



National Fish and Wildlife Foundation
Draft Business Plan for the Sky Island Grasslands
March 24, 2009

What Is a Business Plan?

A business plan serves two broad, primary functions. First, it provides specific information to those (e.g., prospective investors) not familiar with the proposed or existing business, including its goals and the management strategy and financial and other resources necessary to attain those goals. Second, a business plan provides internal guidance to those who are active in the operation of the business, allowing all individuals to understand where the business is headed and the means by which it will get there. The plan helps keep the business from drifting away from its goals and key actions through careful articulation of a strategy.

In the context of the National Fish and Wildlife Foundation's conservation efforts, business plans represent the strategies necessary to meet the conservation goals of Keystone and other initiatives. Each business plan emphasizes the type(s) and magnitude of the benefits that will be realized through the initiative, the monetary costs involved, and the potential obstacles (risks) to achieving those gains. Each of the Foundation's business plans has three core elements:

Conservation Outcomes: A concrete description of the outcomes to which the Foundation and grantees will hold ourselves accountable.

Implementation Plan with Strategic Priorities and Performance Measures: A description of the specific strategies that are needed to achieve our conservation outcome and the quantitative measures by which we will measure success and make it possible to adaptively revise strategies in the face of underperformance.

Funding and Resource Needs: An analysis of the financial, human and organizational resources needed to carry out these activities.

The strategies and activities discussed in this plan do not represent solely the Foundation's view of the actions necessary to achieve the identified conservation goals. Rather, it reflects the consensus or majority view of the many federal, state, academic or organization experts that we consulted with during plan development.

In developing this business plan, the Foundation acknowledges that there are other ongoing and planned conservation activities that are aimed at, or indirectly benefit, keystone targets. This business plan is not meant to duplicate ongoing efforts but, rather, to strategically invest in areas where management, conservation, or funding gaps might exist in those broader conservation efforts. Hence, the aim of the business plan is to support the beneficial impacts brought about by the larger conservation community.

Summary

The Sky Islands are a unique region of more than 40 isolated mountain ridges surrounded by a sea of dry grasslands that straddles the Mexico/Arizona/New Mexico border. It is one of America's great hotspots for wildlife diversity, hosting more than twice as many mammal species as Yellowstone National Park and supporting the nation's highest diversity of reptiles, bees and ants.

Of the 13 million acres of grassland which once dominated this 30 million acre landscape, at least 2 million acres still have exceptional wildlife values and another 4 to 7 million acres of grassland could be restored. These grasslands are centered around 10 valley landscapes, each of which contain more than 100,000 acres of grassland habitat of exceptional value, and most of which support embedded wetlands. Within these landscapes we are targeting jaguar, bison, pronghorn, black-tailed prairie dog, Chiricahua leopard frogs, pronghorn and grassland sparrows as wildlife whose population response to conservation investments will be the best indicators of success.

Sky Island Grasslands are threatened by wide-scale disruption of natural fire regimes that have already allowed shrubland to invade and likely permanently transform 4 million acres of grassland and their associated wetlands; this threat continues to expand. Additional damage is from historic wounds that have yet to heal. The abundance and diversity of surface water habitats was compromised in the late 1800s and early 1900s during periods of excessive livestock grazing and drought, followed by heavy rains and subsequent arroyo erosion and downcutting. Continuing drought and climate change, as well as groundwater pumping, irrigation and spring development, further threaten grassland streams and cienegas. Expanding home development, road and border security infrastructure also threaten this ecosystem.

This business plan maps out a 10 year plan to restore, manage and conserve grasslands embedded and adjacent habitats in the Sky Island region. This business plan will guide every aspect of the Foundation's anticipated \$13 – \$15 million in grant-making associated with this habitat over 10 years. Ultimately we hope that the strategy and activities described herein are adopted by the broader community of agencies and organizations working on the same goals and responsible for the additional \$265 million or more of investments identified as necessary to protect and restore grasslands and the wetlands that depend upon them. Our resources will be focused on the following strategies:

Restore grasslands. Fire has been suppressed on most grasslands allowing invasion of shrub species that have eliminated more than 4 million acres of grassland. *Activity* — Implement at least 70,000 acres/year of burning, mechanical clearing and other management practices.

Protect threatened land and water. Important grasslands in some areas are threatened by home development, which eliminates and fragments habitats, interrupts fire cycles, and depletes the water resources that sustain wetland habitats and grassland wildlife. *Activity* — Support prioritization for land and water protection and fund efforts that protect at least 320,000 acres of grassland in the US and nearly a million acres in Mexico, along with improved land use and water planning.

Restore populations of target species. Black-tailed prairie dogs, bison, and leopard frog all need targeted investments to create new populations or improve habitat and population viability for existing populations. *Activity* — More than \$2 million in targeted efforts to improve population viability.

Expand capacity and incentives for landowners to manage for conservation. Private landowners own many of the highest priority grasslands in the United States and almost all grasslands in Mexico. In the US, regulatory incentives like safe harbor agreements are needed to secure necessary voluntary landowner participation in targeted landscapes. In Mexico, helping landowners develop and certify management plans can enable them to benefit directly from wildlife enhancements. On both sides of the border, government funding for wildlife, forage and habitat enhancement activities is underutilized. *Activity* — Support landowners' increased use of regulatory incentives and access to funding and technical support for conservation actions.

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Conservation Need

The Sky Islands is a region on the U.S./Mexico boundary that is a world renowned Biodiversity Hotspot, linking the North American continent's temperate and tropical latitudes. The region also bridges the lowest point in the Continental Divide, melding two of the largest deserts (Sonoran and Chihuahuan) in the western Hemisphere with short-grass prairie and semi-desert grasslands, which are interspersed with towering mountains of pine-oak, mixed conifer, and spruce-fir forests. This landscape still supports a community of ranchers and others whose livelihoods are still largely a land-based economy.

The Sky Island region is defined as much by the grassland sea as by the mountains that rise from it. These grasslands include semi-desert and Plains grasslands, as well as sacaton grassland bottomlands and many variations on the three types. Built on the alluvial fans of rock worn off mountainsides and come to rest as valley soils, these grasslands serve as the stage for extraordinary plant life; one valley can contain more than 50 species of native perennial grasses. They also provide habitat for grassland-specialist wildlife like pronghorn and prairie dogs, and movement corridors for wide-ranging species like jaguar and black bear.

In the face of climate change, this region provides unique opportunities for wildlife to follow the conditions they depend on — upwards in elevation along the steep gradients created by the Sky Island's many mountain ranges, or northwards through valleys or along mountain chains. The north-south orientation of the region's topography is already credited with promoting mixing of floras and faunas, and will continue to facilitate wildlife movement. This region is already at the northern frontier of many species' ranges, making it the anchor point for their journeys further north. These factors make preserving both corridors across latitudes and continuity across valleys even more important as conditions continue to shift.

The black-tailed prairie dog was once the most abundant and widely distributed species of prairie dog, but has declined precipitously and has been petitioned for protection under the Endangered Species Act in the US; it was extirpated in Arizona. Just across the Mexican border, though, northern Chihuahua is a stronghold for the species, supporting the largest remaining colony in North America. Prairie dogs are keystone species that create grassland habitat diversity and heterogeneity, prevent shrub encroachment, support raptor and predator populations and whose colonies or 'towns' provide preferred habitat for pronghorn, golden eagle, ferruginous hawk, burrowing owl and swift fox.

Jaguars in the grasslands and thorn-scrub of the Sky Island region comprise the northernmost outpost of a species best known from jungles of central and South America. As such, they represent a unique way of life for this grand cat — and a marker of the region's tropical natural heritage. It has been estimated that the northern segment of the jaguar population (southern Arizona and New Mexico, Sonora, and northern Sinaloa) is about 150 to 200 individuals.

A herd of bison on the prairies of Chihuahua is the southernmost outpost of this species. Though few people imagine bison as part of the region's natural heritage, archeological evidence shows they have been present in Mexico and the U.S. Sky Islands several thousand years. If numbers can be increased, this bison herd would become one of only 14 on the continent with more than 400 animals that is managed in the public interest.

The Chiricahua leopard frog is an endemic species of the Sky Island region and the Sierra Madre Occidental and inhabits montane and river valley cienegas, springs, pools, cattle tanks, lakes, reservoirs, streams, and rivers. Several factors pushed it onto the endangered species list, including habitat loss caused by watershed degradation and drying up of valley wetlands; introduced disease; pollution; and exotic species. The frog is now limited to the comparatively few aquatic systems that support few or no non-native predators (e.g. American bullfrogs, fishes, and crayfishes).

Pronghorn are indicators for ecological and landscape integrity. These wide-ranging grassland specialists require sight lines unbroken by shrubs and movement corridors unfragmented by human development. Because of this, they are among the first species to decline when shrubs take over grasslands, and among the first to disappear as roads, fences, and homes block the paths they use to wander in search of fresh food.

Grassland bird populations have shown a steeper, more consistent, and more geographically widespread decline than any other guild of North American bird species. Breeding Bird Survey data collected from 1966 to 1993 indicate that approximately 70% of the grassland bird species surveyed had negative population trends. The grasslands of the southwestern US and northern Mexico are the primary over-wintering grounds for most North American grassland bird species and are therefore, continentally important to their survival.

Major threats:

- ☐ Fire suppression has led to shrub encroachment into millions of grassland acres and is a direct threat to many grassland specialist species. Lands with high densities of invasive brush typically exhibit accelerated soil erosion rates, decreased water infiltration and decreased biodiversity. Creosote, mesquite, acacia, whitethorn, tarbush and juniper trees now dominate landscapes that used to be grasslands. This ecological degradation is often self-perpetuating, and interventions such as prescribed fire will be required to set ecosystems on the path to recovery.
- ☐ Technical capacity limits the ability of private ranchers and public lands managers from implementing prescribed burns; lack of time, information and adequate financial or regulatory incentives limits adoption of beneficial grazing practices, fire and other conservation tools. This lack of capacity also prevents owners and operators from fully taking advantage of cost-share and other assistance programs.
- ☐ In the US, subdivision development continues to eliminate viable grassland ecosystems, making natural fire regimes impossible, draining wetlands and the aquifers that support them, introducing exotic species, and fragmenting remaining habitats with roads and fences. In Mexico, the greatest ongoing land-use conversion risk to grasslands is from irrigated agriculture.
- ☐ Native frogs and fish are being pushed out of their last remaining cienega and valley stream habitats by exotic invaders such as bullfrogs, crayfish, and non-native fishes. Rare species such as the Chiricahua leopard frog, Sonoran tiger salamander, Mexican garter snake, and a dozen species of native fish will not recover without a major effort to eliminate invaders from priority areas.
- ☐ Direct mortality to rare wildlife species: Several of the region's most charismatic species — including jaguar, bison, pronghorn, and prairie dogs — continue to be impacted by poaching, impoundment, and control efforts. Addressing these threats directly will enable these species to benefit from the habitat improvements this plan will create.

Conservation Outcomes

Of approximately 2 million acres of high value grassland and 3.8 million acres of restorable grassland (plus another 4 million acres whose ecological state is unclear), an estimated 2,047,000 acres are already protected and a million acres are under active management by public or private landowners to maintain and enhance grassland habitat values.

This plan will be focused around a core set of large grassland landscapes in Arizona, New Mexico and Mexico which have extensive high quality and restorable grasslands and support many of the most important grassland biodiversity values. Together these areas create important north-south corridors that connect grassland habitats as well as the 'Sky Island' mountain ranges among the grasslands.

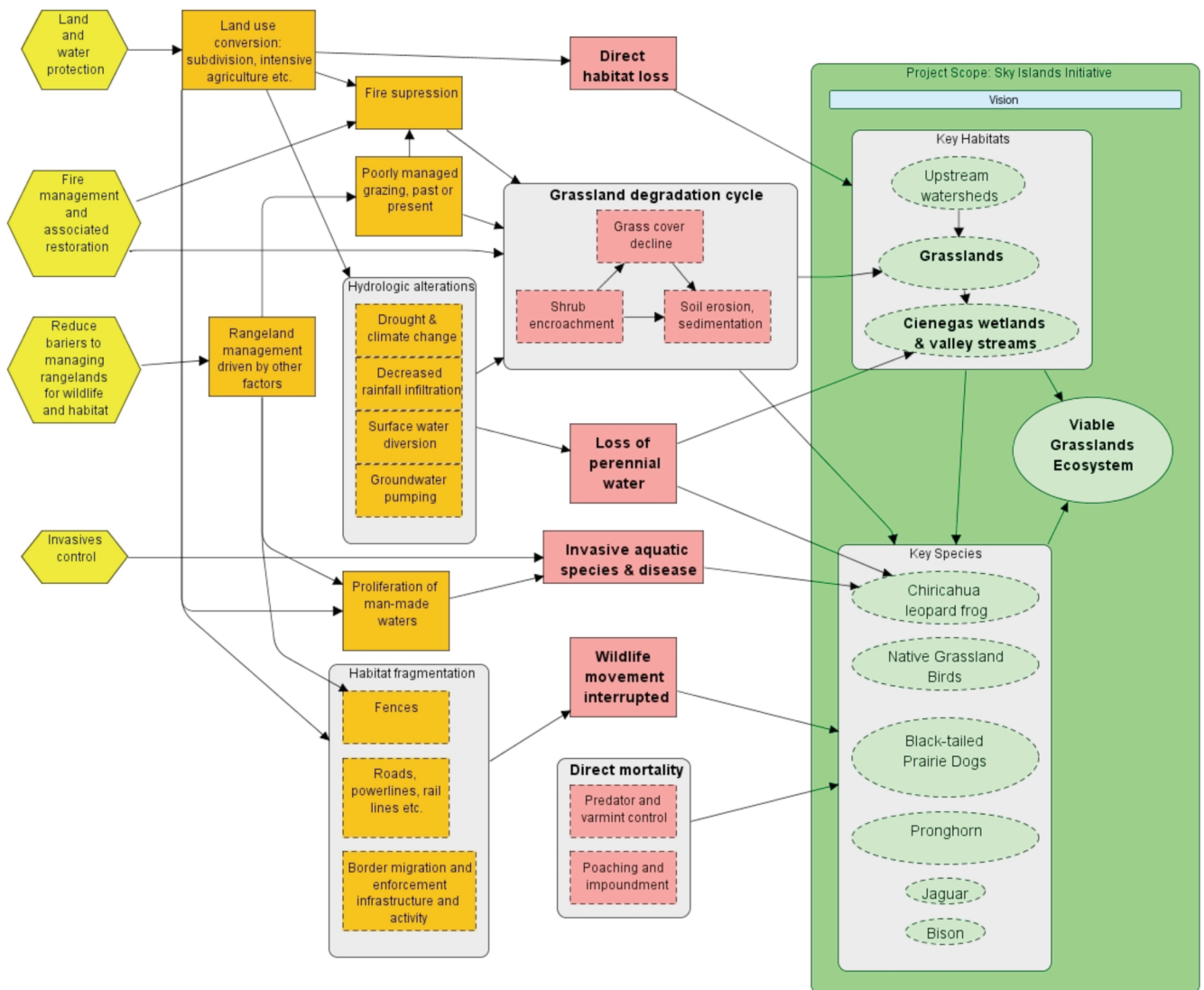
We expect that full implementation of these strategies of land protection, grassland management and restoration, and wildlife restoration will have the following benefits for wildlife populations:

- **Black-tailed prairie dog.** The Sky Islands area comprises only about 3 – 6 % of the historic range of the Black-tailed prairie dog, but the area is of disproportionate importance in connecting remaining Mexican colonies with populations further north in the United States. Of the 125,000 acres of potential habitat for the prairie dog on public lands in Arizona, more than 85% needs to be restored before prairie dogs can be reestablished. This initiative will restore at least 50 percent of this habitat. There are currently less than 4 acres of habitat occupied by prairie dogs at a single location in Arizona. This initiative will achieve at least 70% of Arizona's 10-year target of 7,100 acres of occupied prairie dog habitat in at least 3 locations.
- **Jaguar.** The northern segment of the jaguar population (southern Arizona and New Mexico, Sonora, and northern Sinaloa) totals about 150 – 200 individuals. As a major predator potentially found in diverse habitats, jaguars will benefit from the restoration and protection of grasslands, mainly as corridors between mountain ranges. This initiative will also decrease threats, such as poaching and killing due to cattle predation, rangeland management practices and subdivision and fragmentation. It is not possible at this time to estimate what a viable population of jaguars might be for the region, and thus the magnitude of the benefit of this initiative.
- **Bison.** Approximately 300 bison currently exist in Mexico and this population is expected to increase by 100 – 200 percent as a result of this initiative; bison populations are considered minimally viable at 400 animals, with 1,000 free roaming animals being the long term goal. This initiative will achieve the former and help achieve 30 – 60% of the larger viability goal. Rangewide, this bison herd would become one of only 14 wild herds with more than 400 animals.
- **Chiricahua leopard frog.** Roughly half of the known remaining populations of this endangered frog occur in the Sky Island region, most now relegated to isolated mountain canyons. Networks of wetlands embedded in the region's grassland valleys could support the metapopulations needed to recover the species in this region. This initiative is intended to protect the existing metapopulations, and create 15 new breeding populations (an increase of 50% from known sites), within at least two functioning metapopulations. Combined with habitat restoration and developing plans to address other threats for each metapopulation, this could meet delisting criteria for this threatened species in 4 of its 8 official recovery units.

- **Baird's sparrow (grassland sparrows).** Due partly to limited range for both breeding and wintering ranges, the Baird's sparrow population of some 1.2 million birds is relatively small compared to other grassland birds. The Sky Island grasslands comprise a significant portion of the Baird Sparrow's wintering range. By maintaining existing open grassland and restoring shrub-invaded grassland, this plan could increase available winter-grassland habitat in the Sky Island Ecosystem by 20%. This would help reverse a downward population trend by increasing overwintering survivorship and the robustness of birds returning to their breeding grounds. For other vulnerable grassland birds such as Botteri's sparrow and loggerhead shrike, achieving just moderate reductions in shrub cover in restorable grasslands may increase abundance by up to 30%.

Logic Framework

A logic framework is a diagram of a set of relationships between certain factors believed to impact or lead to a conservation target (species representing Keystone Initiatives). Logic frameworks are typically composed of several chains of logic whose arrows are read as “if-then” statements to help better understand how threats contribute to conservation target declines. Logic frameworks are used to define the conservation problem, assess limiting factors, and prioritize key strategies.



Legend			
	Strategy		Contributing Factor
	Direct Threat		Conservation Target

Implementation Plan

The following strategies describe the most important threats that currently face these wildlife species and affect our ability to conserve large Sky Island grassland landscapes and all the wildlife diversity they harbor. The strategies and outputs described are intended to take place over 10 years. Although additional threats affect these species and grasslands, the group of experts who helped develop this plan prioritized threats and the emphasis of this plan is on the highest priority threats. There are rough 10-year budget numbers assigned to some of the activities herein. If there is no budget next to an activity, that activity is not clearly identified as required in order to achieve the biological impact described above (however in some circumstances, those activities are necessary but are already covered through other agency budgets or staff time).

ADDRESSING THREAT 1 — Ecological degradation from fire suppression and shrub invasion

Grassland in the Sky Islands region was historically exposed to less intense (or regular) grazing pressure and much more frequent natural fire frequency. Fire return interval (time between fires), although irregular, was typically between five and ten years as documented by evidence such as tree rings, cienega sediments deposits, and historical records. Suppression of these fires over recent decades has allowed creosote, mesquite, acacia, whitethorn, tarbush, and juniper brush to invade close to 7 million acres of historic grassland, likely irreversibly converting more than 3 million acres to a permanent shrub-dominated system. This conversion is ongoing and has profound effects on wildlife species composition and diversity. The shift from grass to shrub dominance also has important hydrological impacts such as increasing soil erosion rates, decreasing water infiltration and stream flow, and degrading water quality, as well as lowering forage quality for livestock.

Landowner support for ecologically appropriate fire management is growing in many areas. As scientific evidence for the historic role of fire has accumulated over the last twenty years, along with better understanding of the role of fire in maintaining grasslands, many ranchers have begun to support more prescribed burning. They recognize that the restorative role of fire in sustaining grassland productivity also benefits their ranching operations by improving forage availability. However, the capability of individuals and local organizations to carry out prescribed burning has lagged behind the recognition of its importance. The limiting factor in developing fire management programs lies in the lack of trained people more than lack of funding. The NRCS can help support prescribed fire through its Environmental Quality Incentives Program (EQIP), but the lack of trained people to complete the planning and permitting required for burning on private and state land has led to a nearly complete lack of request to use EQIP funds for fire.

Strategy 1: Expand implementation of prescribed burns and associated treatments

Several barriers exist to expanding the use of prescribed fire. One is the traditional time-consuming approach of preparing fire plans one project at a time. A more efficient strategy is to prepare “programmatically” fire plans which address fire management needs over a large geographic area and for an extended period of time, thus completing the interagency consultation requirements for many burns at once rather than one at a time. Another barrier is the need for more detailed knowledge about how vegetation responds to specific burn prescriptions; that is, how do factors like season, temperature, humidity, fuel loads, etc. effect the amount and rate of grass recovery following fire. This can only be determined by monitoring the results of prescribed burns.

Activity 1: Use programmatic fire planning to enable public land managers to apply more fire on the ground.

Programmatic planning efforts such as the Peloncillo Mountains Programmatic Fire Plan in the Malpai area and Huachuca FireScape Project are already alleviating planning bottlenecks by satisfying planning needs for multiple burns over many years and large areas. Expanding on these and other existing interagency fire agreements, planning templates, and cooperative planning efforts will enable more burns to be conducted across larger acreages and multiple jurisdictions. Reconciling differences between state and federal objectives would facilitate prescribed fire efforts that include federal and state management areas. Areas where existing support for prescribed burning can be built on to create larger, more effective fire programs include the Malpai Borderlands area, Las Cienegas/Huachuca Mountains Area, Muleshoe-Arivaipa, and Altar Valley. Coordinating agency fire management efforts by bringing local, state, and federal crews together for cooperative projects can multiply the effectiveness of available resources for landscape-scale fire management.

At least 20,000 acres/yr need to be treated with prescribed fire to achieve long-term grassland restoration goals. \$500,000/year will fund such burns. Planning costs are mostly covered in agency budgets; contributions by community fire planners, research ecologists, and other partners can greatly accelerate and improve planning.

Activity 2: Maximize use of new interagency fire policy that expands options for using wildfires to benefit grasslands.

A new (2009) interagency fire policy expands federal agencies' options for using wildfires for resource benefit. When wildfires ignite in the right places, they can benefit grasslands without the expense and delay of prescribed burns. In order to consider managing such fires for resource benefits rather than suppressing them, however, existing fire plans must identify areas as being suitable for wildland fire use. One important tool for allowing this kind of fire management is a regional fire planning map, such as that produced annually by the Malpai Group, which shows how different land owners want wildfires treated. Managers and resource staff must also become educated about the new regulations.

Activity 3: Plan and implement prescribed fires in Mexico.

Planning prescribed fires in the upper San Pedro basin and Janos Valley, including understanding the natural fire regime at Janos, will cost \$50,000. Applying fire to at least 4,000 acres/year will cost \$100,000/yr.

Activity 4: Mechanically and/or chemically treat shrubland, as a transition to fire-maintained grassland.

The process of shrub conversion of grassland results in displacement of perennial grasses, which readily carry fire, by shrubs which are separated by more-or-less bare ground where fire cannot carry. Once this threshold has been passed, prescribed burning cannot be carried out on degraded rangeland until the invasive shrubs have been controlled enough to enable ground litter and fine fuel load to build up. In New Mexico, BLM has implemented more than 80,000 acres of chemical control of shrub encroachment (mostly creosote) in Southern New Mexico grasslands and is seeking to expand these activities. In Arizona, mechanical treatments of mesquite (including root-plowing, masticating, and grubbing) in the San Bernardino and Empire valleys have shown that this treatment can allow grass abundance to recover to the point that it can carry fire. Since 2007 in Arizona BLM has implemented chemical and mechanical shrub reduction treatments on some 2000 acres and continues to do so, primarily on the Las Cienegas National Conservation Area. Appropriate methods differ between habitats and their shrub types, with creosote treatable by large-scale aerial spraying at costs of ~\$10-20/acre, and mesquite often needing ground-based treatments that can run ~\$400/acre. Across the Sky Island region, at least 15,000 acres per year needs to be mechanically or chemically treated to reverse shrub invasion in targeted landscapes. Targeted investments of \$500,000/year will facilitate these treatments.

Activity 5: Repair watershed damage from historical fire suppression and other impacts.

Impacts of past events — fire suppression, overgrazing, poorly designed roads and berms, droughts, etc. — are still draining many Sky Island habitats of water and soil via gullying and sheet erosion. In some places, intervention will be needed to jump-start the healing process and enable upland grasses and riparian plants to restore watershed functions (holding soil, slowing runoff, increasing water infiltration). Small-scale but extensive erosion control treatments done on the El Coronado Ranch and elsewhere in this region have shown tremendous success in building soil, encouraging grass growth, enabling return of fire, and increasing water in streams and cienegas. Soil loss across the region is too extensive to apply these methods everywhere they are needed, but targeting them carefully, e.g. to sub-watersheds with high-value cienegas, produces results well worth the investment. Expending \$250,000/yr would enable treatment of at least 15 sub-watersheds in the US and Mexico.

Activity 6: Track effectiveness to promote use of best practices.

A critical need throughout the region is better monitoring of effects of fire and other vegetation treatments, including effects on target wildlife species, and better dissemination of these results to fire managers to help them improve prescribed burn plans. Documentation of effectiveness will encourage wider adoption and increased investment in successful methods. Tracking impacts will enable managers to adapt practices to changing conditions, e.g. warmer drier springtime weather now being seen throughout the Southwest, and new information on vegetation and wildlife response to fire under varying conditions. \$45,000/year at each of three major landscapes using fire would include tracking some wildlife impacts and helping managers incorporate results into subsequent fire prescriptions.

Strategy 2: Expand capacity to use fire and other tools for maintaining and restoring grasslands

Activity 1: Target treatments across the region by comparing effectiveness of various methods for conditions on the ground.

Recent broad-scale ecological assessments provide guidance for targeting restoration methods to sites across the region. However, getting the most bang for restoration dollars will require more extensive project-scale assessments of conditions on the ground such as fuel loads and shrub densities by size class. Further testing of various methods on sites with different ground conditions will improve our ability to use funds most effectively. Preliminary case studies will cost \$750,000 over three years. Results could guide application of as much as \$14 million over ten years, treating some 300,000 acres with a combination of fire, vegetation, and soil treatments.

Activity 2: Improve local capacity for fire planning.

Cooperative fire management programs are being pursued in four major areas in the United States and two areas in Mexico. On the U.S. side of the border there are active fire programs in the Malpai Borderlands, the greater Huachuca area, the Muleshoe/Aravaipa area, and the Altar Valley. In Mexico prescribed fire and fire use is being applied in the Upper San Pedro River valley and in the Sierra San Luis. In all these areas the size of the fire program is severely limited by availability of trained staff dedicated to fire planning. The two major federal agencies with land management responsibility, USFS and BLM, have the majority of fire capability in the region, but they have limited authority to conduct fire management beyond their legislated boundaries. A number of agencies, especially USFWS and the AZ and NM state land departments have some capacity for fire suppression, but lack adequate staffing to proactively plan and conduct prescribed burning. For example, The Altar Valley Conservation Alliance, a private non-profit group, has recently completed an interagency cooperative fire management agreement for their 500,000 acre watershed. Now, having invested three years of effort in bringing private, state and federal partners together to prepare the fire plan, implementation is lagging due to lack of personnel who can plan fire projects. There is a critical need to make qualified fire planners available in communities such as Altar Valley, Empire Valley and Malpai who

have the community support and preparation for a more active fire management program. A recent example of building cooperative capacity in Mexico for prescribed burning was a burn conducted at Los Fresnos Ranch by TNC and Mexican NGO partner Naturalia which involved several Mexican fire crews as training exercise. Mexican crews are well trained in suppression, but generally have little experience in ecological prescribed fire. Supporting local community-based fire planners and implementation teams will cost \$200,000 per year.

Activity 3: Landowner and Community support.

In spite of progress made recently in developing local community support for ecologically appropriate fire management, there is still misunderstanding about the role of fire in the landscape. Outreach to local landowners, and to the broader community, is needed to develop more support that is needed to make use of fire more routine. For example, during a prescribed fire, a single phone call from a neighbor complaining about smoke-related distress will cause the fire to be shut down. Also, for most efficient, and ecological appropriate, fire management it is helpful to plan burns across large landscapes. This often means working with multiple land owners. Reaching out to all neighboring land owners to build their support is a key factor in managing fire across large grassland landscapes.

ADDRESSING THREAT 2 — Subdivision and development (land use conversion and water depletion)

Conversion of natural habitat into residential and commercial development is an overwhelming threat to grasslands throughout the Sky Island region. The natural geography of the Sky Island valleys makes them especially vulnerable to development: they lie at elevations between 3,500 and 5,500 feet on relatively level terrain. The pleasant climate and gentle terrain makes the valleys ideal for development of all kinds, and the scenic beauty and recreation opportunities in the surrounding mountains adds to the attraction of the region. As an indicator of this problem, Arizona is one of the fastest growing states in the U.S., and Cochise County is one of the fastest growing counties in Arizona. In addition, growing international trade related to agricultural imports to the U.S. and Maquiladora industries is putting tremendous growth pressure on the border region in Mexico.

The irreversible destruction done by subdivision and development is a trump card for all other threats to the grassland valleys of the Sky Island region. Not only is the direct impact to converted habitat permanent, but the indirect effects to surrounding natural habitat due to fragmentation of wildlife movement corridors, disruption of watershed function, and introduction of exotic species can have far-reaching impacts. For some valleys it is already too late; unfragmented, valley-wide grassland habitat has already been lost. However, there are several valleys where protection of sustainable, ecologically functional grassland ecosystems is still possible. To achieve our long-term goals for grassland conservation, protection of natural grassland habitat from fragmentation is the foundation upon which all other conservation strategies depend.

As well as being one of the most important threats, protection of land from subdivision is the most expensive to address — but has also engaged many partners and generated high-leverage strategies to reduce and cover costs. Land values on the U.S. side of the border range from \$500/acre in the most isolated valley bottoms up to \$20,000/acre in the scenic foothills within commuting distance of urban centers. Relatively large tracts of high quality grassland have recently sold for between \$4,000 and \$5,000/acre. Land prices south of the border are lower, ranging from \$50 to \$500/acre, but the size of tracts necessary to protect grassland habitat still makes protection costs very high. The large acreage and high cost of grassland habitat protection makes the full-fee acquisition of grasslands an impractical strategy to accomplish the land protection goal. Lower-cost approaches include protection of habitat through acquisition of conservation easements. Conservation easements also leave the land in hands of private owners as productive ranch land, rather than adding land management costs to already over-burdened public agencies.

Protection of water, both surface flows and subsurface aquifers, is a topic that deserves special mention. Because water rights are generally appurtenant to a specific tract of land, one of the most effective ways to protect water is through acquisition of land or conservation easement. Land use restrictions in conservation easements are often specifically crafted to minimize water consumption. The criteria used to establish land protection priorities often include presence of important water rights or vulnerable aquifers. For example, in the Upper San Pedro Basin ground water modeling that identifies core groundwater recharge zones is used to guide land protection. For these reasons, water protection is an integral part of all land protection goals. Nevertheless, explicit policy and planning work to protect water resources is sometimes needed in addition to land protection.

In recognition of the importance of protecting natural habitat, the residents of Pima County passed an Open Space Bond for \$174 million for purchase of conservation easements and other land protection. Conservation goals — largely focused on grassland and riparian target species — guided the spending of these public monies, which is now protecting ranch land in some of the area's most important grassland valleys. Additional grassland purchases are being negotiated, and a second open space bond initiative is now being planned. Although both threats and land costs are highest in Pima County, grassland landscapes outside Pima County have urgent need for similar protection efforts.

An important element of land protection in the U.S. is the status of State Trust Lands, which are generally available for sale to the highest bidder without consideration for their conservation values. Changing this situation, and conveying real protection to State Trust Lands will require passage of a citizen's initiative to reform the laws governing the disposition of these lands. State land reform initiatives in Arizona have been attempted recently, and failed by a narrow margin. Another initiative will be organized in the near future, and will be an important component of grassland conservation in the region.

Effective land protection strategies in Mexico differ in many regards from those in the United States due to different land tenure laws, Federal regulations, and socio-economic pressures. There are a number of conservation opportunities in Mexico that do not exist in the U.S. because of these differing circumstances. One example is a conservation agreement called an Unidad de Manejo Ambiental, which is signed between a land owner and the Mexican government in which a land owner agrees to protect wildlife habitat in exchange for the right to benefit financially from hunting fees on the property. Such agreements do not exist in the U.S., but have already been applied to 13 million acres in the Mexican states of Sonora and Chihuahua. However, there is a great need to improve the oversight and enforcement of UMA agreements for them to reach their full potential for long-term conservation.

Strategy 1: Protection of high priority Mexican grasslands

Driven by high commodity prices, the relatively low cost of labor and water, farming companies and landowners in Mexico (including companies based in the U.S. and working across the border) are plowing thousands of acres of grassland habitat and replacing it with irrigated farms. Several opportunities for land protection through cooperative agreements and special designation by the Mexican Federal government have potential to protect large expanses of grassland.

Activity 1: Designation of the Janos Biosphere Reserve, a new protected area in Chihuahua.

Mexican conservationists have been working with the local community in Janos to promote the establishment of a new Biosphere Reserve which would cover 1,235,000 acres extending from the International border south to the foothills of the Sierra Madre. This area includes the largest prairie dog colony in North America and the only surviving wild bison herd in Mexico. The Biosphere Reserve concept includes a core protected zone, as well as a large multiple-use buffer zone that supports compatible economic activities. A plan has been prepared for the Reserve, but additional work is needed to get final Federal designation. Total cost for seeing the designation through to completion will be \$100,000.

Activity 2: Improved UMA management.

Cooperative UMA agreements between land owners and the Mexican government have been signed over many millions of acres in the Mexican states of Sonora and Chihuahua. These agreements have the potential to be one of the most powerful tools available for conservation in Mexico. However, the agencies responsible for oversight and enforcement of the UMAs do not have the capacity to adequately carry out their mission. Approximately 2 million acres covered by UMAs is located in core grassland areas. Improving UMA management on these lands to protect them adequately will cost \$1 million over ten years.

Activity 3: Designation of Private Reserves under Mexican Law.

Under Mexican law, based on a proposed management plan submitted by the land owner, the Federal government can convey Private Reserve designation to privately owned lands that have recognized ecological value. This is an opportunity that is not widely applicable, but is important for some land owners of land with high conservation values. This designation can be very important to protect undeveloped land from encroachment under Mexico's land tenure laws. Providing assistance to land owners to receive this designation could protect 20,000 acres over ten years for \$200,000.

Activity 4: Protection of key ranches with conservation easements and direct acquisition.

There are some important ranches in focal conservation areas where purchase of conservation easements, or simple acquisition, is the best conservation solution. Conservation easements are a relatively new legal tool in Mexico, and an effort is being made to develop the precedent for using conservation easements in core conservation areas. A combination of conservation easement and full title acquisition could protect 150,000 acres for \$5 million.

Strategy 2: Protection of high priority U.S. grasslands and embedded wetlands

Many tools exist to protect lands in the U.S., and many partners are already using them.

Activity 1: Assist land trusts and others with acquisition of conservation easements

Local land trusts are among the most effective organizations for protecting ranch land from development. Locally managed organizations are often in a position to gain the trust of landowners who might not otherwise consider encumbering their land with an agreement such as a conservation easement. Land trusts play an active role in all of the grassland valleys we are working to protect, in particular the Malpai Borderlands Group work in the eastern part of the region, the Altar Valley Conservation Alliance works on the western side of the Sky Islands, and the Arizona Land and Water Trust work with a number of ranchers which span the middle. Partnerships between private organizations like these and local and state agencies, such as Pima County, has resulted in a tremendous amount of successful conservation progress in the last few years. Protecting an additional 85,000 acres with conservation easements and full fee purchase will cost \$230 million over ten years.

Activity 2: Help generate additional sources of funds for land and water protection and direct them to areas with highest conservation value.

Other stakeholders in the region have goals that overlap with those of this initiative. In recent years, acquisition of land, water, and easements has been funded by many stakeholders for a wide range of purposes, including Pima County to protect communities from flooding, reduce infrastructure costs for new growth, and mitigate for effects of other developments; the Department of Defense and the Army Buffer Program to protect open-space buffers around Fort Huachuca and to avoid further depleting the aquifer that supports the San Pedro River as well as the Fort; the Arizona Department of Transportation to protect the views from scenic roadways; and the Salt River Project to mitigate for

effects of dam-building and water diversions in other parts of Arizona. Involvement of conservation agencies and NGOs has directed these interests towards some of the highest-impact purchases in the region. Continuing to cultivate these funding streams and direct them where they will most benefit Sky Island grasslands and wetlands will be an ongoing effort.

Activity 3: State Trust Land reform.

The only way to provide long-term protection to State Trust Lands in Arizona is to organize a drive to place an initiative on the ballot which amends the state constitution to reform the land disposal limitations and protect ecologically important lands. The last time such an initiative made it to the ballot, it failed by one percentage point in the face of well-funded opposition. The 700,000 acres slated for protection under this initiative included 237,000 acres of Sky Island grassland. Another state trust land reform initiative is being planned. The cost of successfully organizing and publicizing a ballot initiative will be \$800,000.

Activity 4: Reduce impacts of growth to high priority lands and waters.

Wise land use planning can steer population and infrastructure growth towards areas where it will have the least impacts on natural infrastructure (community open-space lands, wildlife corridors, aquifer recharge zones, groundwater-dependent wetlands, etc.). Growth projections in Arizona show major overlap with high-value lands and waters. Engaging county planners and other policymakers to examine how alternative growth scenarios affect natural and human systems is already improving planning outcomes in Arizona. Similarly, using ecological flows and other methodologies can highlight tradeoffs between increased human water use and loss of wetland function and other ecosystem services. Understanding these tradeoffs is a powerful platform from which to engage communities in finding ways to reduce impacts on streams and cienegas. Focusing these tradeoff analyses and policy/planning engagements on this study area would cost \$400,000 over ten years.

ADDRESSING THREAT 3 — Rangeland management driven by factors other than wildlife and habitat needs

Private landowners, primarily ranchers, are directly responsible for day-to-day management of many hundreds of thousands of acres of grassland. Their decisions and actions have the most direct effect on grassland restoration and maintenance of any of the many stakeholder groups in the Sky Island region. However, their decisions and actions are constrained by the practical and economic necessities of making a living from their land. They generally cannot afford the luxury of making investments in activities like brush control or retrofitting fences that may have high short-term cost, and relatively low long-term financial returns. Government funding and technical support can help landowners improve wildlife, habitat and forage, but such programs are underutilized because individual landowners often do not have the time or information to capitalize on them. For the same reason, it is difficult for landowners to coordinate closely with their neighbors on watershed-scale projects.

Many land owners recognize the importance of broader scale, longer term land management projects but simply cannot afford to conduct them on their own. There are three key needs to make such landscape-scale projects more feasible: first, a coordinator who can develop cooperative projects among neighboring land owners and help them find funding for projects (ideally someone who works with a local land-owner based group) can be an important catalyst for accomplishing larger scale cooperative projects. Second, regulatory incentives such as Safe Harbor Agreements in the U.S. and UMA agreements in Mexico can create a “safe” regulatory environment in which landowners can pursue habitat restoration projects that might otherwise have been seen as threatening. And third, direct financial support for projects can often serve as a catalyst where a relatively small contribution can be used to match larger amounts from other partner organizations. For example, the Mexican government manages new programs to pay for ecosystem service and provide some funding for grassland restoration, but the program requires matching funds.

Public land managers also face shortages of resources for conservation planning and action, and are often balancing multiple use mandates. Collaboration with partners and stakeholders can dramatically improve public land managers' ability to achieve their conservation goals. Use of ecological models can improve both communication with stakeholders and conservation outcomes. Tracking effectiveness of restoration actions and looping information back into decision making encourages adoption of best management practices as they emerge.

Strategy 1: Coordinate grassland restoration/watershed improvement projects among neighboring landowners

Activity 1: Support community-based watershed restoration coordinators in high-priority landscapes.

There are several community-based groups on both sides of the U.S./Mexico border that are involved in this kind of work, but whose efforts are limited by inadequate staffing to fully engage all willing land owners and funding sources.

Activity 2: Support watershed-wide restoration planning efforts in high priority landscapes.

Landscape-scale planning has been done to some degree, and with varying detail, in most important grassland landscapes. However, in most cases coordination of planning among neighboring land owners at the project scale is needed to get real benefit from such plans.

Activity 3: Coordinate unified land management goals and activities among neighboring private and public land managers.

Developing a unified vision for landscape management among neighboring private and public land managers is difficult due to the varying mandates driving agency goals and socio-economic dynamics of landowners. However, such coordination has proven to be a powerful force for conservation with groups like the Malpai Borderlands Group and Sonoita Valley Planning Partnership.

Activity 4: Catalyze specific high-priority restoration projects such as brush control, erosion control, and other grassland restoration actions.

A number of state, federal and local organizations can contribute funding and technical support to grassland and watershed restoration projects, but frequently key funding is needed to catalyze support from these sources.

Strategy 2: Complete private land conservation agreements that encourage landowners to improve habitat and populations of rare species.

Activity 1: Enroll landowners under existing private land agreements for particular species such as Safe Harbor Agreements and Habitat Conservation Plans in the U.S., and prepare new plans where they are needed.

Some cooperative agreements of this kind are already in place, but are not being used as widely as they could be by cooperating land owners.

Activity 2: Work with land owners in Mexico to participate in improved Unidades de Manejo Ambiental (UMAs) and Private Land Reserves to protect and improve wildlife habitat.

UMA agreements create a strong financial incentive for land owners to protect wildlife habitat by enabling landowners to benefit directly from increases in wildlife populations. Private Reserves under Mexican Law create a strong, permanent protection from encroachment by conflicting land uses.

UMAs now cover over 6 million acres in Sonora and Chihuahua. Additional investments in UMAs and private reserves will also help improve the standards by which these programs are managed, by training more of the biologists and consultants that help landowners design, implement, and monitor the management plans on which these agreements are based. (Cost for improving the UMA system and enrolling additional landowners are included above).

ADDRESSING THREAT 4 — Species-specific threats

While grassland restoration and management as a whole will benefit all the wildlife species that are the targets of this plan, a number of species require additional specific investments without which they will not benefit from grassland restoration and management activities

Strategy 1: Reestablishment of black-tailed prairie dogs in Arizona

Prairie dogs were extirpated from Arizona by the early 20th century, but the state of Arizona and Bureau of Land Management successfully released them to the Sky Islands area (Las Cienegas National Conservation Area) in 2008. However, the absence of prairie dogs elsewhere in Arizona leaves some Mexican populations isolated and leaves the developing Las Cienegas colony isolated. As part of a multi-state planning effort, Arizona intends to reestablish the prairie dog in at least three of the four counties in which they were historically found; all four counties are in the Sky Islands area. Potential black-tailed prairie dog habitat in Arizona is a mosaic of federal, State Trust, tribal and private lands with approximately 50% on private lands. Opportunities for species recovery are limited by scarcity of suitable open grassland habitat of favorable soil types, and by opposition to reintroductions by surrounding landowners.

Activity 1: Support continued expansion and management of Las Cienegas population.

Prairie dogs were successfully released to BLM's Las Cienegas National Conservation Area in 2008 as part of the Arizona Game and Fish Department's statewide strategy to re-establish viable prairie dog populations in the state. Las Cienegas National Conservation Area is the only site at which prairie dogs could be reestablished without prior grassland restoration. Approximately \$250,000 is needed over ten years to continue release and monitoring efforts at this site.

Activity 2: Support prairie dog reestablishment in two more Arizona counties.

Arizona has identified 4 additional reestablishment sites in Cochise and Graham counties on public lands in the San Bernardino Valley, San Simon/Sulphur Springs Valley, San Pedro/Fort Huachuca/Empire Cienega. Reestablishment sites in these areas are currently too shrub invaded or have a high density of non-native grasses that grow too high for prairie dog habitat. These issues must be addressed under Shrub Conversion-Fire Suppression strategies before reestablishment of prairie dogs. Once this threat is addressed, approximately \$300,000 – \$400,000 is needed over ten years for each of these sites to support planning, public discussion, release, and monitoring efforts. Total 10-year cost — \$1.2 – \$1.6 million.

Activity 3: Create incentives for landowners to support reestablishment of prairie dogs on private lands.

The effectiveness of black-tailed prairie dog conservation depends on creating and managing partnerships with private landowners because the majority of the species habitat is on private lands. Encouraging participation of landowners adjacent to reestablishment sites identified in Activity 2 can be accomplished through conservation easements and various federal grant programs. Many private rural landowners cannot meet the match requirements for these programs. Approximately \$50,000 is needed over five years to purchase conservation easements and provide match for these efforts. Total 10 years cost — \$500,000.

Activity 4: Protect prairie dog colonies in Mexico.

Acquire and monitor easements on properties with prairie dog towns in San Pedro and Janos valleys. Establish at least one new prairie dog town on conservation lands in Mexico. Target use of UMAs and other land protection strategies and policy initiatives towards areas with prairie dog towns (costs included in other action items above). Total 10 years cost — \$170,000

Strategy 2: Improve Chiricahua leopard frog population health and number of populations

The Chiricahua leopard frog is vulnerable to a number of threats including habitat and connectivity loss, which can be mitigated through the grassland restoration and management activities in this plan. However the impacts of non-native aquatic species on the Chiricahua leopard frog must be addressed more directly to ensure that historic, current and potential habitat is available which can ensure the long-term persistence of the frog in the face of climate change and other threats.

For Chiricahua leopard frogs, the USFWS Final Recovery Plan calls for the establishment and maintenance of at least two metapopulations within each of the eight Recovery Units identified in the Plan — half of which are within the Sky Island region. These metapopulations must exhibit long-term persistence and be protected from non-native predators, disease, habitat alteration, and other threats. As a buffer against disease, at least one additional robust, but isolated population should be established and maintained in each RU. Currently all each of the four RUs in the region has a metapopulation, some more robust than others. By and large, Chiricahua leopard frogs have been eliminated from the valleys. The exception is the Altar Valley where there is about 14 sites with frogs, 4 – 5 of which are breeding populations. There are only 2 – 3 others in the valleys that we know of. The grasslands have enormous potential for recovery, if we can deal with the non-native problem and restore some wetlands. Disease is a wild card that will probably limit recovery options no matter what else we do. In some areas eliminating exotics will enable CLFs to expand on their own. In others, adding outreach actions to this exotic control work will create new opportunities to reintroduce CLF to areas from which they have been extirpated.

Through other action items in this initiative we will be able to protect and restore enough habitat to ensure more resiliency in the existing metapopulations and identify sites and start work toward the re-establishment of additional metapopulations through protection and restoration activities. Over the next 10 years we can expect thru the full implementation of these strategies of land protection, grassland management and restoration, and wildlife restoration will have the following benefits for the Chiricahua leopard frog: Protection of the existing 4 metapopulations; Restoration of suitable habitat to make these populations more robust and resilient; Identification and restoration of additional sites to fulfill Recovery Plan goal (8 metapopulations); Re-establishment of Chiricahua leopard frogs into these new restored sites; and Monitoring and management plans implemented to ensure conservation of the species and its habitats. Costs for all of these exotic control activities together are estimated at \$400,000/yr.

Activity 1: Support control of exotics and frog recovery actions at individual sites

Exotic control and CLF recovery efforts at particular sites such as Ramsey Canyon, Scotia Canyon, and San Bernardino NWR have maintained CLF populations that otherwise would have been extirpated, preserving genetic diversity and species recovery potential. Continuing to support such actions is necessary but not sufficient for the recovery of the species across the region. In addition, such support will enable us to take advantage of fleeting opportunities to control exotics in situations that are otherwise impossible, e.g. when major fishing lakes are drawn down by drought or undergo one-time draining for other reasons.

Activity 2: Combat exotics in targeted watersheds

Recovery of the species as a whole will require re-establishing and securing CLF metapopulations, which will require control of exotics over large areas. Selecting watersheds where large-scale elimination of exotics and expansion of frog populations is most likely to succeed will be key — using threats, recovery strategies and updated population information from the CLF Draft Recovery Plan, and considering other ecological and social enabling conditions. In selected watersheds, engage public land managers and private landowners to identify all habitats in the watershed that could support exotics or natives, and screen for these species. With inventory information, prepare coordinated plan to eliminate exotics in networks of habitats so as to prevent re-contamination from untreated sites, and so as to create opportunities to reintroduce CLF to cleared sites.

Activity 3: Increase capacity for eliminating exotics at larger scales

Controlling exotic aquatic species is time-consuming, and requires specialized training and follow-up. Control (especially for bullfrogs) must be coordinated and intensive enough to prevent recontamination of sites as they are cleared. The region currently does not have enough trained bodies to carry out such work at more than a few isolated sites. Creating capacity to clear exotics from areas that have enough waters to support viable CLF metapopulations could be done in a variety of ways, combining professionals and trained volunteers, so long as work is well coordinated. The CLF Recovery Team has suggested creating a roving “SWAT Team” of 8 persons for a 10-year period, who would accomplish control work seasonally (March to November), and the rest of the time do planning, coordinate with landowners, and complete compliance for control projects. Capacity (paid or volunteer) that is developed for site-focused control work could also be tapped to address large-scale control efforts, and to provide the long-term follow-up needed to make sure progress is not undermined by recontamination.

Activity 4: Expand community support

Once exotics are removed from an area, many permanent waters, including backyard ponds and stock tanks, are suitable for CLF or could be made suitable with habitat manipulation. Working with ranchers and other local residents can increase the number of people willing to host listed frogs on their private or lease lands, provide extra eyes and ears to catch any exotic re-invasions early, and educate neighbors. Using Safe Harbor agreements provides security for landowners.

Strategy 3: Expand knowledge about grassland bird conservation needs

The grasslands of the southwestern US and northern Mexico are the primary over-wintering grounds for most North American grassland bird species and are therefore, continentally important to their survival. Very little is known about the abundance, distribution and ecology of grassland birds in winter, particularly in Mexico.

Activity 1: Increase knowledge of grassland birds to enable conservation planning

Critical to the success of a plan/strategy to protect, restore, and manage grasslands, is a focused effort to determine the abundance, distribution, ecology, and movements of grassland birds. This information will facilitate the identification of important focus areas and the prioritization of conservation actions.

Strategy 4: Expand incentives for landowners in Mexico to support jaguar-friendly ranching practices

Efforts concentrated on the jaguar core habitat south of this focal area will need to be complemented by work farther north if we hope to continue seeing these jungle cats within the Sky Islands. Engaging diverse Mexican partners — from academics to agencies to landowners — to better understand and protect jaguars and their habitats will go a long way towards making this region more

hospitable to wandering and resident cats. Developing the capacity of local residents, researchers and technicians to study wildlife and manage lands for their needs will create long-term benefits to these and other species.

Activity 1: Engage Mexican partners and landowners to improve understanding of species, ecosystems and natural resources in the region, tied to restoration and conservation measures.

Specific activities could include facilitating an interdisciplinary region-wide assessment of species distribution, conservation status and future habitat restoration measures with collaboration of university professor/students; establishing non-invasive monitoring for large mammal species, as well as migratory and resident birds; conducting trainings for students, landowners and ranch employees for the identification of animal species, their sign and the recording of information; monitoring jaguar, ocelot and other indicator species' distribution throughout the region; and engaging the public in education and outreach to promote the appreciation of regional biodiversity. Costs would be \$2.5 million over ten years for all of these activities combined.

Activity 2: Create a network of protected lands (private and public) aligned with biological corridors, connected to protected areas north of the border.

This ties in with Mexico land protection and restoration actions, focusing them on the movement needs of this species. Specific activities could include informing private landowners and ejidos about programs offered by Federal agencies in Mexico; training field technicians on federal programs and land protection designation (as bridges between landowners and government agencies); and facilitating the protection of private and ejido lands through Federal programs (CONANP, CONAFOR) in Northern Mexico. Costs are \$700,000 over ten years, most of which is included in the land protection activity figure.

Strategy 5: Expand incentives for landowners that will result in free-ranging bison having access to more Mexican and New Mexican grasslands

Activity 1: Compensation for landowners allowing bison grazing

Activity 2: Install wildlife friendly fencing

Activity 3: Confirm that Mexican bison are disease-free

Funding Needs

Success in achieving the goals of this business plan depends upon the Foundation raising and spending at least \$13 – \$15 million over 10 years on the strategies described herein. It also depends upon government and non-government agencies and organizations providing an additional \$265 million over 10 years. Other partners who are already committed to making investments to conservation include the Arizona Game and Fish Department, Bureau of Land Management, National Resource Conservation Service, Pima County, US Fish and Wildlife Service, US Forest Service, Altar Valley Conservation Alliance, Arizona Land and Water Trust, Malpai Borderlands Group, Naturalia, Pronatura, Sky Island Alliance, Sonoran Institute, Sonoran Joint Venture, The Nature Conservancy, and Veolia Foundation.

Table 1. Budget estimates for the Sky Island Grasslands conservation initiative.

Budget Category	Years 1-4	Years 5-10	Total
Habitat			
Prescribed burning	\$2,400,000	\$3,600,000	\$6,000,000
Fire planning, outreach, capacity building	\$891,000	\$1,308,000	\$2,200,000
Erosion control	\$1,200,000	\$1,800,000	\$3,000,000
Brush control	\$2,000,000	\$5,000,000	\$5,000,000
Additional restoration, methods TBD: fire, brush control, erosion control	\$2,400,000	\$6,600,000	\$9,000,000
Restoration of cienega function	\$510,000	\$150,000	\$660,000
Aquatic invasives control	\$1,600,000	\$1,800,000	\$3,000,000
Landowner use of incentives	\$600,000	\$1,500,000	\$1,500,000
Fencing and fence improvements	\$400,000	\$1,000,000	\$1,000,000
Monitoring, research and analysis	\$1,300,000	\$2,200,000	\$3,500,000
Land-water policy & planning, US	\$200,000	\$300,000	\$500,000
US Land Protection			
* Easements on 65,000 acres	0		\$110,000,000
Acquisition on 20,000 acres	\$110,000,000		\$110,000,000
* Secure legislative protection on 237,000 acres of public lands			\$800,000
Mexico land protection			
Biosphere Reserve and Land Policy	\$160,000	\$40,000	\$200,000
Private land outreach	\$120,000	\$180,000	\$300,000
* Ranch protection			\$5,000,000
UMA management	\$400,000	\$600,000	\$1,000,000
Total			\$277,000,000

Evaluating Success

All conservation investments are made with a desire to have something change. Monitoring tells us whether that change is occurring. Evaluation tells us whether the combined set of investments being made are being designed and implemented to maximize that change.

The Foundation will work with outside experts to prioritize proposals based on how well they fit in with the results chains and priorities identified in this plan. Success of funded projects will be evaluated based upon success in implementing proposed activities and achieving anticipated outcomes. As part of each project's annual (for multi-year awards) and final reports, individual grantees will provide a summary of completed activities and key outcomes directly to NFWF. These would likely include outcome metrics identified at the initiative scale.

Periodic expert evaluation of all investments funded under this initiative will occur and will help grantees to monitor key indicators to ensure that data across individual projects can be scaled up to programmatic and initiative levels. Findings from monitoring and evaluation activities will be used to continuously learn from our grantmaking and inform future decision-making to ensure initiative success.

The majority of these strategies are based on the premise that intact landscapes of high-quality grassland habitats will promote recovery of grassland dependent and wide-ranging species. In addition to species-specific threats, target species are particularly sensitive to three primary factors, as follows:

Vulnerable to habitat fragmentation by homes, roads, fences etc.	Require open grassland with few shrubs	Vulnerable to loss of grass cover and soil erosion
Jaguar	Black-tailed prairie dog	Chiricahua leopard frog
Bison	Grassland sparrows	
Pronghorn		

Actual population changes in specific focal areas will be reasonably straightforward to calculate or estimate for some targets (e.g. pronghorn and bison). For others, numbers of occupied locations will be more informative e.g. number of Chiricahua leopard frog locations or prairie dog towns. Additional measures such as frog sites' average number of years since invasives were last reported, will help track progress across the region. In many cases, measuring habitat proxies may be more feasible or more timely. For prairie dogs in Arizona, tracking changes in the number or acreage of sites that rate as suitable release sites will give indications of progress long before occupied acres have made much progress towards the stated goal. Similarly, tracking the size of contiguous blocks of grassland habitat with shrub cover below thresholds acceptable to pronghorn will be a useful proxy for long-term population potential while short-term numbers fluctuate for reasons unrelated to grassland health (e.g. drought).

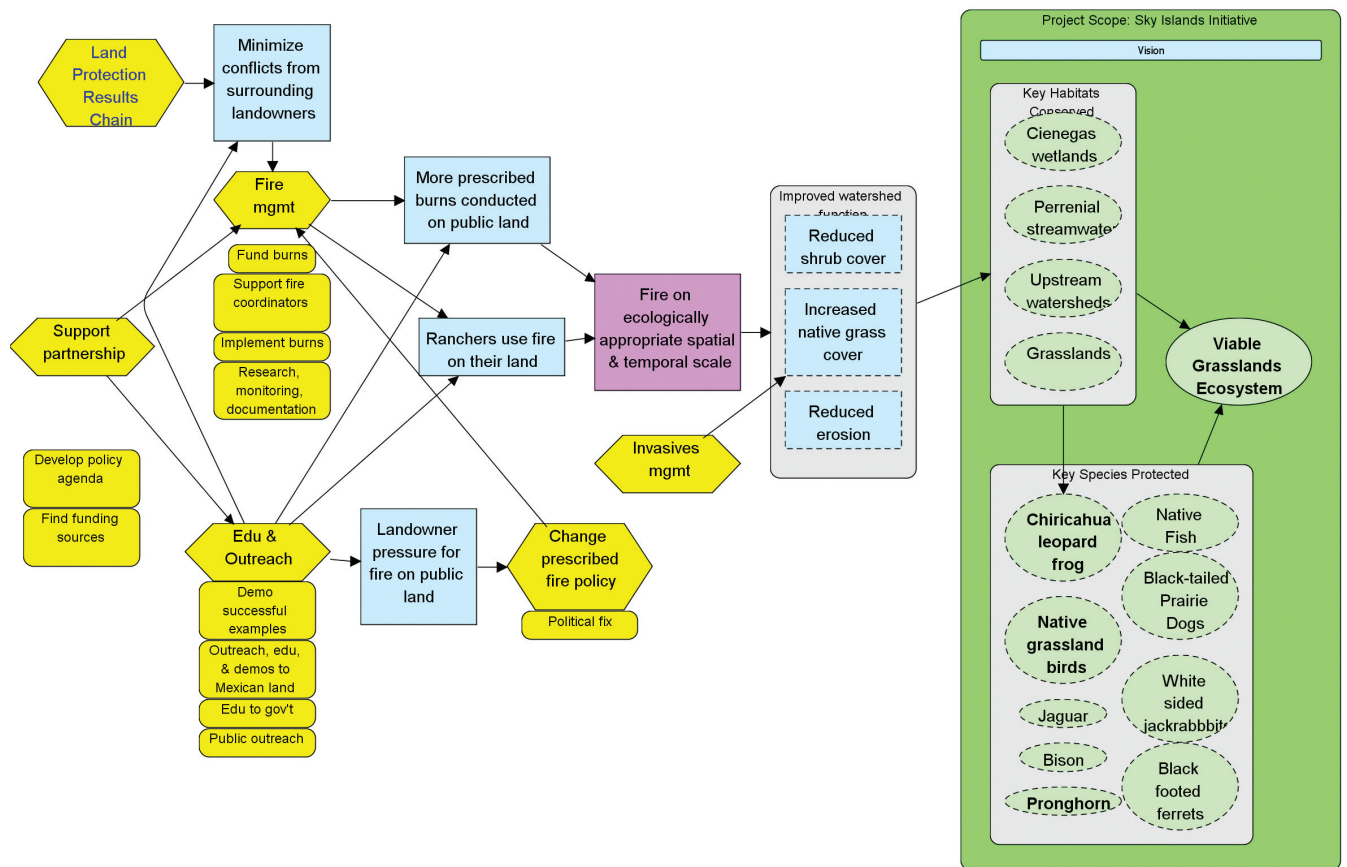
Basic success for land protection goals will be measured by increases in land acreage under various protected designations. The derivative measure of percent change in protected lands within target valley landscapes will be more meaningful for conservation. Additional measures of success will include increases in connectivity of protected lands across these valleys and between multiple valley landscapes.

Evaluating success in restoration offers more options. Reporting numbers of acres treated with particular methods will be necessary but not sufficient. Grassland condition assessments such as Enquist and Gori (2003, 2008) and Yanoff et al. (2008) offer baselines for the region. Comparisons of acreage in broad categories of open native grassland (shrub cover <10%), restorable (shrub cover 10 – 35%), and historic (shrub cover >35% and/or extensive soil loss) will show broad trends in grassland health. However, these regional scale assessments will likely not be fine-scale enough to evaluate

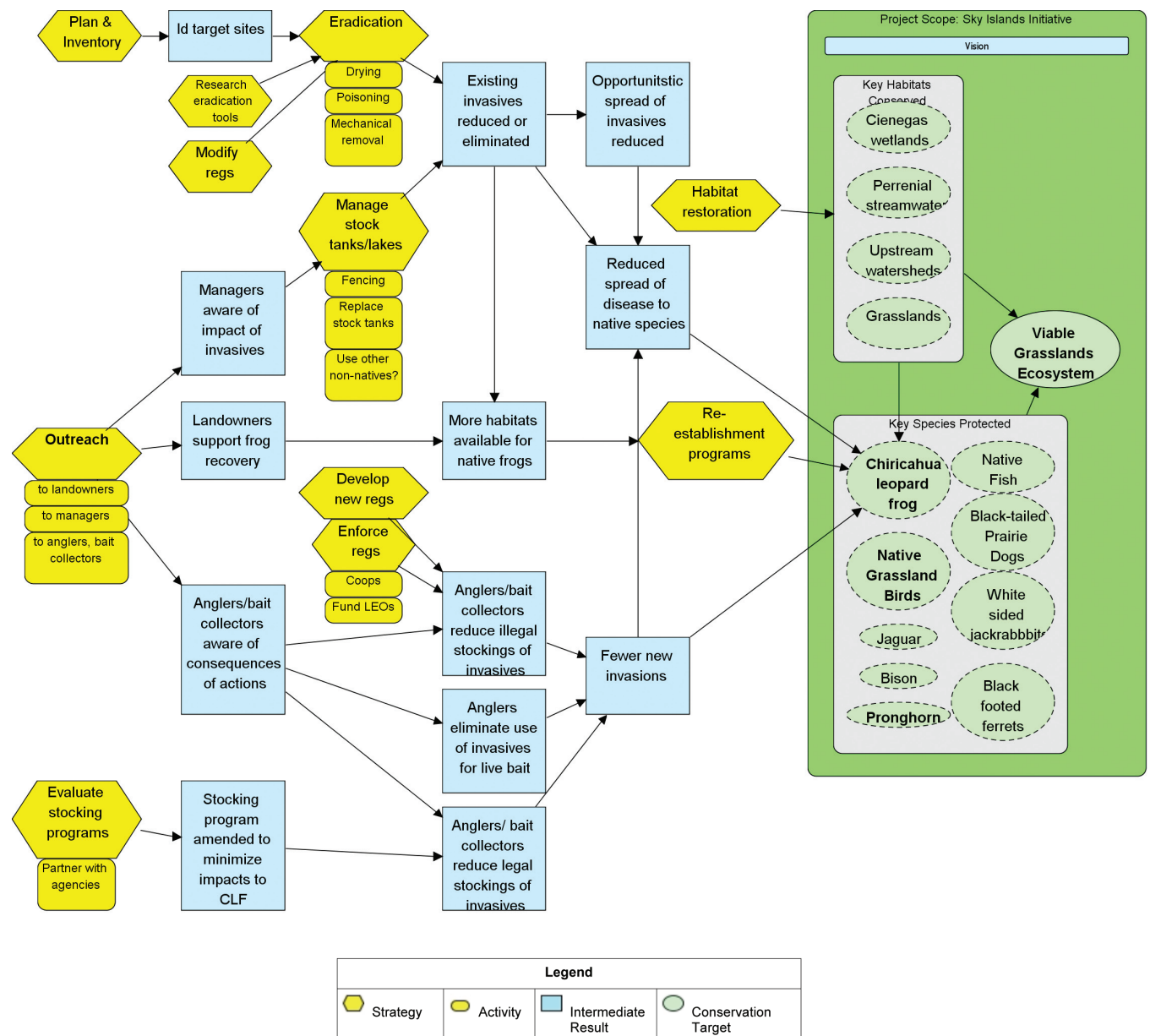
effectiveness of treatments on particular sites. Comparing basic parameters such as shrub canopy cover and/or density of shrubs, canopy and/or basal cover of perennial grasses, and percent bare ground will show changes that are important to both watershed function and populations of many wildlife species, including most of the targets specified here. For both site-scale and regional scale evaluations, a variety of methods under development offer a combination of remote sensing and field sampling to estimate key parameters like bare ground and shrub cover/density. On public lands where managers routinely use particular measures such as Indicators of Rangeland Health, reporting before and after values for these measures will be particularly useful for demonstrating success in terms that managers are accustomed to and use in decision making.

Proxy measures will give some early evidence of progress in restoration as well. We expect to see increases in numbers of grassland acres covered by fire plans, and acres identified as suitable for managing wildfires for resource benefit (i.e., wildland fire use) before we see dramatic increases in acres of prescribed fire across the region. Multi-landowner restoration plans will increase faster than acres treated for soil erosion or brush control.

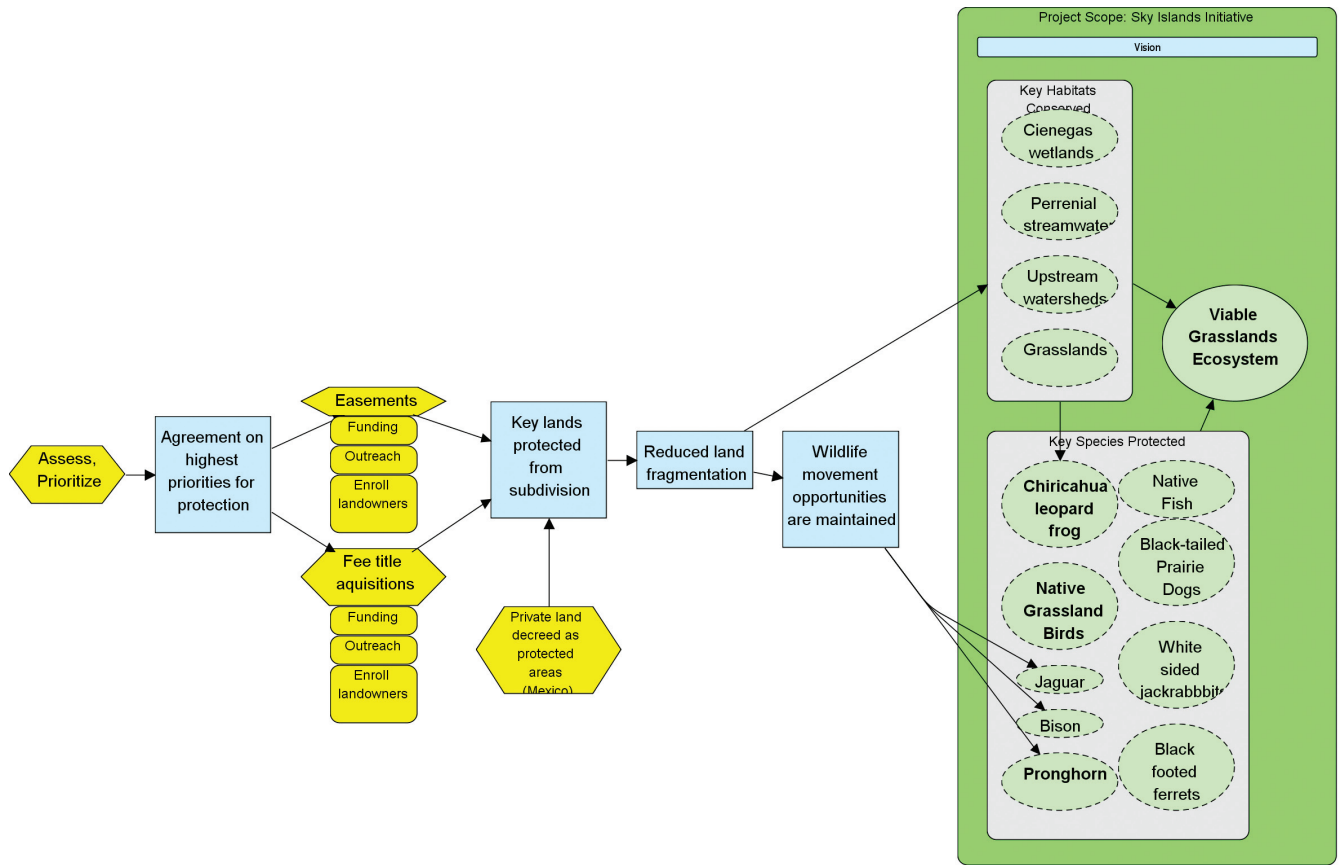
Results Chains for Addressing The Threat of Fire Suppression: A results chain is a chain of logic that illustrates how a specific strategy is presumed to reach a particular conservation outcome. Results chains are used to develop a suite of indicators to show progress at different stages in the initiative.



Results Chains for Addressing The Threat of Aquatic Invasive Species

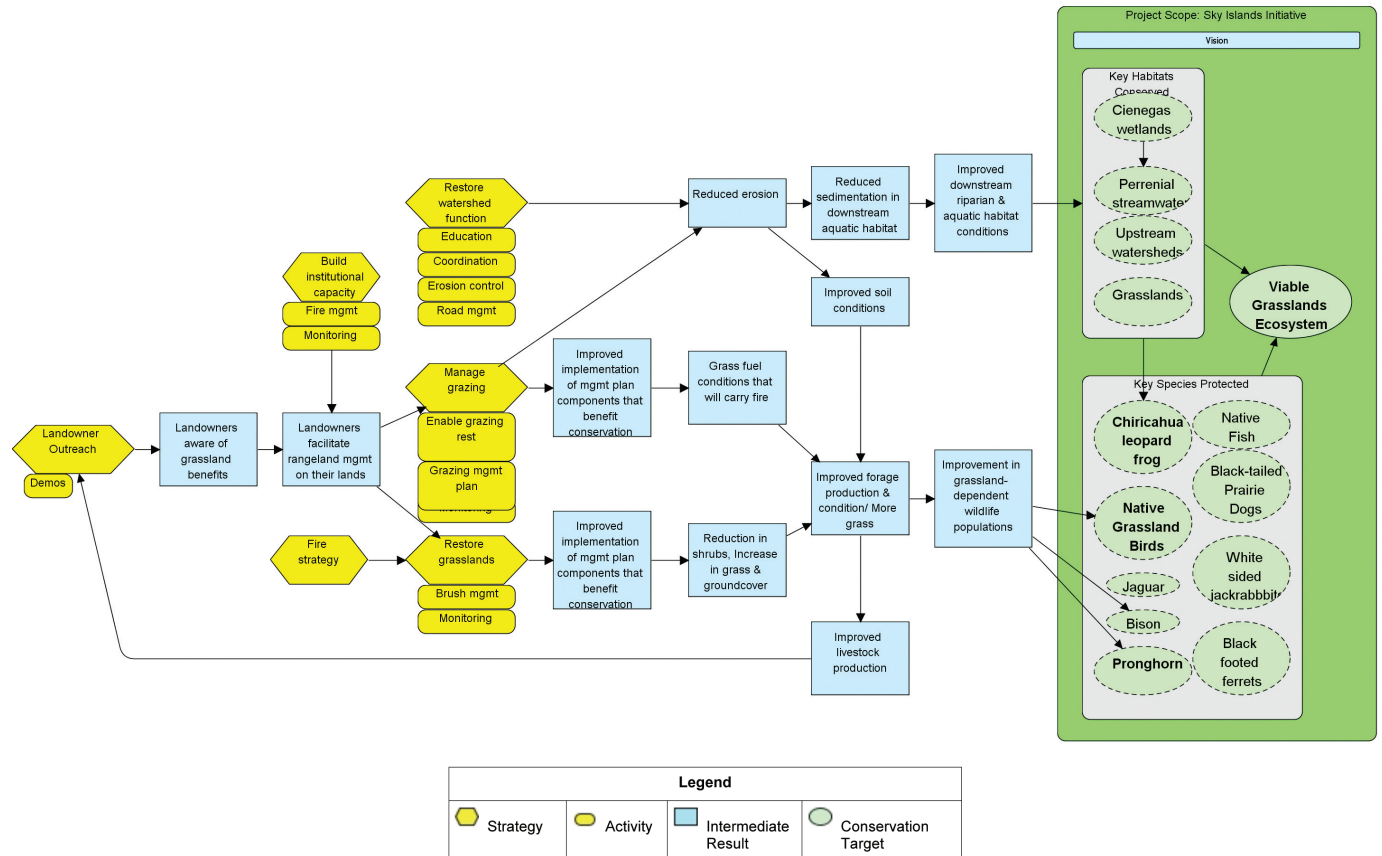


Results Chains for Addressing The Threat of Subdivisions and Development



Legend			
	Strategy		Activity
	Intermediate Result		Conservation Target

Results Chains for Addressing The Threat of Rangeland Management



Ancillary Benefits

This initiative will have a measurable benefit for a host of other wildlife which can and should thrive in one of the continent's most expansive grassland complexes. We do not plan to monitor progress in achieving benefits for these species although others may be doing so.

Table 2. High priority species likely to benefit from activities.

	Species	Overall benefits
Aquatic amphibians and reptiles		Land protection will secure water and habitat.
	Sonoran tiger salamander	Invasive control will improve population viability by reducing impacts of exotics.
	Lowland leopard frog	
	Mexican garter snake	Use of safe-harbor and candidate conservation agreements (with control of invasives) will also expand opportunities for reintroductions and new population establishments. For garter snake, increased populations of native frogs and fish also increases prey base.
Native fishes		As above, plus grassland restoration will reduce stream sedimentation and increase permanence of streamflow.
	Gila topminnow	
	Gila chub	
	Yaqui topminnow	
	Yaqui chub	
	Yaqui catfish	
(plus 15+ other native fish species with restricted ranges)		
Grassland reptiles		
	Bunch grass lizard	Restoration will improve habitat
	Ornate box turtle	
	Desert massasauga	As above, plus land protection could prevent loss of a unique localized and isolated population
Grassland birds		
	Aplomado falcon	All of these bird species depend on open grasslands. Increasing acreage of open grassland will boost numbers in existing populations, provide opportunities for expansions.
	Botteri's sparrow	
	Cassin's sparrow	
	Grasshopper sparrow	Increasing grass cover will improve population viability for grassland sparrows.
	Rufous-winged sparrow	
	Loggerhead shrike	For Aplomado, increasing acreage of open grassland will provide additional areas of suitable habitat for reintroductions.
	Eastern meadowlark	
	Masked bobwhite quail	
	Burrowing owl	As above, plus protection and expansion of prairie dog colonies will create additional habitat.
Mammals		
	White-sided jackrabbit	Maintaining and restoring open grassland will protect existing populations and provide opportunity for expansion or population growth. Work in Mexico may reveal additional populations.

Acknowledgements

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About NFWF — The National Fish and Wildlife Foundation is a 501(c)(3) organization dedicated to funding sustainable conservation initiatives. Chartered by the United States Congress in 1984, NFWF leverages federal grants and private support to achieve maximum conservation impact. Recently, the Foundation — through its Keystone Initiatives — strategically repositioned itself to more effectively capture conservation gains by directing a substantial portion of its investments towards programs that had the greatest chance of successfully securing the long-term future of imperiled species. By leveraging innovative program design from scientific experts, the Foundation is able to structure conservation programs that consistently achieve measurable and meaningful outcomes. [www.nfwf.org]



