/10/2011*	Upper WC (Above Trail)	29	0	360	0.81
08/10/2011*	Upper WC (Below Trail)	11	0	200	0.55
08/11/2011*	Lower WC (Bridge Area)	2	0	120	0.17
08/11/2011*	Twilight Canyon	59	0	240	2.46
08/12/2009	Upper WC (Below Trail)	0	0	~20	0
07/08/2008	Upper WC (Above Trail)	9	0	135	0.67
07/08/2008	Upper WC (Below Trail)	19	2	480	0.44
07/08/2008	Lower WC (Bridge Area)	3	0	360	0.08
11/08/2006	Upper WC (Above Trail)	0	0	~20	0
11/08/2006	Upper WC (Below Trail)	0	0	~25	0
11/08/2006	Lower WC (Bridge Area)	0	0	30	0

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Survey Date	Survey Site	# <i>Sonorella</i> Observed	# <i>Oreohelix</i> Observed	Minutes of Search Effort	CPUE (# snails per 10 min search)
10/01/2005	Waypoint 62*	0	0	nc	-
10/01/2005	Heliograph Spring Area	0	(8 possible)	nc	-
10/01/2005	Spring S of Webb Peak	0	(1 possible)	nc	-
10/01/2005	N slope of Clark Peak	2	18	nc	-
10/01/2005	Soldier Creek	0	10	nc	-
07/28/2004*	Wet Canyon, Upper and Middle Reaches	25	0	~1680	0.15
07/28/2004*	Lower WC (Bridge Area)	0?	0?	?	0
07/31/2003*	Upper WC (Above Trail)	10	0	~270	0.37
07/31/2003*	Upper WC (Below Trail)	12	0	~270	0.44
07/31/2003*	Lower WC (Bridge Area)	10	0	60	1.67
07/31/2003*	Twilight Canyon	10	0	90	1.11
05/01/2003	Upper WC (Above Trail)	0	0	~60	0
05/01/2003	Upper WC (Below Trail)	0	0	~60	0
09/11/2002*	Upper WC (Above Trail)	6	0	~60	1.00
09/10/2002*	Upper WC (Below Trail)	35	0	~630	0.56
05/22/2002	Upper WC (Above Trail)	0	0	~120	0
05/22/2002	Twilight Canyon	0	0	~750	0
08/08/2001*	Upper WC (Above Trail)	>82	1	~540	1.52
08/08/2001*	Lower WC (Bridge Area)	3	0	~180	0.17
08/08/2001*	Twilight Canyon	12	0	~60	2.00
08/08/2001*	Unnamed drainage ¼ mile west of Twilight Canyon	~15	0	~60	2.50

7.5 Species Status

The ESA requires the USFWS to identify wildlife and plant species that may become endangered or threatened, based on the best available scientific and commercial information. As part of this responsibility, the USFWS maintains a list of species that are being considered for listing.

PINALEÑO TALUSSNAIL

USFWS first placed the Pinaleño talussnail on the Federal Notice of Review as a Category 2 species in 1991 (56 FR 58804). As previously stated, in the 1996 Notice of Review USFWS discontinued the practice of maintaining a list of species regarded as Category 1, 2, or 3 candidates (61 FR 7596). When the rule was finalized, any species that had been a Category 1 candidate simply became a candidate, and Category 2 species, such as the Pinaleño talussnail, were removed.

On June 25, 2007, USFWS received a petition from Forest Guardians to list 475 species in the southwestern United States as threatened or endangered under the provisions of the Act, including the Pinaleño talussnail. On January 6, 2009, USFWS issued a partial 90-day Finding

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(74 FR 419) concluding that the petition did not present substantial information for 270 species. On December 16, 2009, USFWS published the second partial 90-Day Finding (74 FR 66866) concluding the petition presented substantial information indicating that listing the Pinaleño talussnail may be warranted. There has been no change in this species potential listing status since 2009.

The Pinaleño talussnail has been on the Regional Forester's Sensitive Species List since at least 1999 (B. Barrera, USFS, Region 3, pers. comm., 6/8/2010).

WET CANYON TALUSSNAIL

USFWS first placed the Wet Canyon talussnail on the Federal Notice of Review as a Category 1 species in 1991 (56 FR 58804). On February 28, 1996, USFWS issued the Endangered and Threatened Wildlife and Plants; Review of Plant and Animal Taxa that are Candidates for Listing as Endangered or Threatened Species, in which the practice of maintaining a list of species regarded as Category 1, 2, or 3 candidates was discontinued (61 FR 7596). When the rule was finalized on December 5, 1996, any species that had been a Category 1 candidate simply became a candidate. The Wet Canyon talussnail maintained candidate status in the subsequent review of plant and animal taxa in 1999 (64 FR 57534).

On December 15, 1999, the USFWS, USFS, and AGFD entered into a Conservation Agreement to implement the Conservation Assessment and Strategy for Wet Canyon talussnail (USFS *et al.* 1999; USFS 1999). On October 31, 2001, USFWS removed the Wet Canyon talussnail from the candidate list (66 FR 54808). The Conservation Agreement expired on December 30, 2004, and has not been renewed.

On June 25, 2007, USFWS received a petition from Forest Guardians (2007) to list 475 species in the southwestern United States as threatened or endangered under the provisions of the Act, including the Wet Canyon talussnail. On January 6, 2009, USFWS issued a partial 90-Day Finding (74 FR 419) concluding that the petition did not present substantial information for 270 species. On December 16, 2009, USFWS published the second partial 90-Day Finding (74 FR 66866) concluding the petition presented substantial information indicating that listing the Wet Canyon talussnail may be warranted. There has been no change in this species potential listing status since 2009.

The Wet Canyon talussnail has been on the Regional Forester's Sensitive Species List since at least 1999 (B. Barrera, USFS, Region 3, pers. comm., 6/8/2010).

MIMIC TALUSSNAIL

USFWS first placed the mimic talussnail on the Federal Notice of Review as a Category 3C species in 1991 (56 FR 58804). As previously stated, in the 1996 Notice of Review USFWS discontinued the practice of maintaining a list of species regarded as Category 1, 2, or 3

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candidates (61 FR 7596). When the rule was finalized, any species that had been a Category 1 candidate simply became a candidate, and Category 3 species, such as the mimic talussnail, were removed.

The mimic talussnail has been on the Regional Forester's Sensitive Species List since at least 1999 (B. Barrera, USFS, Region 3, pers. comm., 6/8/2010).

CLARK PEAK TALUSSNAIL

USFWS first placed the Clark Peak talussnail on the Federal Notice of Review as a Category 2 species in 1991 (56 FR 58804). As previously stated in the 1996 Notice of Review USFWS discontinued the practice of maintaining a list of species regarded as Category 1, 2, or 3 candidates (61 FR 7596). When the rule was finalized, any species that had been a Category 1 candidate simply became a candidate, and Category 2 species, such as the Clark Peak talussnail, were removed.

On June 25, 2007, USFWS received a petition from Forest Guardians to list 475 species in the southwestern United States as threatened or endangered under the provisions of the Act, including the Clark Peak talussnail. On January 6, 2009, USFWS issued a partial 90-day Finding (74 FR 419) concluding that the petition did not present substantial information for 270 species. On December 16, 2009, USFWS published the second partial 90-Day Finding (74 FR 66866) concluding the petition did not present substantial information indicating that listing the Clark Peak talussnail may be warranted. There has been no change in this species potential listing status since 2009.

The Clark Peak talussnail has been on the Regional Forester's Sensitive Species List since at least 1999 (B. Barrera, USFS, Region 3, pers. comm., 6/8/2010).

PINALEÑO MOUNTAINSNAIL

USFWS first placed the Pinaleño mountainsnail on the Federal Notice of Review as a Category 3C species in 1991 (56 FR 58804). As previously stated, in the 1996 Notice of Review, USFWS discontinued the practice of maintaining a list of species regarded as Category 1, 2, or 3 candidates (61 FR 7596). When the rule was finalized, any species that had been a Category 1 candidate simply became a candidate, and Category 3 species, such as the Pinaleño mountainsnail, were removed.

The Pinaleño mountainsnail has been on the Regional Forester's Sensitive Species List since at least 1999 (B. Barrera, USFS, Region 3, pers. comm., 6/8/2010).

SNAGGLETOOTH SNAILS

No federal actions have been initiated for either of these species, except that the NatureServe ranking (G1-G3) was the reason these species were incorporated into the Coronado National

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Forest Plan revision process, as species for which there are potentially population viability concerns. It is surprising that the shortneck snaggletooth ranks out as G2G4 (hence, mean = G3) by NatureServe because of its widespread range, presumed abundance, and catholic habitat requirements.

Species Status Under Other Federal and State Processes

NEPA (42 U.S.C. 4321 et seq.) requires federal agencies to consider the environmental impacts of their actions. Most actions taken by the USFS, BLM, and other federal agencies that affect land snails and other candidate or ESA-listed species are subject to NEPA. NEPA requires federal agencies to describe the proposed action, consider alternatives, identify and disclose potential environmental impacts of each alternative, and involve the public in the decision-making process. However, federal agencies are not required to select the alternative having the least significant environmental impacts. A federal action agency may select an action that will adversely affect sensitive species provided that these effects were known and identified in a NEPA document. The four *Sonorella* and one *Oreohelix* species in the Pinaleño Land Snail CA are listed on the USFS Regional Forester 2013 Sensitive Animals List for Forest planning and analysis purposes (USFS 2013).

Wet Canyon talussnail is identified as a Tier 1A Species of Greatest Conservation Need (SGCN) in Arizona's SWAP (AGFD 2012b). Tier 1A includes, in part, those species that are closed season (as identified by Arizona Game and Fish Commission Order), currently listed under the ESA as endangered or threatened, including those populations considered essential or nonessential experimental under section 10(j) of the ESA, are candidates for listing, or are covered under an existing conservation agreement. With the finalization of this CA, Pinaleño talussnail, Mimic talussnail, Clark Peak talussnail, and Pinaleño mountainsnail will be elevated to SGCN Tier 1A, as well. The purpose of the SWAP is to inform development of annual work plans, to inform strategic planning at all levels within the AGFD, and to inform conservation strategies of external partners. Additional benefits include providing a foundation for directing wildlife conservation within a collaborative framework that engages state/federal agencies and other conservation partners to think strategically about individual and coordinated roles in prioritizing conservation efforts (AGFD 2012b). Tier 1A species also represent those species requiring conservation actions aimed at improving conditions through intervention at the population or habitat level.

In August 2016, the Pinaleño talussnail, Mimic talussnail, Clark Peak talussnail, Pinaleño mountainsnail, and both snaggletooth snails were added as closed season species under Arizona Game and Fish Commission Order 42 – Crustaceans and Mollusks. These species, along with the Wet Canyon talussnail, are prohibited from being harvested by the public, unless by authorized scientific collecting licenses.

8. FACTORS AFFECTING THE PINALEÑO LAND SNAILS

This section follows the “5-factor threats analysis” used by USFWS and reflected in corresponding SSAs.

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The eastern slopes of the Pinaleño Mountains have a long history of human occupation and use. Wet Canyon, along with other canyons, was logged extensively during the late 1800's to early 1900's. Canyons were particularly targeted for heavy wood harvesting. Jacobson Canyon was the location of one of the early sawmills, and a sawmill town and small community were located in Frye Canyon. Cable logging using steam engines was common. Logging during that era left large quantities of down wood material (C. Wilcox, USFS, CNF, pers. comm., 2013). To what extent logging and other activities may have altered the canyon or affected the range of the talussnail is unknown. Currently, sawtimber or fuelwood harvest is done only to enhance recreation, visual quality, and wildlife values, or to reduce hazards. Any harvest of standing trees is limited to individual tree selection, and is done under permit. Gathering of small amounts of firewood for local use occurs in and near the developed recreation sites. Fuelwood harvesting occurs on the mountain but is believed to be insignificant in the Wet Canyon watershed (Casey 2010).

USFS (1999) reports current human activity in the habitat of talussnails is primarily dispersed recreation (that is: hiking and picnicking). Two USFS-developed sites exist near Wet Canyon: Arcadia Campground, located on a knoll above Wet Canyon, and Wet Canyon Picnic Site, located where Highway 366 crosses Wet Canyon at the lower end of occupied habitat. Arcadia has 20 units (including one group site) available for overnight visits, and Wet Canyon has a parking area with three picnic tables and three fire rings. Both are open year-round, but the group site is only reservable April 1 through November 1. Campfires are permitted in metal fire-rings or barbecues provided at each unit.

Arcadia National Recreation Trail is used by hikers between Shannon and Arcadia campgrounds, and crosses Wet Canyon about one mile upstream from Wet Canyon Picnic Site. A self-guided nature trail leads from Arcadia Campground to Wet Canyon (USFS 1999). An extension of that trail leads downstream along Wet Canyon to intersect with a user-built trail back to the campground. Another user-built trail was known to extend along Wet Canyon from the picnic area upstream about one mile to Arcadia National Recreation Trail. This trail was known to pass over and through talus slopes occupied by talussnails. It is not part of the USFS trail system.

Designated roads are open to vehicular travel; cross country travel by vehicles is prohibited. Highway 366 is generally open beyond Wet Canyon year-round, but is seasonally closed (November 15 to April 15) above the intersection of Forest Road 507, the access to High Peak, with the exception of administrative travel by USFS and Mount Graham International Observatory employees. Occasionally during snow removal operations, the road may be closed at the entrance to the Wet Canyon Picnic Area.

Twilight Road (Forest Road 819) extends north from Highway 366 toward Wet Canyon at about 2,286 m (7,500 ft) elevation and terminates at Twilight Campground, between Twilight and Wet canyons. The USFS has no plans to extend Twilight Road into the Wet Canyon watershed.

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There are no certified water rights in Wet Canyon. The USFS is applying for five water rights: two claims for recreation (0.11 and 0.01 acre-feet), an application for domestic use (0.61 acre-feet), an instream flow application (145 acre-feet), and a groundwater well for domestic use (56 acre-feet) (Barclay 2016).

The east-facing slopes of the Pinaleño Mountains, starting at approximately 1,829 m (6,000 ft) in elevation and extending over the crest, were closed to domestic livestock grazing in the 1940's. Although current livestock allotment boundaries extend to about 1,981 m (6,500 ft), cattle are generally restricted by topography to below about 1,372 m (4,500 ft). Rangeland within the area is closed to livestock (Casey 2010).

Before the USFS phased out fire suppression, this practice caused dead brush and decayed plant matter to build up on top of the talus slopes. For this reason, potentially intense fires and post-fire ash flows are a potential threat to the Pinaleño land snails. Specific impacts from fire include snail mortality due to being burned or extreme temperatures, loss of tree canopy and local moisture and temperature levels related to those canopies, and siltation from post-fire flooding and landslides that may fill in interstitial spaces of talus habitat.

It is important to note that threats vary geographically throughout the range of Pinaleño land snails, and the specific threats potentially impacting a geographic area or populations will be evaluated separately. In Appendix A, the PLSWG has identified and developed associated conservation measures for the covered species to be implemented through the Pinaleño Land Snail CA. Using the USFWS five-factor analysis as a guide to evaluate a species for listing under the ESA, the threats summarized below are those currently observed in occupied land snail habitat and/or are likely to occur in the future. The five factors are as follows: A) the present or threatened destruction, modification, or curtailment of its habitat or range; B) overutilization for the commercial, recreational, scientific, or educational purposes; C) disease or predation; D) the inadequacy of existing protection; and E) other natural or manmade factors affecting its continued existence (50 CFR part 424).

As previously noted in section 2, a desired outcome of the Pinaleño Land Snail CA is to provide sufficient conservation to ensure the continued persistence of the species into the future. The success of any conservation or recovery effort depends on reducing or eliminating threats to the continued existence of the species. The following summarizes the five listing factors identified in section 4(a)(1) of the ESA which must be considered by the USFWS in evaluating current threats to the covered species.

The Parties involved in the Pinaleño Land Snail CA will, to extent practicable, implement conservation actions intended to reduce or eliminate current threats to the species. The primary needs for short-term conservation and long-term maintenance of viable land snail populations and functional processes have been identified based on the existing information outlined in the Stressor/Conservation Measure Matrix (Appendix A). As improved understanding of threats to the land snails and accompanying conservation needs are developed, the management strategy

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for covered species will be updated and revised by the PLSWG through an adaptive management process that is described in section 10 herein.

The success of any conservation or recovery effort depends on reducing or eliminating threats to the continued existence of the species. The following subsections summarize the five listing factors identified in section 4(a)(1) of the ESA which must be considered by the USFWS in evaluating current threats to the covered species.

8.1 Present or Threatened Destruction, Modification or Curtailment of the Species' Habitat or Range

The *Sonorella* and *Oreohelix* species of the Pinaleño Mountains are all endemic species vulnerable to any disturbance that would remove talus, increase interstitial sedimentation, open forest canopy, alter stream hydrogeomorphology, or otherwise change moisture conditions (USFS 1999).

Wildfire and Suppression

A potential threat to the populations of Pinaleño land snails is fire. Fire frequency and intensities in southwestern forests are much altered from historical conditions (Dahms and Geils 1997; O'Connor *et al.* 2014). Before 1900, surface fires generally occurred at least once per decade in montane forests with a pine component. Beginning about 1870-1900, these frequent ground fires ceased to occur due to intensive livestock grazing that removed fine fuels coupled with effective fire suppression in the mid to late 20th century that prevented frequent, widespread ground fires (Swetnam and Baisan 1996). Absence of ground fires allowed a buildup of woody fuels that precipitated infrequent but intense crown fires (Danzer *et al.* 1997). Lack of vegetation and forest litter following intense crown fires exposed soils to surface erosion during storms, often causing high peak flows, sedimentation, and erosion in downstream drainages (DeBano and Neary 1996).

While the general condition of forests and watersheds is a concern, site-specific information regarding fuel-load conditions in drainages or slopes occupied by land snails is limited. Fire is recognized as a threat to these species because watershed conditions could result in stand-replacement fires in the Pinaleño Mountains.

A stand-replacement fire in occupied land snail habitat could conceivably affect a population through habitat modification in the form of sedimentation and erosion caused by stream banks and soil slopes destabilized by the loss of vegetation. A decrease in canopy cover from a crown fire may lead to lower levels of humidity, and increases in direct sunlight and temperatures may also result from burned areas.

The Gibson Fire, which was started by lightning on June 22, 2004, burned through portions of Mount Graham along with the Nuttall Fire, which began on June 26, 2004. Both of these fires caused much damage to habitat on Mount Graham. The Gibson Fire burned through Wet Canyon causing damage to land snail habitat and resulting in individual mortality of numerous snails, based on burnt shells found after the fire. During the July 28, 2004 post-fire survey, interagency

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investigators noted 35 live talussnails and 209 dead (Sorensen and Martinez 2016). Heavy siltation as a result of post-fire rains had occurred. Direct damage to talussnails and habitat within the Wet Canyon drainage appeared to be severe, with large portions of habitat completely burned and subjected to extreme heat, as evidenced by cracked rocks. Secondary damage was also apparent from the siltation of interstitial spaces of talus rock outcroppings within the drainage (Sorensen and Martinez 2016). Fortunately, the Gibson-Nuttall Fire Complex burned in a mosaic throughout many parts of Wet Canyon, leaving undamaged “fingers” of habitat and surviving snails that extend from ridgeline to the drainage. These areas were vital for the recolonization of the damaged habitat. From AGFD survey data for land snails in the Wet Canyon area, the Catch-Per-Unit-Effort estimates (snail counts divided by total search time) were similar in range both before and after the 2004 Gibson-Nuttall Fire. Based on survey results over a 16-year timeframe, it appears that the averaged relative abundance of the talussnail and mountainsnail populations in Wet Canyon and vicinity are essentially unchanged following the 2004 Gibson-Nuttall Fire. Fire does impact these species and their habitats, but these effects may be temporary (Sorensen and Martinez 2016).

There are several studies on mollusk responses to fire, with findings that vary from: fire-driven extirpation of snails (Beetle 1997); reductions in density, but not species richness (Kiss and Magnin 2006); reductions in species richness, but not density (Bros *et al.* 2011); reductions in both species richness and density (Hylander 2011); slow population recovery (Burke 1999); and no change in densities post-fire (Gaines *et al.* 2011). The relative impact of fire to mollusk populations depends a lot on the species life history, habitat associations, and how that fire burns over the landscape (i.e. level of intensity, duration, and mosaic of coverage).

It is likely that the land snail populations in the Pinaleño Mountains have evolved with fire on the landscape, at least historically. Anderson and Shafer (1991) report that wildfires in the Pinaleño Mountains were common during the pre-settlement period (prior to 1880) going back at least 8,000 years. Grissino-Mayer *et al.* (1996) reconstructed the fire history at two sites along the mixed-conifer forest and spruce-fir transition zone using dendroecological analyses (i.e. dating fire scars on tree core and cross-section samples). They found that the mixed-conifer fire regime of the past four or five centuries was characterized by frequent, low-intensity surface fires—as often as every four to six years (Grissino-Mayer *et al.* 1996). Additionally, they noted that the mixed-conifer burns typically did not spread into the cooler, moister habitat of the spruce-fir zones, except during severe droughts. In contrast, the spruce-fir fire regime likely had a 300-400 year fire return interval, with a widespread stand-replacement fire that occurred during an extreme drought in 1685 (Grissino-Mayer *et al.* 1996). For the Pinaleño Mountains, the 2004 Gibson-Nuttall Fire was the closest in severity to the 1685 fire (O’Connor *et al.* 2014). O’Connor *et al.* (2014) cautions that without restoration of forest structure and fire, inland Southwestern forests are likely to burn with increasing fire size and severity, with increased risk to human interests and specific habitat-adapted sensitive species.

Under the guidance of RMRS-GTR-310 (2013), the USFS now uses a science-based framework that offers management recommendations for achieving the key compositional and structural

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elements for restoring frequent-fire forests. Once restored, these forests comprise a temporally shifting mosaic of groups of trees with interlocking crowns; scattered single trees; open grass-forb-shrub interspaces between tree groups; and dispersed snags, logs, and woody debris. The framework's objective is to increase forest resiliency by managing forest composition and structure toward reference conditions. The USFS believes that restoration of key compositional and structural elements on a per-site basis will enhance the resiliency of frequent-fire forests in the Southwest, thereby positioning them to better adapt to future disturbances and climates (Reynolds *et al.* 2013).

Contamination from aerial fire retardant is also a potential threat to the species. Millions of gallons of fire retardants and suppressants are broadly applied aerially, and from the ground, to control wildfires in the western United States each year. Contamination of land snail habitat could potentially occur via direct application, or runoff from treated uplands. Many of the older formulations of aerial fire retardants contained the chemical yellow prussiate of soda (i.e. sodium ferrocyanide), which was added as an anticorrosive agent. As of 2005, sodium ferrocyanide is no longer used in fire retardants, and old stocks of retardants with this additive have since been used up. However, many current fire retardants have additives that are ammonia-based, which are also potentially toxic to aquatic and other organisms. Toxicity of these formulations is typically found to be low in the laboratory, but in the field, toxicity to aquatic life has been found to be photo-enhanced by ambient ultraviolet radiation (Calfee and Little 2003). However, to our knowledge, no land snail sites have been affected by fire retardant.

Other Stressors

Land snail habitat in some of the Pinaleño Mountain drainages are susceptible to adverse effects from human recreational activities, such as human-caused fire and disturbance from trampling (USFWS 1995). While there is no specific information regarding the threat of groundwater depletion on habitats of the land snails, the USFWS believes the threat is being mitigated. Livestock grazing on the Pinaleño Mountains does not occur above an elevation of 1,981 m (6,500 ft), because of the steep topography of the mountain most grazing occurs below 1,372 m (4,500 ft) (Casey 2010). Because populations of land snails may be isolated, once extirpated, sites may not be recolonized without active management. Small populations are also subject to genetic deterioration and demographic variability, which increases the likelihood of extinction. Additionally, there is no specific information regarding threats from recreation, timber harvest, or drought (USFWS 2009).

Refer to Stressor/Conservation Measure Matrix (Appendix A) for the conservation measures and associated threat reduction strategy implemented under this CA.

8.2 Overutilization for Commercial, Recreational, Scientific or Educational Purposes

There are a limited number of researchers that study snails, and they are usually sensitive to their rarity and endemism. Consequently, collection for scientific or educational purposes is very

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limited. Few of these land snails have been subjected to a limited number of scientific studies and collections intended to determine taxonomy, distribution, and habitat use. Although sampling-without-replacement can reduce population size of spring-dependent invertebrates (Martinez and Sorensen 2007), studies conducted on land snails in Arizona have not resulted in the removal of large numbers of snails and are not believed to have had any negative effect on these species. None of the CA covered species is known to be utilized for commercial or recreational purposes. Therefore, this is not known to be a factor threatening these land snails.

Refer to Stressor/Conservation Measure Matrix (Appendix A) for the conservation measures and threat reduction strategy under this CA.

8.3 Predation or Disease

The threat from disease or predation to the covered species has not been investigated. However, land snails and other mollusks are known to serve as the intermediate hosts for a variety of trematodes (Taylor 1987). Talussnails are presumably eaten by rodents or birds, but this is probably a sporadic random occurrence (Hoffman 1990). Many mountain ranges in southeastern Arizona are inhabited by a snail-eating beetle (*Scaphinotus*) which presumably preys upon talussnails (McCord 1995). Desert box turtles (*Terrapene ornata luteola*) have been found to be a predator on *S. pedregosensis*, a closely related congener from southeastern Arizona (Gilbertson and Radke 2006). At this time, disease or predation does not appear to be a factor threatening the Pinaleño land snails.

Refer to Stressor/Conservation Measure Matrix (Appendix A) for the conservation measures and threat reduction strategy under this CA.

8.4 Inadequacy of Existing Regulatory Mechanisms

The Wet Canyon talussnail is protected by Arizona Game and Fish Commission Order 42 for Crustaceans and Mollusks, which establishes a closed season for the species. This rule prohibits collection and harvest, but does not protect against habitat modification like fire or unmanaged grazing. The Wet Canyon talussnail is identified as a Species of Greatest Conservation Need (tier 1a) in the Arizona State Wildlife Action Plan prepared by the AGFD. With the finalization of this CA, Pinaleño talussnail, Mimic talussnail, Clark Peak talussnail, and Pinaleño mountainsnail will be elevated to SGCN Tier 1A, as well. This plan helps guide the AGFD and other agencies in determining what biotic resources should receive priority management consideration. However, conservation benefits would mostly come from proactive initiatives because this plan has no legal regulatory authority.

The following subsections provide a summary of the existing regulatory mechanisms for all Parties of the CA, which are also incorporated into the Stressor/Conservation Measure Matrix (Appendix A).

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U.S. Fish and Wildlife Service (USFWS)

The USFWS is charged with managing and protecting threatened, endangered, and proposed species for conservation under the ESA. Protections under the ESA are provided to those species.

The Wet Canyon talussnail became a candidate species in December 1996. When the original Wet Canyon Talussnail Conservation Agreement was signed and begun implementation in December 1999, the species was removed from the candidate list. The ESA does not provide protections or management actions for candidate species or non-candidate species.

U.S. Forest Service (USFS)

Under 36 CFR §219 subpart A and §241, the Forest Service is directed to develop and implement a Land and Resource Management Plan (LRMP). The development of LRMPs requires cooperation with the state wildlife agency or other constituted authority of the state concerned, with special consideration given to rare and/or sensitive species. Therefore, conservation measures for a given species, such as the Pinaleño land snails, will often be in the form of a plan component(s). The Coronado National Forest is currently operating under the 1986 Land and Resource Management Plan; however, in the years since implementation of that plan, many social and resource conditions have changed, scientific information has improved, and land management policies have evolved, thus the Coronado National Forest is currently undergoing forest plan revision.

Forest Service Manual (FSM) 2670 provides specific direction and guidance for managing rare species on national forests, and allows the Regional Forester to designate species as Sensitive (FSM 2670.22, 2670.32). The Pinaleño mountainsnail, Wet Canyon talussnail, mimic talussnail, Clark Peak talussnail, and Pinaleño talussnail are designated Sensitive animals on the Southwestern Regional Forester's 2013 list (USFS 2013).

Through the biological evaluation process (FSM 2670.32) for land and resource management activities, project level effects to sensitive species are evaluated for conformance with the viability directives contained in the FSM. FSM objectives related to the management of Sensitive Species include:

- Develop and implement management practices to ensure that species do not become threatened or endangered because of USFS actions.
- Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands.
- Develop and implement management objectives for populations and/or habitat of sensitive species.

The Coronado National Forest is the primary land manager within the distribution of Pinaleño land snails. The authority to develop the concept of partnerships and enter into specific agreements is outlined in FSM 1580 (1580.1). Regional Foresters, Station Directors, and the Area Director are designated as signatory officials for cooperative agreements, and other FSM

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1580 agreements for programs under their jurisdiction (FSM 1580.41d). FSM 2672.12 allows Regional Foresters to cooperate with the USFWS for development and implementation of Conservation Agreements.

Arizona Game and Fish Department (AGFD)

Legal protections are afforded to native mollusks in Arizona by state laws (i.e., Arizona Revised Statute Title 17) and regulations imposed by the Arizona Game and Fish Commission (Commission). Unless otherwise prescribed in Title 17, it is unlawful to “[t]ake, possess, transport, buy, sell or offer or expose for sale wildlife except as expressly permitted by this title” (ARS 17–309). It is also unlawful to release wildlife into the wild except as authorized by the Commission or as defined in Title 3 (see ARS 17-306). As a closed season species, the seven CA-covered land snails cannot be harvested or possessed without special license or lawful exemption.

- Commission Orders (bag and possession limits)
 - Commission Order 42 – No open season and zero bag/possession limits for Wet Canyon talussnail, Pinaleño talussnail, Mimic talussnail, Clark Peak talussnail, Pinaleño mountainsnail, cross snaggletooth, and shortneck snaggletooth.
- Department Operating Manual – contains AGFD policy that (among other things) establishes standards and expectations for employee conduct.
 - Prior to implementing any activity that might affect wildlife in Arizona, including biological management actions or construction, AGFD staff are required to evaluate the potential environmental effects of that action through the Project Evaluation Program Environmental Assessment Checklist process. Part of this requirement is captured in in the following:
 - Department Policy I2.2 - National Environmental Policy Act Compliance: *The Arizona Game and Fish Department will comply with the National Environmental Policy Act of 1969. This requires that every proposed Federal Aid... project be examined objectively to determine the effects it will have on the environment in accordance with NEPA in Federal Aid NEPA Guidelines. Further, the Department will comply with the objectives of NEPA on any other project or program that may have an effect on the environment. (Contact the Habitat Branch for procedures and guidelines for EAC compliance).*

8.5 Other Manmade or Natural Factors Affecting the Species’ Continued Existence

Periods of drought in the Southwest are not uncommon; however, the frequency and duration of dry periods may become more frequent by future climate change. Global climate change and associated effects on regional climatic regimes are not fully known, but the predictions for the Southwest indicate less overall precipitation and longer periods of drought. Seager *et al.* (2007) predict, based on broad consensus among 19 climate models, that the Southwest will become drier in the 21st century and that the transition to this drier state is already underway. The increased aridity associated with the current ongoing drought will become the norm for the Southwest within a timeframe of years to decades, if the models are correct. Pearce and Paustian

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(2013) noted a change in historical distribution of *Anguispira alternata*—a relatively large and historically common land snail in Pennsylvania—that has not been found in approximately half of the counties it was previously found in 1960, and since then the species has had an upward shift in its elevational range by nearly 100 meters (on average). Perhaps the Pinaleño land snails, along with their habitat (see Bagne and Finch 2013), may eventually be affected in some manner by climate change, but the magnitude and extent of possible change cannot be verified or quantified at this time.

Refer to Stressor/Conservation Measure Matrix (Appendix A) for the conservation measures and threat reduction strategy under this CA.

9. CONSERVATION STRATEGY AND COMMITMENTS

The strategy for organizing a cooperative, range-wide approach to Pinaleño land snail management and conservation in Arizona is focused on establishing a baseline of conservation commitments to which all CA Parties agree, and then collectively accounting for specific agency conservation actions across the state. It also establishes an effective conservation framework for non-federal landowner involvement to be integrated into land snail conservation and management activities. Key components of this strategy are based on the premise that this CA, in the near term, is focused on reducing any deteriorating status of the species by improving, organizing, and implementing specific conservation actions across its range; and in the long term, facilitating the development of a network of affected landowners/managers that can positively influence land snail habitat and population management across the species' range in the Pinaleño Mountains.

The commitment and actions outlined in this section focus on conservation, improvement, and ongoing management of land snail status and habitat. The landscape and local level conservation actions are designed to be adaptable and effectively implemented by all Parties within a comprehensive and collaborative conservation framework. The agency-specific actions describe the specific conservation measures that each Party will deploy to effectively manage the species, including efforts for reducing species threats as well as habitat and population loss (refer to Appendix A). The results of these actions will be evaluated through ongoing monitoring of land snail populations and habitat conditions.

Information obtained from surveys and monitoring will increase the understanding of land snail population trends and management needs. This knowledge will be applied using the concepts of Adaptive Management (see section 10) that the PLSWG will annually assess and use to appropriately modify conservation actions.

9.1 Habitat Conservation Commitments

Each of the Parties to this CA is bound by certain guiding agency requirements which establish their mission, goals, and responsibilities while also managing and conserving the habitat of various land snails in the Pinaleño Mountains. This section addresses general measures that will be taken by the Parties to conserve the covered species and their habitat at the landscape and

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local level. Best practices for habitat management and monitoring of land snails are also outlined in the Stressor/Conservation Measure Matrix (Appendix A).

The Parties agree to jointly identify and pursue appropriate partnership opportunities in support of the conservation measures enumerated in this CA. To the extent authorized by law, the Parties to this agreement will continue or begin implementation of the identified conservation measures, utilizing their own resources, including expenditures of their own funds. Each Party to this agreement, as described below, is dedicated to eliminating or reducing threats to the covered species. However, emergency actions, Congressionally-mandated actions, or future funding allocations could result in a Party's inability to conduct one or more of the proposed conservation measures as described. These circumstances are examples of what is meant when a Party states an action will be conducted "when or where feasible" or "where practicable." The language is not meant to indicate a lack of commitment by the Party(ies), but to candidly note that there may be instances where due to circumstances beyond a Party's control, conservation measures or commitments need to be modified or other means of management identified. If Parties need assistance in developing additional or new proposed conservation measures this could be done in cooperation with the PLSWG to ensure that land snail conservation occurs as intended in the CA.

9.1.1 Landscape Level Conservation Measures

This section describes general conservation efforts that all Parties agree to implement at the landscape level in the Pinaleño Mountains, in accordance with their respective authorities and their individual missions. These common and comprehensive efforts and actions include:

- Identifying suitable or potentially suitable land snail habitat/sites/areas and documenting those areas that are known to support high biodiversity and/or assemblages of federal and state listed threatened and endangered plant and animal species.
- Identifying areas occupied by land snails (for estimating land snail populations [relative densities at each site] following PLSWG-approved protocols/approaches).
- Developing and implementing best management practices (BMPs) for avoiding, minimizing and/or mitigating impacts to suitable and occupied land snail habitat.
- Identifying and collaborating with other possible partners (non-governmental, university, county, commercial, recreational, and private) on conservation/management efforts which contribute to reducing or mitigating impacts to land snail habitat (or sustaining same).
- Appropriately sharing land snail information and data among CA parties to promote the intended conservation partnership and support accompanying adaptive management processes.
- Assessing and evaluating land snail habitat and/or population trends related to conservation actions implemented by CA partners or otherwise associated with efforts to mitigate identified threats to the species.
- Develop and disseminate educational outreach material.

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9.1.2 Local Level Conservation Measures

This section describes general conservation efforts that all Parties agree to implement at the local, installation or property level, consistent with their respective authorities and in accordance with their individual missions. These common and site-specific efforts and actions include:

- Considering the effects of actions on land snails during the planning process, and avoiding or minimizing impacts, or implementing mitigation measures to offset impacts to land snail populations and habitat where practical and feasible.
- Identifying presence/absence of land snails in proposed-action areas where the action will disturb soils or other key habitat features in suitable habitat.
- Avoid when practicable, or minimize or mitigate unavoidable adverse effects on land snail populations and habitat during implementation of land management activities.

9.2 Agency-Specific Species and Habitat Conservation Actions

National Environmental Policy Act Compliance

This CA is being developed for planning purposes. Before any on-the ground actions can occur on federally managed lands, a determination must be made whether or not the conservation actions are consistent with the applicable agency's land use or land management plan and whether or not additional NEPA analysis is required. If conservation actions are determined not to be consistent with a land management plan, then these actions, where permissible by law, should be incorporated into the applicable agency's land use or land management plan through an amendment or maintenance process before they can be implemented. Alternatively, the conservation action can be modified such that it is more in line with the land management plan. Actions on lands administered by the state or private lands might not be subject to NEPA analysis.

The following subsections outline specific land snail conservation and management actions that have been implemented, are being implemented, or will be implemented by the Parties. This CA serves to consolidate and coordinate all current conservation commitments and make the Parties signatory to this CA accountable for their efforts moving forward. The Stressor/Conservation Measure Matrix (Appendix A) summarizes the suite of conservation actions that will be deployed by CA Parties to address identified threats facing land snails in the Pinaleño Mountains.

9.2.1 U.S. Fish and Wildlife Service

The USFWS is responsible under the ESA to work with other federal agencies, States, local municipalities, and other partners to help conserve and implement conservation measures for threatened and endangered species across the U.S. As a partner to the PLSWG, the USFWS contributes to the development and refinement of conservation actions identified in the CA, and provides input during Work Group meetings and review of annual progress reports and associated CA documents.

9.2.2 U.S. Forest Service

The USFS has designated the four *Sonorella* and one *Oreohelix* species in this CA as Regional Forester Sensitive status for planning and analysis purposes, and these land snails occur within the Coronado National Forest. In addition to the Forest Service Manual (FSM), USFS administers these public lands within the range of the covered species through one approved LRMP. The CNF is currently operating under the 1986 LRMP, but is undergoing a forest plan revision. Through the FSM and LRMP, USFS works to avoid actions or minimize unwanted impacts to land snail habitat. Conservation measures specific to the covered species include fire management, maintaining talus and riparian habitat, and protecting occupied habitat from livestock grazing; some of these conservation measures are associated with plan components of the draft Land and Resource Management Plan.

The LRMP contains plan components in the form of desired conditions, objectives, and standards and guidelines that can provide for the conservation of the land snails and their habitat on public lands. The 1986 LRMP established Management Area 2B “to perpetuate the unique wildlife and vegetative species, in particular the Wet Canyon talussnail, present within this management area.” The management direction provides for an increase in habitat stability for the Wet Canyon talussnail, while allowing for other uses in the area. This management area is carried forward into the draft revised LRMP as the Wet Canyon Talussnail Zoological Area. LRMP information and revision status for the CNF can be found here:

Coronado National Forest: <http://www.fs.usda.gov/land/coronado/landmanagement>

Forest Service Manual 2670

Through the biological evaluation process (FSM 2670.32) for land and resource management activities, project level effects to sensitive species are evaluated for conformance with the viability directives contained in the FSM. Other direction relevant to Pinaleño land snails in the FSM and the LRMPS includes, but is not limited to:

- *FSM-Objectives: 2670.22 - Sensitive Species*
 - Develop and implement management practices to ensure that species do not become threatened or endangered because of USFS actions.
 - Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands.
 - Develop and implement management objectives for populations and/or habitat of sensitive species.
- *FSM-Policy: 2670.32 - Sensitive Species*
 - Assist states in achieving their goals for conservation of endemic species.
 - Review programs and activities as part of the NEPA process through a biological evaluation, to determine their potential effect on sensitive species.
 - Avoid or minimize impacts to species whose viability has been identified as a concern.
 - Analyze, if impacts cannot be avoided, the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole.

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- Establish management objectives in cooperation with the states when projects on National Forest System lands may have a significant effect on sensitive species population numbers or distributions. Establish objectives for federal candidate species, in cooperation with the USFWS and the states.

Conservation Measures for the Main Stressors on the Units

Coronado National Forest

- LRMP Range Management Guideline: Grazing intensity, frequency, occurrence, and period should provide for growth and reproduction of desired plant species while maintaining or enhancing habitat for wildlife.
- Ensure that all occupied sites remain protected from detrimental effects from livestock.
- Ensure that all occupied sites remain protected from detrimental effects from recreation. In particular:
 - The Wet Canyon user-built trail is not maintained by the Forest, which may reduce the amount of recreational users that use the trail and therefore reduce impacts to the snails and their habitat in that canyon from hikers.
- Develop and implement the Pinaleño FireScope Southeast Project (www.data.ecosystem-management.org) and continue implementation of the 2009 Pinaleño Ecosystem Restoration Project (PERP) to help manage the potential effects of stand-replacement wildfires. Follow all BMPs to help manage the effects of fuel reduction activities to important aquatic sites. Coordinate with USFWS and the PLSWG, when appropriate.
- As project areas within the Pinaleño Mountains are identified for analysis, evaluate fuel load conditions in the geographic areas occupied by the covered snail species, and determine if those fuel loads are moderately altered (Fire Regime Condition Class [FRCC] 2) or substantially altered (FRCC 3).
- If funding and resources are available, implement a fuels reduction program (e.g., thinning, prescribed burning, etc.) if it is determined that fuel loads are moderately (FRCC 2) or substantially (FRCC 3) altered.
- Follow the Red Book Chapter 12 guidelines from the National Interagency Fire Center (https://www.nifc.gov/policies/pol_ref_redbook.html) in applying fire retardant during fire suppression operations. The USFS also follows the guidance in the October 2007 Final Environmental Assessment on aerial application of fire retardant. As part of an annual update to the Fire Retardant Biological Assessment in 2017, the Forest has added all known locations of snails covered in this CA, plus a 400-foot buffer, to the fire retardant avoidance maps. In addition, the Forest added 400-foot buffers to the fire retardant avoidance maps for portions of Twilight Spring (and associated downstream area), and Noon and Marijilda Creeks; there is an existing 400-foot buffer on the stream in Wet Canyon.
- Conduct and/or facilitate monitoring of the status of land snails in the Pinaleño Mountains in coordination with the PLSWG.
- In coordination with the PLSWG, reevaluate the effectiveness of this CA in the event that new threats to covered land snails are identified.

9.2.4 Arizona Game and Fish Department

The AGFD is a wildlife management agency, and cooperates with PLSWG partners to actively monitor and manage Pinaleño land snails since 2001. In cooperation with USFS, AGFD has conducted periodic surveys of land snail populations and their habitat through timed presence-absence surveys throughout the range of talussnails in Wet Canyon, Twilight Canyon, Turkey Flat, Post Canyon, and the northeast side of Clark Peak. Heritage-funded reports have provided information on the species distribution, status, threats, and habitat use in Arizona.

As outlined in the SWAP (AGFD 2012b), the AGFD commits to coordinate with partners to achieve collaborative conservation and research goals, and to complete and implement the CA with PLSWG partners.

- Conduct and continue to support population monitoring and habitat surveys, per an agreed-on rotational schedule of monitoring sites, in cooperation with PLSWG partners.
- Review, and as necessary revise and implement recommendations and guidelines for management of the covered species and their habitats.

AGFD's Project Evaluation Program facilitates the incorporation of fish and wildlife resource needs or features in land and water development or management programs in Arizona, and is responsible for coordinating the Environmental Assessment Checklist (EAC) process. The EAC process strives to ensure that all AGFD activities comply with applicable laws, policies and directives including: NEPA, ESA, State and National Historic Preservation Acts, and granting entities and management plans. The EAC process also ensures coordination with affected land managers and land users. AGFD Policy I2.2, states that the AGFD will meet the objectives of NEPA on any project or program that may have an effect on the environment. The EAC process provides a systematic process for identifying issues and evaluating effects associated with a project or program.

In addition to any project documentation, existing plans, blueprints, protocols, and maps, the EAC process requires a complete description of the proposed project and includes the following information, if applicable: habitat types, equipment/tools to be used, description of all potential surface and subsurface disturbance, including total acreage and dimensions of all project areas with potential surface and subsurface disturbance, potential impacts, including visual or auditory effects, alternatives considered in order to avoid or minimize impacts, anticipated implementation date and duration of project, and how the site will be accessed. AGFD's Project Evaluation Program is also responsible for coordinating the review of other agencies' land and water development, management programs, or other actions/projects that may impact wildlife resources, and developing official AGFD position statements for these actions.

9.3 CA Funding Commitments

The Parties are committed to achieving the goals of this CA, and each party will manage their respective resources and activities, in a separate, coordinated, and mutually beneficial manner. Contingent on the individual Party's statutory authority and availability of appropriated funds, pursue funding opportunities for implementation of the conservation measures set forth in this

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CA. As appropriate, Parties will support the PLSWG and all management activities undertaken in accordance with the responsibilities of the PLSWG. Many of the respective agency conservation actions outlined in the preceding section have already been funded and are part of standard operating procedures or commitments outlined in existing land use/management plans. However, the Parties recognize funding could be reduced over future years. Therefore, it is understood that the commitments under this CA, may not be undertaken and/or implemented until there has been an appropriate obligation of funds for said commitments.

No provision herein shall be interpreted to require obligation or payment of funds in violation of the Anti-Deficiency Act, 31 U.S.C. § 1341, or any applicable state law. Nothing in this CA will be construed by the Parties to require the obligation, appropriation, or expenditure of any funds from the U.S. Treasury. The Parties acknowledge that the USFWS and the USFS will not be required under this CA to expend any federal agency's appropriated funds unless and until an authorized official of that agency affirmatively acts to commit to such expenditures as evidenced in writing.

10. ADAPTIVE MANAGEMENT

The conservation commitments and actions, summarized in the section 9, have been developed by the Parties to this CA to address identified threats to Pinaleño land snails (section 8). Appendix A provides the details for the specific conservation actions - as they relate to these identified species threats - that have been implemented, are being implemented, or are being developed for implementation by the Parties to this CA. Accordingly, the conservation actions outlined in this CA are designed to achieve the stated purpose of this CA of providing comprehensive, range-wide conservation by effectively addressing threats to land snails in the Pinaleño Mountains. In implementing this CA, the PLSWG will apply adaptive management principles through the duration of the CA to ensure associated conservation measures remain responsive and effective.

Adaptive management is a scientific approach that: 1) recognizes uncertainty that is inherent in natural systems, 2) capitalizes upon change and improvement in data gathering and analysis techniques, and 3) treats actions in an experimental framework in which learning becomes an inherent objective and alternative hypotheses are evaluated. It is basically a mechanism for continuous improvement based on what has been learned through monitoring and evaluation of management actions (Salafsky *et al.* 2001). Adaptive management is designed to bring new information immediately into new management direction. An adaptive management program can also help to anticipate and resolve uncertainty related to the covered species, the effect of conservation measures and/or changes in environmental conditions.

Because of the range of habitat conditions that these covered species occupy in Pinaleño Mountains and the continual growth of knowledge in areas such as threats and life history, this strategy will have to remain flexible in order to capture and reflect new information on snails. Based on the expanded duration and geographic application of conservation measures implemented under this CA, the success of this CA will benefit from the adoption of an adaptive

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management approach to conserving land snails. Cooperators agree and recognize, consistent with the goals of this CA, that monitoring actions and conservation measures implemented will be conducted consistent with the concepts of adaptive management. The effectiveness of all conservation measures and monitoring methods will be periodically reviewed and evaluated by the cooperators. Based on such evaluation, appropriate modifications to strategies and actions will be made to ensure scientific rigor and the efficacy of conservation measures. The signatories to this CA are committed to seeking the resources necessary to ensure successful implementation of adaptive management principles.

The essential steps of the CA adaptive management strategy are summarized as follows:

- Step 1. Implement CA conservation actions, measures, and associated strategies.
- Step 2. Implement annual work plans for management and monitoring.
- Step 3. Review CA conservation goals, objectives and strategies, and adjust as necessary based on updated information.
- Step 4. Prioritize locations for implementation of conservation actions and identify and prioritize supporting research needs.
- Step 5. Initiate site-specific actions to reduce or eliminate identified threats.
- Step 6. Implement monitoring plan to determine effectiveness of conservation actions.
- Step 7. Analyze and evaluate monitoring and management results to determine progress towards attainment of conservation objectives.
- Step 8. Return to Step 3.

11. CA DURATION, RENEWAL AND REVIEW

Long-term protection and management, as outlined in this CA, are necessary for the continued conservation of the Pinaleño land snails. The initial term of this CA shall be twenty-five (25) years. Thereafter, the Parties agree that this CA shall be extended for additional five (5) year increments until long-term habitat and population conservation of the land snails is achieved, as determined by the PLSWG with concurrence by USFWS. Throughout the initial term of this CA, the PLSWG will also develop successive 5-year action/work plans to help the respective signatories in planning associated staff workload and implementation of the CA. With each new 5-year action/work plan, the signatories review progress made and make updates on stressors and conservation actions needed.

Any Party to the CA may propose modifications to this CA by providing written notice to the other Parties. Such notice shall include a statement of the proposed modification and the reason for the modification. The Parties will use their best efforts to respond to proposed modifications within 60 days of receipt of such notice. Proposed modifications will become effective upon the other Parties' written approval and completion of any necessary environmental analysis. Any Party may withdraw from this CA upon sixty (60) days written notice to the other Parties.

All parties are hereby put on notice that the State of Arizona's participation in this CA is subject to cancellation pursuant to ARS 38-511. Pursuant to ARS 35-214 and 35-215, and Section 41.279.04 as amended, all books, accounts, reports, files, and other records relating to this CA

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shall be subject at all reasonable times to inspection and audit by the state for 5 years after CA completion. Such records shall be reproduced as designated by the State of Arizona. Federal agencies may comply with the aforementioned State statutes to the extent they do not conflict with applicable federal law. All parties are hereby put on notice that AGFD's participation in this agreement is subject to Executive Orders 99-4 and 75-11, entitled "Prohibition of discrimination in State Contracts – Non-discrimination by Employment by Government Contractors and Subcontractors". Said non-discrimination orders, by reference, are made a part of this CA.

12. EFFECT OF THE CA IN EVENT OF SPECIES LISTING DECISION

It is the intent and expectation of the Parties that the execution and implementation of this CA will lead to the conservation of the Pinaleño land snails within their natural range in Arizona. If, subsequent to the effective date of this CA, the Secretary of the Interior should determine pursuant to section 4(a) of the ESA (16 U.S.C. §1533(a)), that any of the land snails are threatened or endangered, the Parties may participate in recovery planning for the listed species. It is also the expectation of the Parties that the conservation and management commitments made in this document may be considered by the USFWS in their listing determination in the event any of the covered species are evaluated for listing under the ESA.

13. ADDITIONAL PROVISIONS

13.1 Remedies

No Party shall be liable in damages for any relief under this CA (including, but not limited to, damages, injunctive relief, personal injury, and attorney fees) for any performance or failure to perform under this CA. Furthermore, no Party has any right of action under this CA. All Parties will have all remedies otherwise available to enforce the terms of the CA and any associated permits. No party shall be liable in damages for any breach of this CA, any performance or failure to perform an obligation under this CA, or any other cause of action arising from this CA.

13.2 Dispute Resolution

The Parties agree to work together in good faith to resolve any disputes, using dispute resolution procedures agreed upon by the Parties. In addition, the PLSWG will coordinate as needed to help resolve any disputes among the Parties. To the extent required pursuant to ARS 12-1518, and any successor statutes, the parties agree to use arbitration, after exhausting all applicable administrative remedies, to resolve any dispute arising out of this CA, where not in conflict with federal laws.

13.3 No Third-Party Beneficiaries

This CA does not create any new right or interest in any member of the public as a third-party beneficiary, nor shall it authorize anyone not a Party to this CA to maintain a suit for personal injuries or damages pursuant to the provisions of this CA. The duties, obligations, and responsibilities of the Parties to this CA with respect to third parties shall remain as imposed under existing law.

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APPENDIX A: STRESSOR / CONSERVATION MEASURE MATRIX

Definitions of terms used:

Stressor - a process or event having a negative impact on land snail populations. Stressors are grouped under each of the five listing/delisting factors.

Scope - the geographic and temporal extent of the stressor. The following are used to describe geographic extent: "Insignificant" - stressor's geographic extent negligible; "Small" - <10% of population's potential range; "Moderate" - 11-30% of population's potential range; "Significant" - 31-60% of population's potential range; or "Very Significant" - > 60% of population's potential range. The following are used to describe temporal extent: "Long-term" - stressor expected to be persistent without intervention; "Short-term" - stressor expected to dissipate on its own with <5-10 years; or "N/A" – not applicable.

Immediacy - the action time frame of the stressor. The following are used to describe immediacy: "Future" - effects anticipated in the future; "Imminent" - effects occurring now; "Historic" - effects already realized, but restorative action necessary; or "N/A" – not applicable.

Intensity - the strength of the stressor itself to harm the species. The following are used to describe intensity: "Low" - minor reductions in range or vital rates [survival and reproductive capacity]; "Moderate" - reductions in range or vital rates; or "High" - severe reductions in vital rates.

Population Exposure – how much of a land snail population is exposed to a stressor in space and time. The following are used to describe exposure: "Insignificant" - level of exposure negligible; "Small" - <10% of population exposed; "Moderate" - 11-30% of population exposed; "Significant" - 31-60% of population exposed; and "Very Significant" - >60% of population exposed.

Species Response - the change in the species' reproductive capacity or survival due to being exposed to a stressor. The following are used to describe response: "Basic Need Inhibited" - capacity to meet basic needs of feed/breed/shelter altered, possibly reducing growth or vital rates; "Confirmed" mortality or identifiable reduction in individual growth or vital rates; or "Significant" mortality or reduction in individual growth or vital rates.

Overall Threat Level - the integration of the scope, immediacy, and intensity of the stressor with the exposure and response of the species measured at the population or species level. The following are used to describe the overall threat level: "Low" - no action needed at this time; "Moderate" - action is needed; "High" - immediate action is needed; or "Severe" - immediate action is essential for survival of population.

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Landowners and Partners – “USFS” = U.S. Forest Service (Coronado National Forest); “USFWS” = U.S. Fish and Wildlife Service; “AGFD” = Arizona Game and Fish Department

Note: In the October 2016 meeting of the PLSWG, the partners decided to base the land snail monitoring program on AGFD’s talussnail survey protocol, as described in Sorensen and Martinez 2016. The land snail monitoring program will be outlined in a separate document.

Factor A: Present or threatened destruction, modification, or curtailment of the species’ habitat or range					
Stressor: Loss or degradation of habitat due to ash flows, debris, and sedimentation following severe wildfires					
Scope:	Immediacy:	Intensity:	Population Exposure:	Species Response:	Overall Threat Level:
Significant / Long-term	Future / Historic	Moderate	Significant	Confirmed	Moderate
Populations Affected:	Landowners and Partners:	Conservation Measures:	Conservation Benefits:	Measure of Success:	Annual Reporting Metric:
Sonorella and Oreohelix	USFS	Monitor and manage woodland fuel loads through prescribed burns or mechanical removals	Reduced risk of severe wildfires in drainages that contain land snail populations	Reduced acreage of habitat burned in wildfires; land snail populations maintained	Acres of habitat treated for fuel reduction, and identify drainages that were treated
Sonorella and Oreohelix	USFS	Educate land users on fire awareness and prevention	Reduced risk of severe wildfires in drainages that contain land snail populations	Reduced incidents of human-caused wildfires by land users	Identify education / outreach efforts completed annually on fire awareness and prevention
Sonorella and Oreohelix	USFS USFWS AGFD	Salvage land snail populations affected by post-wildfire impacts	Prevent short-term extirpation of affected land snail populations while their habitat stabilizes	Secure sufficient numbers of land snails from the affected populations to maintain their lineages and possible future repatriation	Number of land snails salvaged from wildfire affected populations, and identify the holding facility
Sonorella and Oreohelix	USFS	Implement erosion control measures when needed around land snails sites	Reduced impacts from ash flows, debris, and sedimentation to land snail habitat	land snails habitat and populations are minimally or not affected by post-fire flows	Identify land snail sites where erosion control measures were implemented

Note: Non-fire treatments include a variety of options for thinning dense stands of trees and shrubs, reducing surface and ladder fuels, and creating openings in forest canopy where it exists. Fire treatments consist of prescribed burning and burning piles of hand- and machine-cut materials.

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Factor A: Present or threatened destruction, modification, or curtailment of the species' habitat or range					
Stressor: Incidental exposure to aerial fire retardant during fire-fighting actions					
Scope:	Immediacy:	Intensity:	Population Exposure:	Species Response:	Overall Threat Level:
Moderate / Long-term	Future / Historic	Low	Small	Basic Need Inhibited	Low
Populations Affected:	Landowners and Partners:	Conservation Measures:	Conservation Benefits:	Measure of Success:	Annual Reporting Metric:
Sonorella and Oreohelix	USFS USFWS	Follow the Red Book Chapter 12 guidelines for aerial applications of fire retardant near mapped avoidance areas	Reduced risk of contaminating land snail habitat and populations from aerial fire retardant chemicals	No land snail populations affected by aerial applications of fire retardant	Number of misapplications of aerial fire retardant in areas that contain land snail populations
All covered land snails	USFS USFWS AGFD	Avoid fire line construction in Wet Canyon and within other mapped avoidance areas	Reduced risk of direct and indirect mortality due to habitat alteration (potential desiccation due to removal of vegetation and leaf litter)	No land snail populations affected by fire line construction during fire suppression activities	Meters of fire line constructed in areas that contain snail populations
All covered land snails	USFS USFWS AGFD	Avoid placement of pumps and hose lays in Wet Canyon and within other mapped avoidance areas	Reduced risk of direct and indirect mortality due to habitat alteration (water removal, streamflow alteration/disruption, and potential contamination from fuel spills)	No land snail populations affected by water pumping and/or hose lay operations during fire suppression activities	Number of pumping and/or hose lay operations within areas containing snail populations
All covered land snails	USFS USFWS AGFD	Pursue opportunities to research the effects of ammonia and other fire retardant chemicals on land snail survival and recruitment	Increased knowledge on effects of fire retardant chemicals on land snails	Document the Lethal Dose-50 thresholds of various fire retardant chemicals on <i>ex situ</i> land snails in a research study	Results of research on fire retardant chemicals on land snail survival and recruitment

Conservation Agreement for Pinaleño Land Snails

Factor A: Present or threatened destruction, modification, or curtailment of the species' habitat or range					
Stressor: Incidental exposure to aerial fire retardant during fire-fighting actions					
Populations Affected:	Landowners and Partners:	Conservation Measures:	Conservation Benefits:	Measure of Success:	Annual Reporting Metric:
All covered land snails	ACNC – PZ USFWS AGFD	Pursue opportunities to develop <i>ex situ</i> management and propagation techniques	Increased understanding of the life cycle assessments and conditions required for <i>ex situ</i> propagation and maintenance	Document propagation, growth, development rate, and longevity	Results of sustainability of <i>ex situ</i> populations and knowledge gained

Notes: The Red Book, Chapter 12 guidelines are from the National Interagency Fire Center, and can be accessed at https://www.nifc.gov/policies/pol_ref_redbook.html. The USFS also follows the guidance in the October 2007 Final Environmental Assessment on aerial application of fire retardant and updates the fire retardant maps in the Biological Assessment on an annual basis.

Factor A: Present or threatened destruction, modification, or curtailment of the species' habitat or range					
Stressor: Reduction of stream flow and moisture to snail habitats					
Scope:	Immediacy:	Intensity:	Population Exposure:	Species Response:	Overall Threat Level:
Significant / Long-term	Future / Imminent	Moderate	Significant	Basic Need Inhibited	Moderate
Populations Affected:	Landowners and Partners:	Conservation Measures:	Conservation Benefits:	Measure of Success:	Annual Reporting Metric:
Sonorella and Oreohelix	USFS AGFD	Monitor presence of stream flow and relative humidity levels at these land snail sites using PLSWG survey protocols	Information on water available and sufficient relative humidity to support land snail population and habitat	Stream flow and relative humidity sufficient to support land snail populations; if not sufficient, then a trigger point for PLSWG to consider other actions	Identify land snail sites monitored and presence of stream flow or relative humidity; note if land snail population present and estimated CPUE

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Factor A: Present or threatened destruction, modification, or curtailment of the species' habitat or range					
Stressor: Loss or degradation of habitat from residential development, roadway construction, and mining					
Scope:	Immediacy:	Intensity:	Population Exposure:	Species Response:	Overall Threat Level:
Insignificant / Long-term	Future / Historic	Low	Insignificant	Basic Need Inhibited	Low
Populations Affected:	Landowners and Partners:	Conservation Measures:	Conservation Benefits:	Measure of Success:	Annual Reporting Metric:
Sonorella and Oreohelix	USFS AGFD	Maintain or improve habitat at land snail sites	Maintain habitat that supports self-sustaining and robust land snail populations	Habitat is sufficient to support land snail populations	Identify land snail sites monitored; note if land snail population present and estimated CPUE

Factor A: Present or threatened destruction, modification, or curtailment of the species' habitat or range					
Stressor: Impacts from poor livestock management practices (i.e. overgrazing, trampling, sedimentation)					
Scope:	Immediacy:	Intensity:	Population Exposure:	Species Response:	Overall Threat Level:
Insignificant / Long-term	Imminent / Historic	Low	Small	Basic Need Inhibited	Low
Populations Affected:	Landowners and Partners:	Conservation Measures:	Conservation Benefits:	Measure of Success:	Annual Reporting Metric:
All covered land snails	USFS	Maintain or improve land snail occupied habitat	Maintain land snail habitat that supports a self-sustaining and robust snail populations	Land snail habitat is sufficient to support snail populations; if not sufficient then a trigger point for PLSWG to consider other actions	Note impacts to condition of land snail habitat during surveys, results of timed snail counts, and estimated CPUE
Sonorella and Oreohelix	USFS	Evaluate the benefits of installing exclosure fencing around snail habitat within active grazing allotments	Fencing would protect snail habitat from livestock grazing and trampling	Snail habitat is fenced to exclude livestock	Acres of snail habitat protected by fencing

Notes: Livestock grazing is not permitted on most of the high elevation areas of the Pinaleño Mountains that have land snail populations.

Conservation Agreement for Pinaleño Land Snails

Factor A: Present or threatened destruction, modification, or curtailment of the species' habitat or range					
Stressor: Impacts from off-trail Off Highway Vehicle use (i.e. trampling, sedimentation)					
Scope:	Immediacy:	Intensity:	Population Exposure:	Species Response:	Overall Threat Level:
Insignificant / Long-term	Imminent / Historic	Low	Small	Basic Need Inhibited	Low
Populations Affected:	Landowners and Partners:	Conservation Measures:	Conservation Benefits:	Measure of Success:	Annual Reporting Metric:
All covered land snails	USFS	Maintain or improve occupied land snail habitat	Maintain snail habitat that supports a self-sustaining and robust snail populations	Habitat is not being degraded by OHV use	Evidence of OHV use in the habitat or not; describe actions taken to reduce this impact
Sonorella and Oreohelix	USFS	Evaluate the benefit of installing enclosure fencing, barriers, or access restricted signs around snail habitat	Protect snail habitat from OHV use and trampling	Snail habitat is fenced, blocked, or signed to exclude OHVs	Acres of snail habitat protected by fencing, barriers, or access restricted signs

Notes: Off-trail OHV use is not permitted on the high elevation areas of the Forest on the Pinaleño Mountains with land snail populations.

Factor B: Overutilization for commercial, recreational, scientific or educational purposes					
Stressor: Impacts to populations from over-collection					
Scope:	Immediacy:	Intensity:	Population Exposure:	Species Response:	Overall Threat Level:
Insignificant / N/A	N/A	Low	Insignificant	Basic Need Inhibited	Low
Populations Affected:	Landowners and Partners:	Conservation Measures:	Conservation Benefits:	Measure of Success:	Annual Reporting Metric:
All covered land snails	USFS USFWS AGFD	Maintain existing regulations that restrict collection of land snails, except for licensed scientific use	Reduced risk to land snail populations from over-collection of individuals	Agency rules and regulations established on the collection of land snails	Identify agency rules and regulations in effect that restrict collection of land snails, and number collected annually for scientific use

Conservation Agreement for Pinaleno Land Snails

Factor C: Predation or Disease					
Stressor: Predation or competition from birds and small mammals					
Scope:	Immediacy:	Intensity:	Population Exposure:	Species Response:	Overall Threat Level:
Small / Long-term	Future / Imminent	Low	Insignificant	Basic Need Inhibited	Low
Populations Affected:	Landowners and Partners:	Conservation Measures:	Conservation Benefits:	Measure of Success:	Annual Reporting Metric:
All covered land snails	USFS AGFD	Monitor land snail populations to document changes in status and distribution	Reduced predation to land snails populations from natural predators	No significant reduction or loss of land snail populations from natural predators	Identify sites surveyed for land snails each year, and results from those surveys

Factor C: Predation or Disease					
Stressor: Impacts from parasites or pathogens					
Scope:	Immediacy:	Intensity:	Population Exposure:	Species Response:	Overall Threat Level:
Small / Long-term	Future / Imminent	Low	Insignificant	Basic Need Inhibited	Low
Populations Affected:	Landowners and Partners:	Conservation Measures:	Conservation Benefits:	Measure of Success:	Annual Reporting Metric:
All covered land snails	USFS AGFD	Monitor land snail populations to document changes in status and distribution	Reduced illness and mortality to land snail populations from parasites and pathogens	No significant reduction or loss of land snail populations from parasites and pathogen outbreaks	Identify sites surveyed for land snails each year, and results from those surveys
All covered land snails	USFS USFWS AGFD	Evaluate the feasibility to investigate various land snail populations to determine if they are impacted by parasites or pathogens	Improve adaptive management capability with increased knowledge on effects of parasites and pathogens on land snails	Document population level impacts of parasites and pathogens on captive land snails in a research study	Results of research on parasites and pathogens on land snail survival and recruitment

Conservation Agreement for Pinaleño Land Snails

Factor D: Inadequacy of existing regulatory mechanisms					
Stressor: Degradation or loss of habitat due to inadequate regulations					
Scope:	Immediacy:	Intensity:	Population Exposure:	Species Response:	Overall Threat Level:
Small / Long-term	Future / Imminent	Low	Small	Basic Need Inhibited	Low
Populations Affected:	Landowners and Partners:	Conservation Measures:	Conservation Benefits:	Measure of Success:	Annual Reporting Metric:
All covered land snails	USFS USFWS AGFD	Monitor land snail populations to document changes in status and distribution	Maintain spring habitat that supports self-sustaining and robust snail populations	No significant reduction or loss of land snail populations due to existing regulations	Identify sites surveyed for land snails each year, and results from those surveys

Factor E: Other man-made or natural factors affecting the species' continued existence					
Stressor: Climate change / drought impacts (i.e. loss of water to stream habitats, reduced moisture to habitat)					
Scope:	Immediacy:	Intensity:	Population Exposure:	Species Response:	Overall Threat Level:
Moderate/ Long-term	Future / Imminent	Low	Moderate	Basic Need Inhibited	Low
Populations Affected:	Landowners and Partners:	Conservation Measures:	Conservation Benefits:	Measure of Success:	Annual Reporting Metric:
All covered land snails	USFS	Monitor land snail populations and their habitats to document changes in status and distribution	Increased knowledge of the variability of land snail populations and their habitat under various wet/dry years	Identify impact thresholds to trigger other management actions to help maintain land snail populations and their habitat	Identify sites surveyed for land snails each year, and results from those surveys
Sonorella and Oreohelix	USFS	Continue implementation of fuel load and fire management plans	Reduced risk of severe wildfires in drainages that contain land snail populations	Reduced acreage of habitat burned in wildfires; land snail populations maintained	Acres of habitat treated for fuel reduction, and identify drainages that were treated

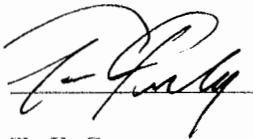
Note: Non-fire treatments include a variety of options for thinning dense stands of trees and shrubs, reducing surface and ladder fuels, and creating openings in forest canopy where it exists. Fire treatments consist of prescribed burning and burning piles of hand- and machine-cut materials.

Conservation Agreement for Pinaleño Land Snails

APPENDIX B: SIGNATORIES

to the Conservation Agreement for the Pinaleño Land Snails (page 1 of 3)

IN WITNESS WHEREOF, THE PARTIES HERETO have executed this Conservation Agreement for the Pinaleño Land Snails as of the last date written below

 for 3.13.18
Date


Ty E. Gray
Director
Arizona Game and Fish Department

Conservation Agreement for Pinaleño Land Snails

Appendix B: Signatories

to the Conservation Agreement for the Pinaleño Land Snails (page 2 of 3)

IN WITNESS WHEREOF, THE PARTIES HERETO have executed this Conservation Agreement for the Pinaleño Land Snails as of the last date written below

 3/26/2018
Date

Kerwin S. Dewberry
Forest Supervisor
Coronado National Forest

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Appendix B: Signatories

to the Conservation Agreement for the Pinaleno Land Snails (page 3 of 3)

IN WITNESS WHEREOF, THE PARTIES HERETO have executed this Conservation Agreement for the Pinaleno Land Snails as of the last date written below

 3/21/18
Date

Steve Spangle
Field Supervisor, Arizona Ecological Services Office
U.S. Fish and Wildlife Service