Business Plan for the
Upper Klamath Basin Keystone Initiative
A 10-Year Initiative to Secure Upper Klamath Basin Native Fish Populations: Lost River Sucker, Shortnose Sucker, and Klamath Redband Rainbow Trout

Version 1.0

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November 2008

1. *Lost River Sucker.*
   Photo courtesy of The Nature Conservancy
   © Tupper Ansel Blake.

2. *Shortnose sucker.*
   Photo courtesy USFWS.

3. *Redband Rainbow Trout.*
   Photo courtesy Larry Dunsmoor.

What is a business plan?

Each of the Foundation's keystone business plans has its own unique structure that reflects the conservation problem and the needs of the community working to solve that problem. However, each plan has four elements at its core:

- **Impact**: A concrete description of the outcomes to which the Foundation and grantees will hold ourselves accountable.

- **Strategic priorities**: The specific actions and activities that must take place and have a cause-and-effect connection with the impact we are trying to achieve.

- **Resource implications**: An analysis of the financial, human and organizational resources needed to carry out these activities.

- **Performance measures:** Quantitative outputs and outcomes and a timeline for achieving them that make it possible to measure success and make it possible to adaptively revise strategies in the face of underperformance.

EXECUTIVE SUMMARY

The Upper Klamath Basin has a rich heritage of unique and abundant native fish, among which are the species targeted by this plan: Lost River sucker, shortnose sucker, and redband rainbow trout. This Initiative is a plan to restore habitat, improve habitat quality, and increase population size and distribution of target species in the Upper Klamath Lake watershed in the Upper Klamath Basin of Oregon. Populations of these species are in decline - this effort will coordinate and guide conservation partners to address the significant threats and ecological stressors identified by experts and partners as limiting sucker and redband trout populations.

Both the Lost River sucker and the shortnose sucker are large freshwater fish found exclusively in the Upper Klamath Basin. Historically they were very abundant in the Basin, serving as a major food source for Native Americans, and it is estimated that the aboriginal harvest at one site alone was 50 tons annually. The US Fish & Wildlife Service (USFWS) listed both species as endangered in 1988. Although a number of issues have contributed to their decline, the primary threats include habitat loss, degraded water quality, barriers and entrainment, and predation and competition from non-native species. The development of agriculture has led to significant land use alterations and an altered hydrologic regime, and socio-economic concerns have slowed the implementation of restoration.

Redband rainbow trout are another native fish of particular importance to both tribal and sport fishers. Redband trout share the history of decline with the endangered suckers, although the declines have been less severe. Nonetheless, redbands face threats similar to those faced by suckers, especially habitat loss, degraded water quality, and elevated water temperatures in rivers and streams.

The goal of this Initiative is a consistent increase in the distribution and abundance of target species.

For the two sucker species, successful implementation of actions outlined in this plan are expected to provide conditions that facilitate consistent annual rates of population change such that populations grow, annual survival rates consistently above 0.8, and recruitment increased from current levels in both species for a ten-year period beginning in 2015. During the next ten years, we expect to see increased distribution and abundance of juvenile suckers in the Sprague River, and increased year-round use of the Sprague River by adult suckers. For redband trout, metrics for success include change in ODFW assessments of the status of Upper Klamath redband trout populations from FAIL to PASS for measurements of productivity, abundance, and distribution. Expanding and enhancing summertime thermal refugia will play a key role in successfully changing population status, since such improvements will address a primary limiting factor for the redband trout populations. Measurable indications of success include expanding summertime distribution and abundance of juvenile and adult redband trout using enhanced and expanded refugial areas. Historic sucker spawning areas are in springs entering Upper Klamath Lake and in its tributaries, including the Wood, Williamson and Sprague Rivers. Passage of spawning suckers up the Sprague River was impeded by Chiloquin Dam until its removal in August 2008. The opportunity is ripe to conserve and restore habitat in the tributaries, as well as in Upper Klamath Lake, with an eye to recovering the species. The current opportunity is based on significant existing scientific analysis, past and present federal and state agency contributions to restoration project implementation, growing private landowner engagement in conservation activities – aided by several intermediary organizations creating connections between landowners and conservation programs, and a recent climate of increased cooperation driven by Basin-scale negotiations for an over-arching resource “settlement” among many parties that have historically been in conflict.

It is critical to note that nearly all of the restoration that needs to be done is on private land. Land and water use choices must be aligned with conservation strategies, and conservation actions must dovetail with what is primarily an agricultural economy on target lands. It is imperative that those landowners become willing partners in restoration. Significant work since 2001, much of it supported by NFWF, has built a strong foundation but more work needs to occur in the following priority areas.

1. Habitat Restoration and Conservation: Restoration and conservation of key habitats will be accomplished by implementing projects based on integrated strategic planning. We will provide landowners with necessary information and serve as intermediaries to streamline project funding and implementation. We will also develop additional conservation incentives for landowners.

2. Water Use Management: In addition to implementing irrigation efficiencies, we will develop structures to facilitate settlement of resource conflicts, and develop a water transaction program acceptable to local landowners.

Investment in the following two Support Strategies is in a sense an even more critical role for NFWF. First, federal and state natural resource agencies have contributed and will continue to contribute a large portion of the funding for on-the-ground projects. But agencies' efforts must fit into a more comprehensive, coordinated strategy, and we must do targeted research and monitoring to ensure the restoration investments actually yield the desired biological outcomes. We must also more finely attune conservation strategies to local socio-economic circumstances. We therefore propose the following two Support Strategies:

3. Integrated Strategic Planning & Coordination: We will work with Basin partners to prioritize the biophysical recovery needs of the fishes, integrate socio-economic impacts on landowners, clarify roles and coordinate resources for implementation.

4. Research, Experiments and Knowledge Gaps: The above planning process will help identify knowledge gaps critical to recovering the species. We will design and conduct research and experiments as needed.

Six partners have been working together to develop and implement this Upper Klamath Basin Keystone Initiative: the Klamath Basin Rangeland Trust, the Klamath Tribes, the Klamath Watershed Partnership, the Nature Conservancy, Sustainable Northwest and the US Fish & Wildlife Service. We are in the process of integrating other natural resource agencies and organizations in the Basin, including the US Bureau of Reclamation, the USDA Natural Resource Conservation Service, the Oregon Department of Fish & Wildlife, the Klamath Soil & Water Conservation District and Ducks Unlimited. Implementation will not be limited to the listed entities. As the Business and Strategic Plans are developed, we expect other organizations will participate in both their design and execution. We are confident that together we can develop a science-based and economically feasible strategic path, and coordinate funding and roles to implement restoration actions necessary to recover these key fisheries.

CONTENTS

THE INITIATIVE

This Initiative is a plan to restore habitat, improve habitat quality, and increase population size and distribution of native fish including Lost River sucker, shortnose sucker, and Klamath redband rainbow trout in the Upper Klamath Lake watershed in the Upper Klamath Basin of Oregon (Figure 1). Populations of these species are in decline - this effort will coordinate and guide conservation partners to address the significant threats and ecological stressors identified by experts and partners as limiting sucker and redband trout populations in the Upper Klamath Basin, Oregon.

Conservation Need

Upper Klamath Lake and its tributaries historically supported huge populations of two culturally significant fish species that are listed as federally endangered (USFWS 1988): shortnose sucker and Lost River sucker. Both the Lost River sucker and the shortnose sucker are large freshwater fish endemic to the Upper Klamath Basin. The Lost River sucker (LRS) can grow to a maximum of 39 inches and can live as long as 45 years. The shortnose (SNS) are slightly smaller and grow to approximately 20 inches with life spans up to 33 years. Historically these fish were very abundant in the Basin, which then contained over 350,000 acres of functional wetlands and floodplains. They were a major food source for Native Americans as well as settlers in the late 1800s, and it is estimated that the aboriginal harvest at one site may have been 50 tons annually. Population declines resulting from degraded habitat and water quality, and over-harvest, prompted the Klamath Tribes to close their subsistence fishery in 1986, and the Oregon Department of fish and Wildlife closed their sport fishery for Lost River suckers around the same time. Both suckers were subsequently listed as endangered under the Endangered Species Act in 1988. Current distribution in the Initiative target area is displayed in Figure 2.

The Upper Klamath Lake basin also supports a functional redband trout population. Distribution, abundance, and productivity Klamath redband rainbow trout populations are declining because of limitations imposed by degraded habitats and water quality. As a result, this species is now recognized as "vulnerable" by the Oregon Department of Fish and Wildlife (ODFW 2005). All three of these fish species are adfluvial meaning that they migrate from Upper Klamath Lake and spawn in its tributaries including the Wood, Williamson, and Sprague Rivers. As such, these fish depend on many ecological components of the entire watershed for various periods throughout the year. The complex life history exhibited by these species present major challenges to efforts directed at recovering their populations. Therefore, this Initiative takes a watershed-scale, multi-dimensional approach focus on improving habitat conditions for the Lost River sucker, shortnose sucker, and redband trout populations. While the Initiative necessarily addresses many ecological aspects of the Upper Klamath Lake watershed, it also explicitly addresses local socio-economic factors related to water use and riparian corridors management – vital considerations because success largely depends upon effective conservation actions accomplished on private lands.

The rural economy in target conservation areas of the Upper Klamath Basin is predominately agricultural. Extensive modification to the landscape for agricultural purposes has occurred throughout the Upper Klamath Lake watershed over the last century. These land use alternations resulted in habitat loss and degraded water quality conditions that are frequently cited as the most significant reasons for the poor status of the fish populations addressed in this Initiative (USFWS 1993, NRC 2004). Tens of thousands of acres of emergent wetlands adjacent to Upper Klamath Lake were diked and drained; extensive reaches of tributaries were straightened and riparian vegetation removed or severely degraded due to grazing. Loss of riparian vegetation destabilized stream banks which then eroded and transformed narrow, deep channels to wide, shallow channels choked with fine sediment, in which summertime temperatures soar. Historic and current irrigation practices divert water from streams reducing availability for fish at various

times throughout the year. Irrigation diversion structures impede or prevent fish passage and fish access to good quality habitats, and also entrain fish in irrigation systems. Springs that once provided spawning habitat and contributed cold, clean water to the rivers are degraded and separated from the stream channels. Diking and channelization to prevent flooding and increase irrigation efficiency contributes to erosion and altered the historic structure and function of the river as well as the hydrologic regime.

The effects of cattle management, human population growth, and historic logging practices continue to degrade the water quality throughout the basin through excessive sedimentation, thermal, and nutrient loading. A century of these activities has reduced habitat available to fish and increased nutrient loading to tributaries and Upper Klamath Lake resulting in degraded water quality throughout the basin. This chronic excessive nutrient loading created conditions in the lake that generate massive cyanobacterial (i.e. blue-green algae) blooms several times each summer, such that the lake is classified as culturally hypereutrophic. The effects on water quality from these algal blooms are known to cause severe physiological stress to fish physiology and sometimes result in mass mortality (USFWS 2007).

While not a direct conservation need, there are also a number of socio-economic concerns that if properly addressed, will yield significant conservation benefits. The strategies in the Implementation Plan work closely with these socio-economic factors as both opportunities and challenges to achieve desired restoration outcomes. Private lands targeted for conservation activity operate in a) tight economic margins; b) significant market pressure for land subdivision and sale; c) a history of community conflict driven by natural resource-related litigation, property rights uncertainty and catastrophic events such as fish die-offs and curtailment of water delivery; and d) widespread lack of landowner knowledge about ecology and conservation science. Within this context, a successful approach must thus account for overcoming mistrust and creating a relationship-based approach that cements strong partnerships with landowners for restoration implementation; engaging the community in designing effective conservation strategies; selecting restoration activities that minimize economic hardships on the agricultural community and respond to the community's interest in retaining the rural and agricultural character of the area.

In summary, habitat conditions in some portions of the Upper Klamath Lake basin do not currently support healthy populations of endangered suckers and redband trout, and monitoring data indicate that these species are at dangerously low numbers and not increasing. This Initiative includes several strategies that are based on extensive conservation partner research, planning, and input. These strategies will address the key threats and ecological stressors to the three target species, are cognizant of key socio-economic threats and opportunities, and thus, are expected to result in measurable improvements, first in habitat conditions and then in abundance of redband rainbow trout, Lost River sucker, and shortnose suckers.

Conservation Outcomes

The overall goal of this Initiative is to restore watershed conditions to conditions that support increased distribution and abundance of Lost River sucker, shortnose sucker, and redband rainbow trout over the next ten years. Over the 10-15 year timeline of the Initiative, we expect to see increased distribution both geographically and seasonally (especially during summer when water temperatures are highest) of juvenile and adult suckers and trout. Ultimately, the goal is to increase sucker populations to the extent that these species can be removed from the Endangered Species List. Further, activities described in this plan aim to improve the distribution, abundance, and productivity of certain redband trout populations from the current "fail" status to a "pass" status following Oregon Department of Fish and Wildlife (ODFW) guidelines.

Accurate fish population size estimates are difficult to ascertain and compute for long-lived species with delayed breeding, particularly when those species dwell in a lake the size of Upper Klamath Lake. Individual fish of both sucker species can live for 30 to 40 years and reach sexual maturity when they are five to seven years of age. These life history attributes often result in populations that are very sensitive to temporal variation in adult survival (Janney and Shively 2007), which presents difficulties when relating changes in population metrics to annual conditions. Therefore, it is important to track several population metrics, including the rate of population change, annual survival and average life span of adults, and recruitment.

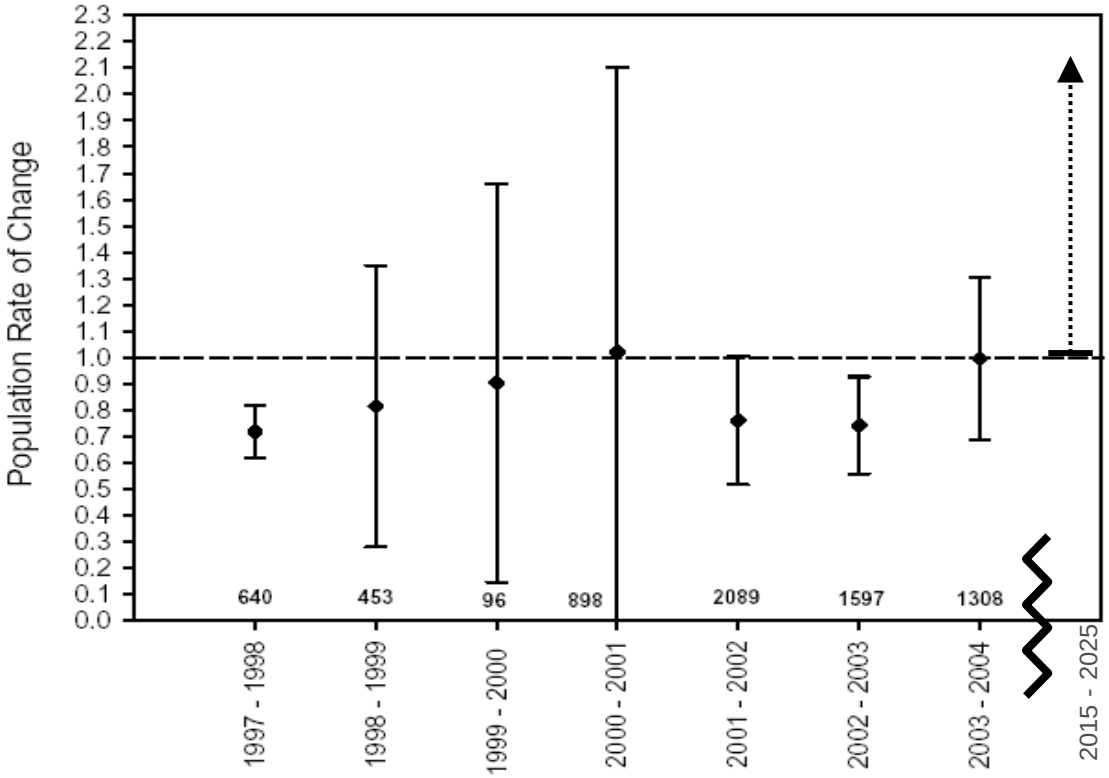
US Geological Survey has an ongoing mark-recapture study that started in 1997 to track trends in Lost River and shortnose sucker populations in the Upper Klamath Lake drainage. One of their primary metrics is the rate of population change, represented by the Greek letter lambda (λ):

$$\lambda = \frac{N_{t+1}}{N_t}, \text{ where}$$

N_t is the adult population size for a given year *t*, but because adult population size cannot be directly estimated, λ is estimated using recruitment parameters based on counts of captured fish (using PIT tags and a mark-recapture study design; Janney and Shively 2007). A ratio of $\lambda=1$ indicates a stable population, $\lambda>1$ indicates population growth, and $\lambda<1$ indicates population decline. Annual estimates by Janney and Shively (2007) of λ for shortnose suckers are highly variable and tend towards population decline over the period from 1997-2004 (Figure 3). These results reflect low annual survival rates coupled with low recruitment, and on average shortnose adults have 3-4 years in which to spawn before they die. While Janney et al. (*in press*) report the Lost River sucker population spawning in Upper Klamath Lake to generally have better annual survival than shortnose suckers, the Lost River sucker population spawning in the Sprague River have substantially lower survival rates than the lake spawners. Taken together, these two Lost River sucker populations have an average life expectancy of about 8 years after reaching sexual maturity.

The goal of the proposed Initiative is to provide conditions that facilitate consistent population growth ($\lambda>1$), annual survival rates consistently above 0.8, and recruitment increased from current levels in both species for a ten-year period beginning in 2015. The ability to measure λ and other population parameters is reliant upon the continuation of the ongoing USGS adult monitoring program. During the next ten years, we expect to see increased distribution and abundance of juvenile suckers in the Sprague River, and increased year-round use of the Sprague River by adult suckers over the next ten years.

Figure 3. The annual rate of change for shortnose sucker populations from 1997-2004, and the projected range of population change rates for all three species from 2015 to 2025 as a result of this Initiative. A rate of change above 1.0 indicates population growth. The Conservation Outcome for this Initiative is expected to be consistent population growth in both species for a ten-year period. (2015-2025). Graph adapted from Janney, 2007.



Conservation Outcomes were determined based on consultation with the lead for the US Fish & Wildlife Service sucker Recovery Team (personal communication, Mark Buettner, USFWS). However, the Recovery Team was just recently convened, and is currently engaged in developing delisting criteria for the sucker populations, due to be completed by 2010. Partners involved in the conservation effort described in this plan expect to adopt any metrics used by the Recovery Team that strengthen the Conservation Outcome assessments for the future of this Initiative.

Oregon Department of Fish and Wildlife leads monitoring and analysis of redband trout population conditions. In 2005, ODFW completed a population assessment that analyzed the existence, distribution, abundance, productivity, independence, and hybridization of different redband sub-populations in the Upper Klamath Basin. Each sub-population was assigned a status of "pass" or "fail" in each parameter. The pass/fail criteria for the parameters are explained in the 2005 *Oregon Native Fish Status Report.* The report identified seven distinct redband sub-populations in the area of interest for this effort. The communities were primarily limited in their distribution, abundance, and productivity (Figure 4A).

At a finer scale, a primary challenge facing redband trout is warm water temperatures during the summer months. Areas of cold water inflow are important to trout during hot periods in many rivers, and in fact the presence of such refugia can have a profound effect on viability of trout populations. Therefore, specific conservation actions and the design of approaches to measuring conservation outcomes for trout will be structured around the location, magnitude, and characteristics of cold-water inflows to larger channels. Two projects have quantified (through thermal infrared radiometry, or TIR, in 1998 and 2007) the interaction between temperature of inflows and temperature in the larger stream or river channel,

which simultaneously provides a baseline for subsequent evaluation of progress and clear guidance on structuring approaches to restoration to maximize the refugial benefits provided by these inflows. For example, the results of the 2007 TIR project for the lower Sprague River shows where cold water inputs enter the river, as well as the magnitude and extent of the impact they have on river temperature (Figure 4B).

The conservation goal of this effort for the redband rainbow trout is to change the assessment of productivity to PASS in four of the five failing communities, abundance in two of the three failing communities, and distribution in one of the two failing communities by the year 2018 (Figure 4A). As this is a complex assessment completed by ODFW, the future species status will be determined when ODFW repeats their assessment of Upper Klamath redband trout. Expanding and enhancing summertime thermal refugia will play a key role in successfully changing population status, since such improvements will address a primary limiting factor for the redband trout populations. Measurable indications of success include expanding summertime distribution and abundance of juvenile and adult redband trout using enhanced and expanded refugial areas.

Figure 4. A. Current redband trout population conditions and objectives for the year 2018. Compiled from information in ODFW's *2005 Oregon Native Fish Status Report.* Sub-population response from this Initiative is shown in Conservation Objectives column with capital letters. B. Median channel temperatures plotted by river mile for the Sprague River. The locations and types of detected surface inflows and some diversions are illustrated on the profile.

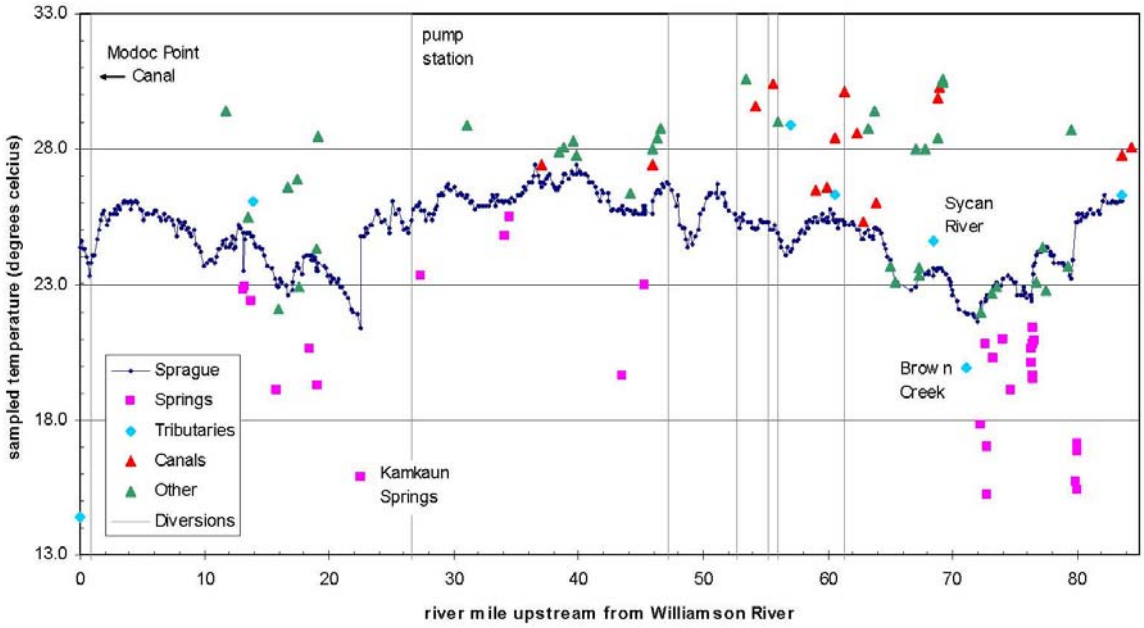
(4A)

Redband sub-population	CURRENT BASELINE CONDITIONS				CONSERVATION OBJECTIVES		
	Distribution	Abundance	Productivity		Distribution	Abundance	Productivity
Cascade complex	Fail	Fail	Fail		PASS	PASS	PASS
Wood River	Pass	Pass	Pass		Pass	Pass	Pass
Lower Williamson	Pass	Pass	Pass		Pass	Pass	Pass
Upper Williamson	Fail	Fail	Fail		Fail	Fail	Fail
Lower Sprague	Pass	Pass	Fail		Pass	Pass	PASS
Upper Sycan	Pass	Fail	Fail		Pass	PASS	PASS
Upper Sprague	Pass	Pass	Fail		Pass	Pass	PASS

(4B)

Sprague River

Longitudinal Temperature Profile



It is important to note the time delay between restoration activities and measurable changes in watershed-scale population size. Therefore, this effort will also track changes in Ecological Stressors (see Logic Model, Figure 5) which can serve as surrogate indicators known to impact the species. For example, miles of stream with stable riparian areas, changes in water temperature, increased flows, and others. These indicators are described as part of the implementation strategies later in the document.

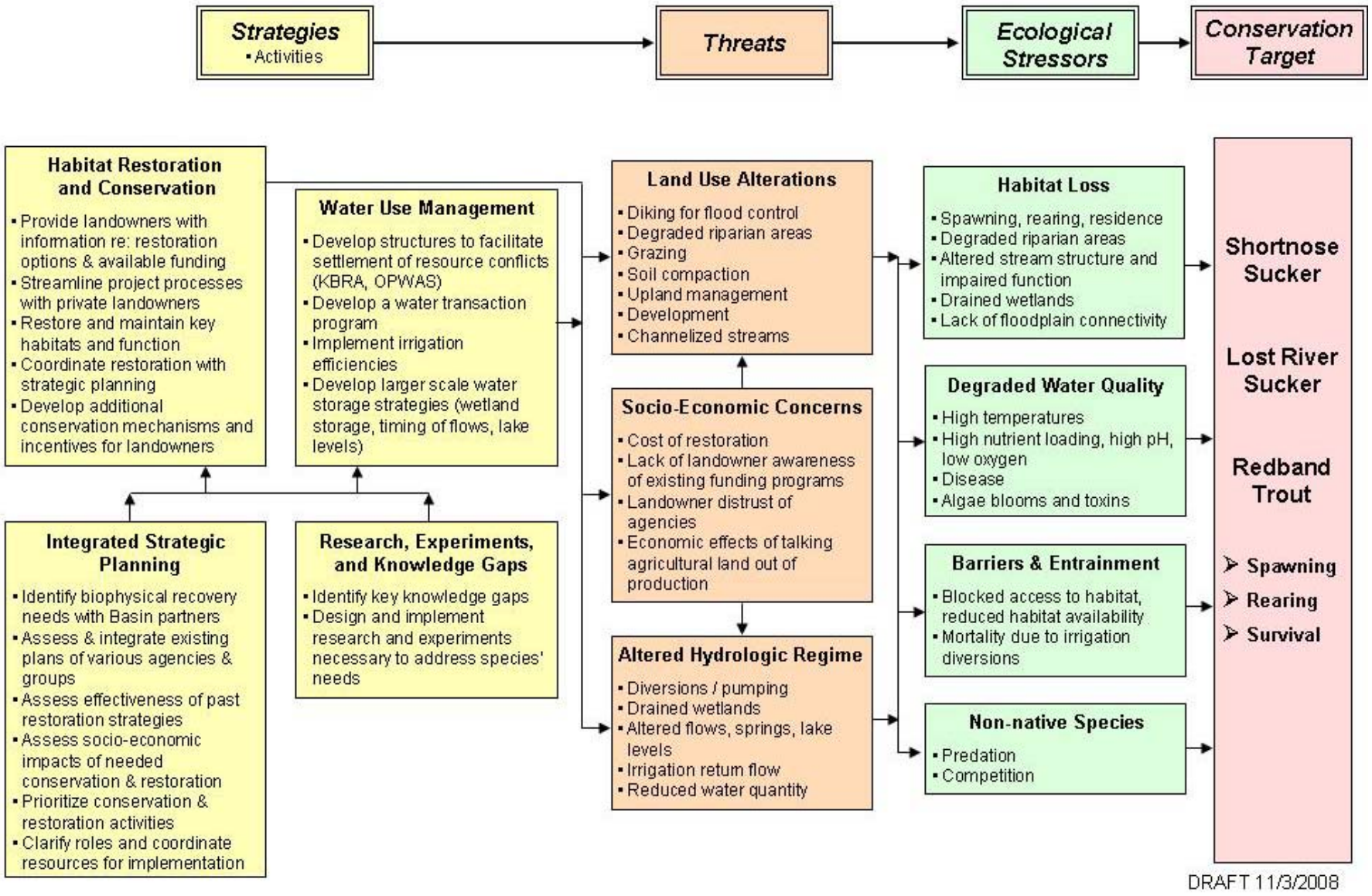
Implementation Plan

The goal of this project is to recover populations of Lost River sucker, shortnose sucker, and Klamath redband rainbow trout within the Upper Klamath Lake drainage including the Wood, Williamson, and Sprague Rivers, and their tributaries. A logic model was constructed to guide the development of a series of strategies toward recovering the target species. As the Logic Model (Figure 5) illustrates, the species suffer from a number of Ecological Stressors including a lack of habitat, poor water quality conditions, barriers and entrainment, and non-native species competition and predation. The key to success is to overturn or compensate for the Threats so that the Ecological Stressors will be reduced.

The two Primary Strategies of this Initiative will directly affect three threats. They are to: (1) restore and conserve habitat; and (2) improve water use management. In turn, these are complemented by two Support Strategies, which include strategic planning and coordination, and the use of targeted research and experimentation. These strategies are necessary to support stable fish populations and improve water quality by addressing the Threats: land use alterations and altered hydrologic regime. However, nearly all of the priority areas for restoration above Upper Klamath Lake are on privately owned land or involve private water rights. Therefore, habitat restoration and water use management improvement efforts must address secondary socio-economic threats in order to be effectively implemented in conjunction with private landowners. .

There has been significant effort and progress toward restoring and conserving habitat in the last decade. Federal and state natural resource agencies contributed and will continue to contribute to restoration project implementation. The strategies in this initiative will make restoration more effective and speed recovery of the fish, not only by contributing toward restoration projects, but in two other very significant ways: (1) enhancing coordination among conservation and restoration partners in planning, research, monitoring, funding and implementation, and (2) incorporating the local economic and land use needs so that landowners become willing partners in restoration. In this way NFWF plays a very critical role in this process. Ultimately, this will lead to a smart and coordinated approach to recovery of the shortnose and Lost River sucker and redband trout.

Figure 5. Klamath Initiative Logic Model



Key Strategy 1: Habitat Restoration & Conservation

Many key habitats historically present are either not available or degraded, and restoring, and conserving these habitats is essential

Lost River suckers, shortnose suckers, and redband trout exhibit complex life history strategies that depend on lake and stream systems, specifically on riparian and lake-fringe wetland habitats throughout the Upper Klamath Lake watershed. In the past century, over 40,000 acres of lake-fringe wetlands along the shore of Upper Klamath Lake were diked, drained and converted to agriculture, and nearly all of the tributary streams, riparian habitat and floodplain wetlands in the Sprague and Wood Rivers and Sevenmile Creek (three of the major tributary systems to the lake) have been altered or degraded due to grazing by livestock and associated irrigation practices. With other factors, habitat loss is cited repeatedly as the primary factor limiting the success of these species at all life stages. Fortunately, many of these land-use alterations are still manageable or reversible and there is tremendous opportunity to strategically identify and restore habitats historically utilized by these species. In the past decade, private landowners with the support of several non-governmental organizations, the Klamath Tribes, and state and federal agencies have made substantial effort to restore these lost or degraded habitats, and there are many clear examples of demonstrated success and improving conditions (i.e. 3,500 acres lake-fringe habitat at the Williamson River Delta, dozens of miles of riparian restoration, removal of the Chiloquin Dam, etc.). These partnerships have more recently coalesced around the potential to contribute to a basin-wide Klamath Basin Restoration Agreement (or "Klamath Settlement"), and there is now a credible opportunity to extend these habitat restoration efforts through these systems.

Primary habitat restoration activities addressing Lost River sucker, shortnose sucker, and redband trout habitat concerns are to:

- Restore and improve ecological condition of riparian habitats, floodplain wetlands and geomorphic stream processes through fencing stream-side corridors, levee removal, channel reconstruction and changes in land management practices on 80 miles of Sprague River and 25 miles of Wood River and key tributaries.
- Restore natural hydrologic function at 20+ cold-water springs and seeps throughout system by fencing and elimination of hydrologic alternations
- Restore spawning and rearing habitat and re-establish connectivity of migratory corridors for redband trout and bull trout in 50 miles of tributary streams in Wood River system, including Fourmile and Sevenmile streams.
- Remove barriers to fish passage, and screen all unscreened diversions > than 30 cfs in Sprague River and Wood River valley systems.
- Designate approximately 80 stream miles and 20,000 acres of riparian and floodplain wetlands in conservation status through agreements with private landowners

These restoration activities will occur throughout the life of the Initiative. There are several priority projects that will take place within the first five years, and others that are still in development and actions might not be taken until later in the project. Assessing current conditions will occur at teh start of the initiative. Major barriers to fish have been previously identified, so partners will begin to address these barriers right away. Reconnecting springs to improve stream temperatures and create thermal refugia is a high priority, and efforts may begin early in the Initiative, but on-the-ground work might occur later. Riparian protection and cattle management are ongoing activities throughout the watershed.

While there is great opportunity to improve conditions and better manage the habitats used by these fish species, there is also substantial challenge and opportunity in balancing restoration of aquatic habitats and naturally functioning hydrologic processes with the land-use-based economy in the watershed. The

tremendous need here is to establish effective and innovative financial incentive options, such as conservation easements, that are easy to implement, address critical economic stability concerns (such as the threat of conversion or fragmentation), are acceptable to landowners, and include a program that assures adequate conservation through frequent follow-up and assessment.

ACTIVITY	KEY PARTNERS	THREAT REDUCTION	IMPROVED ECOLOGICAL CONDITION
Conduct assessment and determine current condition, function and connectivity of riparian habitat, floodplain wetlands, and all cold-water springs and seeps and current management practices along 80 miles Sprague River, 25 miles Wood River and key tributaries; prioritize restoration actions and locations (Yrs 1 – 2)	Private landowners, KWP, Klamath Tribes, USFWS, NRCS, TNC, contracted consultants		Populations of LRS and SNS will exhibit an annual rate of population change consistently >1, annual adult survival rates consistently ≥0.8, and recruitment improved from current rates for a ten year period starting in 2015. During the next ten years, increased distribution and abundance of juvenile suckers in the Sprague River, and increased year-round use of the Sprague River by adult suckers. For redband/rainbow trout, using ODFW's survey and assessment date, change the assessment 3 metrics from pass to fail by 2015 (see Fig. 4): (a) productivity improved to pass in four of the five failing communities, (b) abundance improved to pass in two of the three failing communities, and (c) distribution in improved to pass in one of the two failing communities Increase size and/or functionality (geomorphic improvements, riparian and hydrologic changes to enhance access and persistence) of ≥40% of thermal refugia in the mainstem, North, and South Forks of the Sprague River identified in the 1998 and 2007 thermal infrared radiometry projects. Verify benefits to target species by quantifying changes in abundance and timing of refugia use by juveniles and adults of target species.
Restore/improve riparian habitats, floodplain wetlands and geomorphic stream processes through fencing, levee removal, channel reconstruction and changes in land management practices on 80 miles of Sprague River and key tributaries and 25 miles of Wood River, Sevenmile Creek and tributaries. (ongoing throughout the Initiative)	Private landowners, KWP, Klamath Tribes, TNC, USFWS, NRCS	50% or ca. 40 miles of Sprague and tributaries, 35 miles of Wood, Sevenmile and tributaries are fenced or otherwise appropriately managed to increase riparian cover, stabilize streambanks, encourage natural geomorphic processes and connectivity to floodplain wetlands	

Protect or appropriately manage springs and seeps to maximize benefit and extent of cold water on stream reaches within the watershed (yrs 3 – 10)	Private landowners, KWP, NRCS, Klamath Tribes, FWS, TNC,	At least 20+ cold water springs and seeps are restored, fenced or managed to mimic natural hydrologic processes	Riparian vegetation/cover along Sprague, Wood, Sevenmile and tributaries exhibit and upward trend towards PFC Fish passage for redband trout and LR/SN suckers restored/improved for 40 miles in Sprague River system, 45 miles in the Wood River /Sevenmile Creek
Remove barriers or impediments to fish migration on key migratory corridors on Williamson, Sprague and Wood Rivers, and key tributary streams. (ongoing throughout the Initiative)	Private landowners, ODFW, NRCS, USFWS, Klamath Tribes, TNC	Remove/redesign 4 barriers on Williamson/Sprague/Sycan to improve passage	
Screen all unscreened diversions with maximum spring flow > than 30 cfs (ongoing throughout the Initiative)	Private landowners, ODFW, KWP NRCS, USFWS, Klamath Tribes,	All screens with maximum annual flows exceeding 30 cfs are screened per requirements of ODFW	

Develop menu of potential conservation agreements, acquisitions and associated economic incentives to better enable landowners to participate in restoration; achieve participation covering 80 miles and ca. 20,000 acres in Sprague River and Wood River Valley of riparian and floodplain wetlands. (Yrs 1-5)	KWP, Klamath Tribes, SNW, TNC, FWS, DU	Achieve 20,000 acres of riparian and floodplain wetlands in conservation status through agreements with private landowners	

Key Strategy 2: Water Use Management

Lost River suckers, shortnose suckers, and redband trout are all impacted by limited water availability and degraded water quality. Revising water resources management in the upper Klamath Basin is imperative to provide the water needed for agricultural, Tribal, and fisheries interests.

The natural hydrology of the Klamath Basin was tremendously altered over the past century to optimize water management for agricultural production. There is general consensus that these alterations degraded habitat conditions for sucker and trout species, and that restoring or revising current management practices is necessary to enable species recovery.

Opportunities for new management strategies include developing & implementing a water allocation plan that settles outstanding resource conflicts above UKL; establishing a water transaction program to allow for water right leasing and transfers; creating a hydrologic model that guides how and from where water is moved from agriculture to fishery needs; working with private landowners to modify water management and improve irrigation efficiency in ways that consider long-term maintenance and economic impacts; and determining larger scale strategies, including lake-level management and increased storage, that would result in a water balance between agriculture and fisheries.

The recent "Klamath Settlement" talks (around the proposed Klamath Basin Restoration Agreement, KBRA) have resulted in a Basin-scale hydrologic model which identifies water management changes that are needed to reach a water balance in the basin that addresses both downstream (Coho, Chinook, Pacific Lamprey) and upstream (sucker) fishery needs as it provides certainty to agriculture. To reach this balance, there is a need to implement water management and allocation systems above UKL that settle outstanding resource conflicts (such as water adjudication, tribal trust obligations, etc.) through implementation of conservation actions: habitat restoration, and water quality and quantity improvements). (This management system above UKL, and potential settlement of water rights disputes, is referred to as the "Off-Project Water Adjudication Settlement" or OPWAS between the Klamath Tribes and landowners.) These water management and allocation systems will require significant on-property experimentation and creative design to minimize the economic effects of reduced water for irrigation.

Further, there is also a clear need to establish a method for transferring irrigation water rights instream in a fair manner. In Oregon and across the West, water markets are successfully increasing instream flows

without detriment to water users. Pilot water markets, such as the Bureau of Reclamation's Water Bank, have laid the groundwork for an established water transaction program for Upper Klamath Lake and its tributaries. Additionally, although there have been efforts to improve irrigation efficiency below Upper Klamath Lake, primarily on the Bureau of Reclamation's Klamath Project, there is only scattered activity above the lake. There is still wide-spread opportunity to improve water flows and quality through irrigation efficiency. There are also opportunities to increase storage, adjust lake management, and take other large-scale actions that would help meet the water balance and improve water quality in the upper basin.

There are two priority activities in the Water Use Management strategy. At the outset of the Initiative partners will begin developing the water transaction program (with actual transactions occurring after the program is in place), as well as begin working with landowners and stakeholders to develop management agreements related to water balance and restoration. Alternate irrigation strategies and the development of large-scale restoration projects will be ongoing efforts.

ACTIVITY	KEY PARTNERS	THREAT REDUCTION	IMPROVED ECOLOGICAL CONDITION
Develop and implement management agreements with residents above Upper Klamath Lake that settle outstanding resource conflicts and reach water balance and restoration needs. (Yrs 1-3)	SNW, KWP, KBRT, Klamath Tribes	Decreased socio-economic tensions surrounding water use and restoration. Agreed upon approach to increase instream flows to the lake.	Water allocation in and above the lake that allows for sufficient instream flows and lake levels to support secure Lost River sucker, shortnose sucker, and redband trout populations. Current modeling efforts suggest that a water balance would include an additional 30,000 acft of water flowing into Upper Klamath / Agency Lake each year. Over 10,000 acres of historical lake-fringe wetlands reconnected to the lake, providing 30,000 acft of additional water available in the lake.
Develop a water transaction program (Yr 1-2)	KBRT, KWP, Klamath Tribes, SNW, Oregon Water Resources Department	Provide template for addressing high rates of water diverted from streams	
Implement irrigation efficiency, alternate irrigation management strategies (ongoing throughout the Initiative)	NRCS, KWP, KBRT	Management agreements on approximately 20,000 acres to decrease water use through the method most appropriate for each operation.	
Explore large-scale storage strategies, such as wetland restoration, levee removal, lake-level management. This includes the reconnection of Agency Lake Ranch and Barnes Ranch, and potentially other lake-fringe wetlands, to the lake. (ongoing throughout the Initiative)	Federal agencies, Klamath Tribes	Breach dikes around 10,000 acres of drained lake-fringe wetlands.	

Key Strategy 3: Integrated Strategic Planning and Coordination

Habitat restoration is an essential strategy for sucker and redband trout recovery in the Upper Klamath Basin. This Integrated Strategic Planning and Coordination strategy includes convening conservation partners to (1) hire and review results and recommendations of a panel of expert scientists to evaluate the effectiveness of past project strategies; (2) hire and review the results and recommendations of an expert consultant on socio-economic impacts of restoration in the Upper Klamath Basin, and (3) integrate these two into a strategic plan that is based on science and takes into account, and socio-economic feasibility, with commitment and role clarity among partners for funding and implementation.

Several habitat restoration strategies have been implemented in the Upper Klamath Basin since the early-1990's to improve conditions for native fish populations and restore the river systems overall. The agencies, entities, and landowners completing these projects are always well-intended, but there is often disagreement over whether all strategies are effectively restoring habitat and most beneficial to fish. In addition, since restoration efforts in the Upper Klamath Basin lack an overall strategic plan, there are frequently inefficiencies and disagreement about projects and priorities, due to variability in agency, organizational, and landowner missions. Further, most of the high priority restoration projects in the Upper Basin occur on privately-owned lands where landowner participation is an essential component to the project. Therefore, this **Integrated Strategic Planning and Coordination** strategy will employ science, economics and landowner outreach and engagement to investigate previous restoration strategy effectiveness and subsequently develop a strategic plan for habitat restoration, and for evaluating success of restoration measures. The strategic plan will help ensure that all restoration projects are appropriate to benefit target species, cost effective, and economically viable and socially-acceptable at the macro- and micro-economic scales. The economic data resulting from this analysis will be an asset for landowners to evaluate project feasibility and impacts on their farm and/or ranch operations.

Integrated Strategic Planning and Coordination joins stakeholders to help align philosophies and priorities with science and economics. This activity will occur within the first two years of the Initiative, to guide and refine all future NFWF and partners' investments. Existing scientific analyses provide a basic tier of guidance that allows partners to immediately tackle many important *actions* that are agreed upon as immediate priorities (such as increase in water quantity, water quality improvements, etc.). However, there is an intense need for a higher tier process and plan that is informed by technical experts and cooperatively managed by local partners to identify and prioritize conservation and recovery *approaches* that are scientifically rigorous and socio-economically viable. This effort will result in a jointly developed strategic plan for habitat restoration that is founded in scientific and economic evaluations of previously existing habitat restoration projects and their respective impacts and benefits to suckers and redband trout. This process will refine physical and biological goals and priorities for river restoration to effectively guide future project implementation. It will also identify the most important private lands economic considerations, and likely paths to address them, that will ensure the ability to implement recommended conservation actions. Thus, the process will ultimately ensure the most efficient and effective use of time, funds, and resources for conservation and recovery in the Upper Klamath Basin. The results of the **Integrated Strategic Planning and Coordination** will set up a coordinated scientific process that integrates restoration and conservation project identification, evaluation, refinement, and prioritization.

ACTIVITY	KEY PARTNERS	THREAT REDUCTION	IMPROVED ECOLOGICAL CONDITION

Conduct scientific evaluation of previous restoration projects' effect on rivers in relation to biophysical needs of native fish (Years 1 & 2)	TKT, KWP, KBRT, TNC, SNS, USFWS, USBR, ODFW, NRCS, outside scientific & technical experts	A collaborative, comprehensive habitat restoration **strategic plan** based on an objective, science-based analysis of previous restoration activities, restoration needs, economics, and landowner perceptions	See Strategy 1, **Habitat Restoration and Conservation**.
Conduct micro- and macro-analyses of the Upper Basin land-based economy, including landowner perceptions, to best align habitat improvement project possibilities with local economics (Years 1 & 2)			
Collaboratively and cooperatively integrate results from scientific and socio-economic evaluation to select (or design) the most effective implementation strategies among potential conservation alternatives (By Year 2)			

Key Strategy 4: Research, Experiments & Knowledge Gaps

There is currently no focused effort to answer key questions related to restoration and species recovery in the upper Klamath Basin. A research-based approach to restoration in the upper Klamath Basin is necessary and should involve: (1) identifying key knowledge gaps specific to Upper Basin restoration needs; and (2) research design and implementation of experimental activities.

Carefully structured research is needed to fill in remaining knowledge gaps and to better understand the ecology and ensure the most effective recovery strategies are selected for Lost River sucker, shortnose sucker, and redband trout. There is scientific information available to begin a restoration program for species recovery, but additional research is necessary to refine use of recovery resources and fill in existing gaps in current understanding. USGS and ODFW are both continuing their work with the targeted species to better understand their lifecycles, impediments to population growth, and to track population changes as a result of habitat restoration. There are knowledge gaps around issues such as predation, including extent, and recovery impacts that can inform future conservation design and action. Additionally, we may experiment with different approaches to river restoration in order to determine the rate at which they will yield desired habitat, and under what conditions. Existing knowledge gaps will be clarified by the process of Strategic Analysis and the implementation of activities under the primary strategies of Habitat Restoration and Conservation, and Water Use Management.

Funding Needs

STRATEGY	BUDGET				Comments
	Yrs 1 - 5		Yrs 6 - 10		
	NFWF FUNDS	Other funds	NFWF FUNDS	Other funds	
1. Habitat Restoration & Conservation	$2,500,000	$5,000,000	$2,500,000	$5,000,000	Budget numbers based on recent funding levels of various, state, federal and private funders. The draft Klamath Settlement Restoration Agreement proposes $118M to support an extensive restoration package.
2. Water Use Management	$ 1,500,000	$5,000,000	$1,250,000	$5,000,000	Budget numbers based on recent funding levels of various, state, federal and private funders. The draft Klamath Settlement Restoration Agreement proposes $115M to support an extensive water management package.
3. Integrated Strategic Planning	$400,000	$200,000	$200,000	$250,000	
4. Research, Experiments, & Knowledge Gaps	$400,000	$1,000,000	$900,000	$1,000,000	Includes development and implementation of select fish monitoring protocols.
TOTALS	$4,850,000	$11,200,000	$4,850,000	$11,250,000	

Evaluation of Progress

[Not more than one page describing the monitoring and evaluation strategy and timeline for determining if implemented actions are achieving desired results. Include a process for adaptive management.]

[BOILERPLATE FROM NFWF TO BE ADDED]

It is essential to further develop and maintain a clear understanding of the species and program effects and whether all strategies watershed-wide are providing expected benefits—a coordinated approach is necessary

Assessment and monitoring improve understanding of current conditions, species' needs, program effectiveness, and opportunities for improvements. It is an essential and often undervalued component of conservation and recovery programs in general. Further, monitoring and assessment efforts too often fall short of providing essential information to resource managers in a useable form.

There is a critical need for an assessment and monitoring program in the target area that evaluates success of all strategies and provides feedback to an adaptive strategic plan. Currently, some monitoring efforts are ongoing within the target area particularly for Lost River sucker and shortnose sucker, but these efforts typically do not address

project-specific actions as is essential. There is opportunity to vastly expand this type of monitoring; improve coordination and collaboration among monitoring efforts; synthesize watershed-wide results of all types; and establish effective means for sharing data and reports among all pertinent

Key activities to address the need to develop a clear understanding of program effects include:

- Monitor project effectiveness
- Implement monitoring-informed adaptive management
- Establish formal coordinated and collaborative feedback with strategic planning and restoration activities as well as community

Exit Strategy

[Not more than one page of discussion focused on how accrued benefits will be sustained following NFWF withdrawal. Provide information on when NFWF participation will begin to conclude and end.]

[NFWF BOILERPLATE TO BE ADDED]

Long-Term NFWF Support

"This business plan lays out a strategy to achieve clear outcomes that benefit wildlife over a 10-year period. At that time, it is expected that the conservation actions partners have taken will have brought about new institutional and societal standards and environmental changes that will have set the population in a positive direction such that maintaining those successes or continuing them will be possible without further (or greatly reduced) NFWF funding. To help ensure that the population and other gains made in 10 years won't be lost after the exit of NFWF funding, the partnership must seek development of solutions that are long-lasting, cost-effective, and can be maintained at lower levels of funding (or with secure federal and state implementation funds) in the future. Therefore, part of the evaluations of this initiative will address that staying power and the likelihood that successful strategies will remain successful at lower management intensity and financial investment."

"The adaptive nature of this initiative will also allow NFWF and partners to regularly evaluate the strategies behind our objectives, make necessary course corrections or addition within the 10 year frame of this business plan. In some cases these corrections and additions may warrant increased investment by NFWF and other partners. However, it is also possible that NFWF would reduce or eliminate support for this initiative if periodic evaluation indicates that further investments are unlikely to be productive in the context of the intended outcomes."

Literature Cited

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Ancillary benefits

There will certainly be benefits derived from this Initiative that will improve conditions for other species in addition to those targeted. Measurable benefits to a suite of native fish with distributions that overlap with the target species are expected, including Klamath largescale sucker, lamprey, bull trout, tui chub, blue chub, and eventually anadromous fish species when they are re-introduced as planned. Other species to benefit from this initiative include those dependent on wetlands and riparian ecosystems, including but not limited to Oregon spotted frog and migratory birds for which the Klamath Basin is renowned. Beyond species-specific benefits, results of this initiative will restore conditions that improve ecosystem services and watershed processes that will improve water quality and ecosystem function throughout the Upper Klamath Lake drainage.

Acknowledgements

[short paragraph about the KIBP's origins and writers, describing how the document was put together, if appropriate; who prepared the document (working group, recovery team, etc.)
About NFWF—boiler plate that we provide]

This Business Plan for the Klamath Basin Keystone Initiative was developed collaboratively by a team of conservation partners in the Upper Klamath Basin:

- Matt Barry, US Fish and Wildlife Service
- Larry Dunsmoor, The Klamath Tribes
- James Honey, Sustainable Northwest
- Terry Morton, Klamath Watershed Partnership
- Shannon Peterson, Klamath Basin Rangeland Trust
- Mark Stern, The Nature Conservancy

We want to acknowledge the assistance of Jim Sedell and Christina Kakoyannis of the National Fish & Wildlife Foundation for their invaluable assistance and unfailing support.

Figure 1. Map of Upper Klamath Lake watershed, the area targeted by Klamath Basin Initiative.

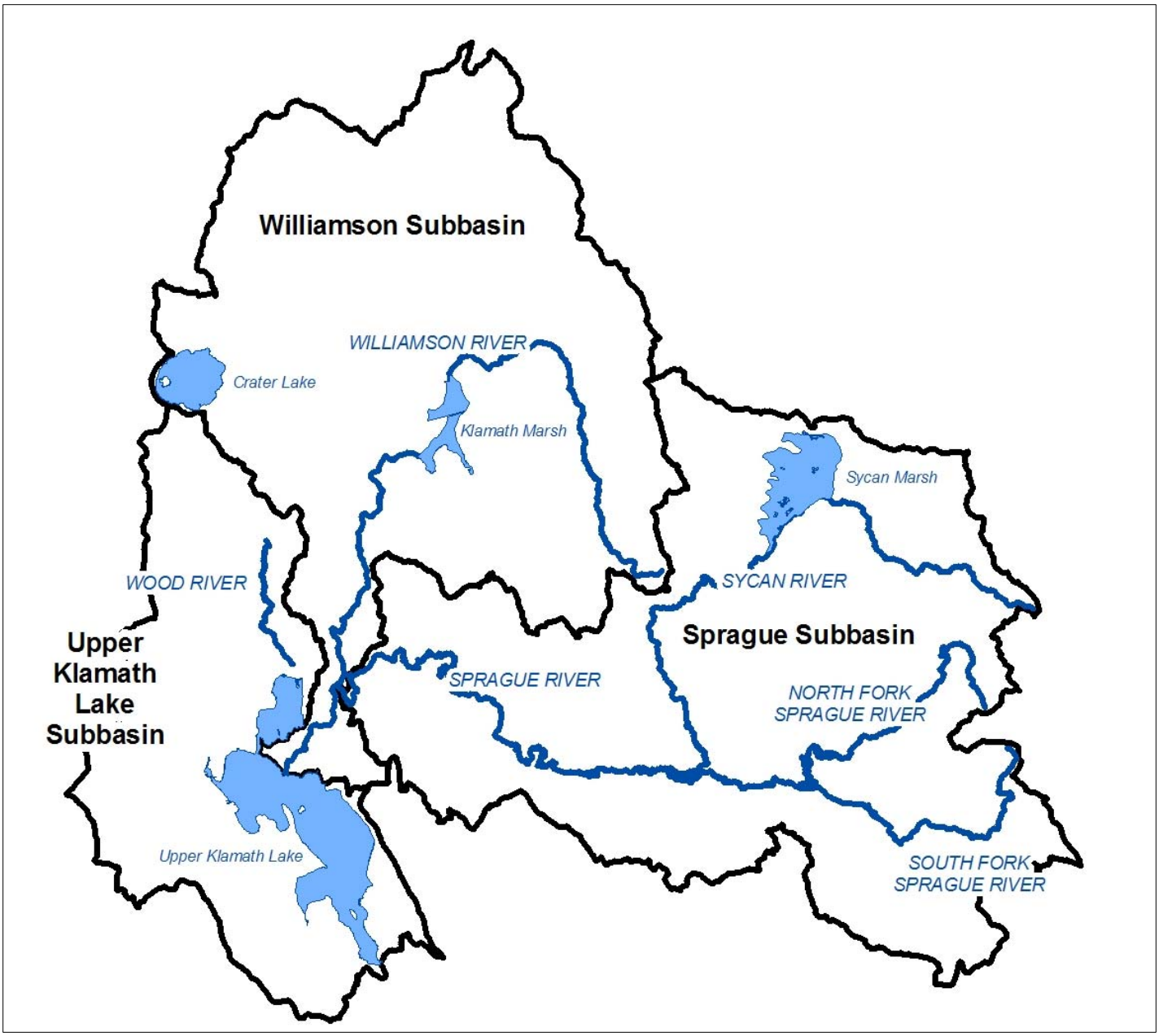

Figure 2. Current distribution of endangered Lost River and shortnose sucker fish in the Klamath Basin Initiatives' area of interest.