LTBMU 2010/2011 MONITORING PROGRAM ANNUAL MONITORING REPORT

USDA Forest Service, Lake Tahoe Basin Management Unit

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I. EXECUTIVE SUMMARY

This report summarizes key findings from 2008, 2009, and 2010 activities related to monitoring that have not previously been summarized. Monitoring questions focus on four broad topics: 1) terrestrial and aquatic flora and fauna, 2) air and water resources, 3) project effectiveness, and 4) post wild fire effects. Specific monitoring accomplishments from 2010 are presented. In addition, monitoring activities that occurred in 2008 and 2009 and monitoring needs for 2011 and 2012 are identified. Monitoring activities during 2010 data collection were associated with 42 of the 81 monitoring questions the LTBMU is currently addressing (2008-2012). Analysis of monitoring activities is ongoing this document only summarizes monitoring reports completed between June 2010 and May 2011. Eighteen reports were completed in 2010/2011, addressing 26 of the 81 current monitoring questions.

II. INTRODUCTION

The Lake Tahoe Basin Management Unit (LTBMU) Monitoring Program provides information to decision makers about the outcome of forest management activities on desired conditions for LTBMU resources. The goal of the Monitoring Program is to provide direction needed for the Forest Plan Revision, the Forest Environmental Management System (EMS), and NEPA decision documents. The Program has evolved to follow monitoring guidelines established in FSH 1901.12, CH. 19 and 20 (Land Management Plan and Adaptive Planning Process); FSM 1331 (EMS directives); the Adaptive Management Strategy (AMS) as described in Appendix E of the Sierra Nevada Forest Plan Amendment (SNFPA); and from the strategy developed by the National USFS Monitoring and Evaluation Team (MET).

The LTBMU continues to work with our partners in the Basin to ensure that a coordinated and prioritized Monitoring Program is developed that meets both the particular needs of the LTBMU as well as the larger Lake Tahoe Basin community.

Monitoring included in this report falls under five categories:

- **Assessments**: Evaluation of system. The assessment is the baseline data that may lead to status and trend monitoring. (Examples: location and distribution of fens, current status of native non-game fish).
- **Status and trend monitoring**: Status is the baseline that trend will be based on. Trend is the directional change in a system/populations characteristics documented by a minimum of three sampling points. (Examples: special status species monitoring; meadow monitoring).
- **Project effectiveness monitoring**: Documents how well management practices meet project objectives. May suggest cause and effect relationships between management actions and resource conditions. (Examples: burn pile monitoring, restoration monitoring of stream channel conditions).
- **Implementation Monitoring:** Documents if management practices were implemented as stated in project design. (Examples: project or contract administration, monitoring to make sure project stays out of areas identified during design criteria).

- **Compliance Monitoring:** Monitoring done to ensure that specific legal requirements are met. (Examples: long-term water quality, maintenance of standards during and after construction of a project).

This report describes monitoring accomplishments and key findings from the analysis conducted during June 2010 through May 2011, as it relates to the 1) terrestrial and aquatic flora and fauna, 2) air and water resources, 3) project effectiveness, and 4) post wild fire effects. Many of reports synthesized in this report can be found at: http://www.fs.fed.us/r5/ltbmu/publications.

III. METHODS

Between 2008 through 2012, the LTBMU monitoring program is focused on 81 different monitoring and/or assessment questions in four categories: 1) terrestrial and aquatic flora and fauna, 2) air and water resources, 3) project effectiveness, and 4) post fire effects. Analysis of monitoring activities is ongoing this document only summarizes key findings from monitoring reports completed between June 2010 and May 2011, addressing 26 of the 81 current monitoring questions. Abstracts, executive summaries, results, and or discussion from each report are summarized in this document.

A summary table that presents all completed monitoring data collection efforts from 2008 through 2010, planned monitoring efforts in 2011, and forecasted monitoring efforts in 2012 is also presented. The objective of this table is to provide data on a five year monitoring time frame (Table 1) so that internal and external partners understand the current LTBMU monitoring program. This provides information on what we have done and what we plan to do in the future.

Table 1: Lake Tahoe Basin management Unit Five Year Monitoring Plan, pre and post monitoring is identified with an X, 2010 monitoring indicates what was done (i.e. number sites, miles, etc.) and if a report has been completed for that activity. 2008, 2009, 2011, and 2012 are presented to provide the background on five years – what has been done and what will is currently planned for the future.

Status and Trend Components							
Status and Trend Invasive Species							
Emphasis/Measure	**Monitoring/Assessment Question**	**2008**	**2009**	**2010**	**2010 Report**	**2011**	**2012**
Assessment of post project impacts on terrestrial invasion of invasive/noxious plants: acres, number of sites, management treatment and design criteria	What effect do projects have on spreading invasive/noxious plants? What mitigation measures for prevention of establishment and spread are working and which measures need to be improved or added?			25 project sites		x	x
Invasive/Noxious Plant Status and Trend - acres, number of sites	What is the status and trend of noxious weeds within the Lake Tahoe basin? How effective are efforts by LTBMU staff at reducing the number of acres of invasive/noxious plant infestations in the Lake Tahoe basin?	x	x	398 sites	Olin, 2010 Draft.	x	x
Status and Trend Rare/Sensitive Species							
Emphasis/Measure	**Monitoring/Assessment Question**	**2008**	**2009**	**2010**	**2010 Report**	**2011**	**2012**
Long term fungi plots: fungal diversity	What fungi occur in the Basin? What are the fungal diversity (species richness) trends in the Basin?	x	x	3 sites	Engelhardt and Gross, 2011a	x	x
TES Census Counts	What is the status and trend in sensitive, special interest, and target plant species plant populations and communities within the Lake Tahoe Basin? What are their primary threats?	x	x	68 sites	Engelhardt and Gross, 2011a	x	x

Draba asterophora long term monitoring: Density & Plant Size, Population Viability, demographic structure	1. What is the status and trend of Draba asterophora density and plant size within the Lake Tahoe Basin? What is the relationship between plant size and reproductive success? 2. What is the status and trend of Draba asterophora demographic structure within the Lake Tahoe Basin? 3. What are the transition rates between stage classes? Given the current transition rates, what is the probability of population extinction within 50, 100 and 500 years? 4. Are changes in climate (total snowfall, timing of spring runoff) influencing the density, demographic structure or transition rates of D. asterophora populations? 5. Are changes in inter-specific competition (total vegetative cover) or habitat suitability (ground cover, erosion features) related to density, demographic structure or transition rates of D. asterophora populations? 6. Are there noticeable differences in trends in density, demography, population viability, competition, or habitat characteristics of D. asterophora populations that occur at ski areas compared to those that occur in remote locations?			8 populations, 26 transects, 167 plots		x	
Lewisia longipetala long term monitoring: Density, Population Viability, demographic structure	1. What is the status and trend of Lewisia longipetala density within the Lake Tahoe Basin? 2. What is the status and trend of L. longipetala demographic structure within the Lake Tahoe Basin? 3. Are changes in climate (snowpack persistence, total snowfall, timing of spring runoff) influencing the density or demography of L. longipetala populations? 4. Are changes in inter-specific competition (associated species, total vegetative cover) influencing the density or demography of L. longipetala populations?			2 populations, 6 transects, 37 plots	Engelhardt and Gross, 2011b	x	
TYC Interagency Survey - fall census count for population numbers	What is the status and trend of Tahoe yellow cress?	x	x		Stanton and Pavlick, 2011	maybe	maybe
Non-game native fish assessment - Assessment piece - abundance and distribution	What is the current status (relative abundance and distribution) of Lahontan tui chub, mountain whitefish, Tahoe sucker, Lahontan redside shiner and Paiute sculpin populations in the Lake Tahoe basin?	x	x	2 miles (Incline, Trout, McFaul)	Santora et al., 2010	x	x
Amphibian visual encounter surveys: number of amphibians, demographics, presence of Bd (chytrid swab) [includes western toad and MYLF]	What is the current status of amphibian populations in the Lake Tahoe basin and how are they changing over time? What is the current status of Sierra Nevada yellow-legged frog (SNYLF) populations in the Lake Tahoe basin and how are they changing over time? What is the distribution of Bd around the basin and infection level?	x	x	1 site: Hell hole		x	x
Spotted owl detections and nests	What is the status and trend of Spotted Owl populations in the Basin?	x	x	35,795 acres	Zanetti et al., 2011	x	x
Goshawk detections and nests	What is the status and trend of Goshawk populations in the Basin?	x	x	31889 acres	Zanetti et al., 2011	x	x
Osprey nests	What is the status and trend of Osprey populations in the Basin?	x	x	17,033 acres	Zanetti et al., 2011	x	TRPA

Bald eagle detections and nests	What is the status and trend of Bald Eagle populations in the Basin?	x	x	26 survey points	Zanetti et al., 2011	x	TINS
Peregrine falcon detections and nests	What is the status and trend of Peregrine Falcon populations in the Basin?	x	x	3 sites, 10 visits	Zanetti et al., 2011	x	x
Townsend's big-eared bat detections and roost sites	What is the status and trend of bats in the Basin?	x	x	6 sites	Zanetti et al., 2011	x	x
Willow flycatcher territories, adults, fledglings, nests	What is the status and trend of willow flycatcher in the Basin?	x	x	12 sites	Zanetti et al., 2011	x	x
	Status and Trend Community Monitoring						
Emphasis/Measure	**Monitoring/Assessment Question**	**2008**	**2009**	**2010**	**2010 Report**	**2011**	**2012**
Freel Peak: GLORIA monitoring (PSW lead): Biodiversity, vegetation patterns, temporal changes in patterns, current patterns of mountain biota along elevation gradients	What is the status and trend of TRPA threshold plant communities found on FS land? (I-1) What are the patterns of species richness, abundance and vegetation cover along elevation gradients in different mountain regions? (I-2) How do these patterns relate to environmental gradients? (I-3) What are the most important potential direct and indirect effects of climate change on high mountain biota in the different mountain regions? (I-4) What are the potential risks for distinct species, species groups (e.g. endemics), life forms or functional groups because of changing climatic constraints, changing habitat stability, changing competition pressure? (I-5) What measures can be taken to mitigate climate-induced biodiversity losses? (II-1) Does species richness change within the study site? (II-2) Is there change in vegetation cover and vegetation structure? (II-3) Is there change in the abundance or cover of species and in species composition? (II-4) If there are changes, is there a (global) pattern related to altitude, latitude and longitude? (II-5) Can observed changes in vegetation patterns be related to observed climatic change? (II-6) Are there any signals which indicate climate-induced threats for species, species groups (e.g. endemics), life forms or functional groups; are determined signals consistent with the risk assessment according to question (I-4)? (II-7) Is there an urgent need for adaptive management measures be taken to ameliorate climate-induced threats to biodiversity?					x	
Hell Hole Vegetation and Photo Point Monitoring: Meesia cover, Sphagnum cover, Long Term Photo points	What is the status and trend of TRPA threshold plant communities found on FS land? Are changes in climate influencing wetland trends?					x	x
Grass Lake Vegetation and Photo Point Monitoring: Meesia cover, Sphagnum cover, Long Term Photo points	What is the status and trend of TRPA threshold plant communities found on FS land? Are changes in climate influencing wetland trends?		x	250 acres			

Meadow Monitoring Region 5 Range monitoring protocol: Species composition, ground cover, wetland rating, vegetation rating, ecological status	What is the current condition and ecological status and trend of wetlands (e.g., wet meadows, fens, marshes, etc.) in the Lake Tahoe basin, based on key indicators of biological integrity and water quality, and how is that condition changing over time? Are changes in climate influencing wetland trends? What is the ecological condition and trend in meadow systems where grazing has been removed? What is the status and trend of TRPA threshold plant communities found on FS land (Pope, Taylor, Hell Hole, Grass Lake)?		x	10 meadows, 12 plots			
Fens: number, condition (species, wetness)	How many fens are found on FS land in the LTB? What is the status of these fens?	x	x	20 fens	Engelhardt and Gross, 2011a; Sikes et al., 2011	x	
Stream Temperature Monitoring: temperature	What is the stream temperature range during spawning season? Is it changing?			22 hobos, 11 streams		x	x
Aquatic Organism Passage (AOP)	What is the extent of road – stream crossings across the Tahoe basin (primarily on Forest Service system roads)? Which crossings are barriers to local fish species, specifically native fishes? Which culverts should be prioritized for replacement within the LTBMU Basin?			112 road/stream crossings	Vacirca et al., 2010		
	Status and Trend Air and Water Resources						
Emphasis/Measure	**Monitoring/Assessment Question**	**2008**	**2009**	**2010**	**2010 Report**	**2011**	**2012**
Maintain Improve Site at Bliss	What is the status and trend of air quality in the Lake Tahoe basin?	x	x	1 site		x	x
Contribute funding to LTIMP Tributary Monitoring Program (USGS)	What is the status and trend of stream water quality in the Lake Tahoe Basin?	x	x	4 sites		x	x
Regional BMPEP Implementation and Effectiveness Monitoring	To what degree are best management practices implemented and effective in protecting soil and water resources for LTBMU management activities?	x	x	37 evaluations	Harris et al., 2011	x	x
Water Uses Survey	Are water uses consistent with existing rights and are instream beneficial uses being protected within existing appropriations?	x	x	7 follow up verifications		x	x
	Project Effectiveness						
	Fuels Reduction and Forest Health Restoration Effectiveness						
Emphasis/Measure	**Monitoring/Assessment Question**	**2008**	**2009**	**2010**	**2010 Report**	**2011**	**2012**

Heavenly Creek SEZ Vegetation Monitoring: Cover of native herbaceous plants and shrubs, weed cover, native plant diversity, proportion of wetland species (upland, obligate, facultative)	What is the vegetation response to stream zone fuels treatments at the Heavenly Creek SEZ project?	x		5 units, 13 transects			x
Pile Burn Plot Monitoring - soil heating, species richness, cover of species by growth form	What are the effects of prescribed pile burning on soil productivity and vegetation cover, native species community structure, native plant species richness, and non native invasive plant species after implementation of fuels reduction projects, and how long does it take for soil cover reestablishment?	x	x	2 vegetation monitoring sites		x	x
Mechanically Treated PAC	What is the status and trend of Spotted Owls and Goshwaks in PACS that occur in mechanically treated areas?	x					
Angora Fen Meesia monitoring: Meesia cover	What is the status and trend of Meesia populations in Angora fen where in 2006 sod was collected from the fen for a stream restoration project and the Angora fire burned the area?	x				x	
Soil Quality in Mechanical Treatment Units- soil porosity/infiltration capacity, bulk density, and soil cover. (see projects below)	What are the impacts to soil quality, and the sediment and discharge loading potential from a variety of vegetation management mechanical treatment prescriptions for various site conditions?	x	x		Cody et al., 2011	x	TBD
Roads and Trails BMP Retrofit Effectiveness							
Emphasis/Measure	**Monitoring/Assessment Question**	**2008**	**2009**	**2010**	**2010 Report**	**2011**	**2012**
Forest Road Retrofit Effectiveness Monitoring -using WQRAP visual assessment and WEPP modeling protocols.	Has the implementation of Road Decommissioning and BMP Upgrades reduced the potential for water quality impacts, and to what degree were BMPs successfully implemented and effective?		x	4.2 miles	Harris et al., 2011		
Forest Trail Retrofit Effectiveness Monitoring - using WQRAP visual assessment and WEPP modeling protocols.	Has the implementation of Trail Decommissioning and BMP Upgrades reduced the potential for water quality impacts, and to what degree were BMPs successfully implemented and effective?		x	4.5 miles, East Shore			
OHV Study -Greensticker qualitative conditions assessment protocol.	What is the current condition of OHV routes as it relates to the potential for soil loss, and what are the current maintenance needs?	x					
Ski Area Management BMP Effectiveness							
Emphasis/Measure	**Monitoring/Assessment Question**	**2008**	**2009**	**2010**	**2010 Report**	**2011**	**2012**

Heavenly Ski Area BMP Effectiveness: WQ sampling, BMP effectiveness ratings, vegetation/soil cover evaluations, and stream condition inventories.	To what degree has the implementation of Ski Area BMPs been successful in protecting soil and water quality?	x	x	6 WQ sites, BMP evals, aeral interp of soil/veg cover, and 6 SCI evals.	Entrix, 2011	x	x
Stream Channel/Floodplain Restoration Effectiveness							
Emphasis/Measure	**Monitoring/Assessment Question**	**2008**	**2009**	**2010**	**2010 Report**	**2011**	**2012**
Temporary BMP Monitoring during channel construction	Are Temporary BMPS being adequately designed, implemented and maintained during construction projects?	x	x	Blackwood Reach 1, and Cold Creek Project	Heller, 2010, Oehrli, 2010	x	X
Blackwood Channel Vegetation Monitoring: vegetative cover by growth form; cover of invasive weeds	What is the change in vegetation structure and composition along Blackwood Creek where restoration project occurred? Did the restoration project change cover of invasive plant species along Blackwood Creek?	x		30 transects	Engelhardt and Gross, 2011c.		X
Cookhouse Meadow Monitoring Region 5 Range monitoring protocol: Species composition, ground cover, wetland rating, vegetation rating, ecological status	Was the seasonal groundwater table elevation raised and was seasonal variation reduced (in part from vegetation response); Was the wet meadow environment maintained or increased (in part from vegetation response); was the diversity and complexity of riparian and meadow habitat increased?		x			x	
Wildlife monitoring - measures of: bird point counts, bird nest success, butterflies, small mammals, herps, bats, meadow wetness	What are the short term/immediate wildlife response to stream/meadow restoration?	Cookhouse, High Meadow					
High Meadows Meadow Monitoring Region 5 Range monitoring protocol: Species composition, ground cover, wetland rating, vegetation rating, ecological status	What is the vegetation response to restoration at the High Meadows/Cold Creek?		x				X
South Fork Marlette Creek Dam Removal -long profile, cross sections, and photopoints	To what degree have restoration efforts been successful in restoring floodplain connectivity and channel/riparian habitat, improving water quality, stabilizing stream banks and sediment transport regimes.	x				x	

Lonely Gulch Stream Channel Restoration - Repeat photopoints after next rain event with a 5+ yr event frequency.	To what degree have restoration efforts been successful in restoring floodplain connectivity and channel/riparian habitat, improving water quality, stabilizing stream banks and sediment transport regimes.					x	
Cookhouse/ Big Meadow Creek Restoration - GW, photopoints, SCI (xs, long profile). May do sooner if determined appropriate from visual inspections after significant flow events.	To what degree have restoration efforts been successful in restoring floodplain connectivity and channel/riparian habitat, improving water quality, stabilizing stream banks and sediment transport regimes.	x	x	13 GW peizometers, 1 Flow guage		x	
Upper Truckee - Current pre-project monitoring includes SCI, and photopoints. (and through CTC, macros and gw levels).	To what degree have restoration efforts been successful in restoring floodplain connectivity and channel/riparian habitat, improving water quality, stabilizing stream banks and sediment transport regimes.	x					x
Blackwood Creek Fish Ladder Removal and Bridge Replacement - Repeat photopoints, cross sections, and long profile.	To what degree have restoration efforts been successful in restoring floodplain connectivity and channel/riparian habitat, improving water quality, stabilizing stream banks and sediment transport regimes.						x
Blackwood Creek Reach 6 - wq sampling during project, post project - photopoints, SCI, high resolution aerial photos, vegetation plots.	To what degree have restoration efforts been successful in restoring floodplain connectivity and channel/riparian habitat, improving water quality, stabilizing stream banks and sediment transport regimes.	x	x	sediment mapping, aerial photo, vegetation plots		x	x
Blackwood Reach 1 - wq sampling during project, post project - photopoints, SCI, high resolution aerial photos.	To what degree have restoration efforts been successful in restoring floodplain connectivity and channel/riparian habitat, improving water quality, stabilizing stream banks and sediment transport regimes.						x
Cold Creek - Current pre-project monitoring, groundwater levels, tributary wq, SCI, photopoints, macros.	To what degree have restoration efforts been successful in restoring floodplain connectivity and channel/riparian habitat, improving water quality, stabilizing stream banks and sediment transport regimes.	x	x	10 GW peizometer, discharge, photo points		x	x
Meadow Restoration Effectiveness							
Emphasis/Measure	**Monitoring/Assessment Question**	**2008**	**2009**	**2010**	**2010 Report**	**2011**	**2012**

Meadow Restoration Monitoring - utilizing Region 5 Range monitoring protocol and UC Davis research: Species composition, ground cover, wetland rating, vegetation rating, ecological status	What is the ecological condition and trend in meadow systems where prescribed fire has been re-introduced? Will the proposed actions cause significant adverse impacts to the non-target vegetation? Adverse impacts include reduction of native plant diversity and cover and an increase in weed cover.	x	x	8 meadows		x	x
Big Meadow Project Photopoints	What are the visual changes in conifer density reduction and riparian meadow grass and shrub species enhancement?			41 photopoints			x
Aspen Stand Restoration Effectiveness							
Emphasis/Measure	**Monitoring/Assessment Question**	**2008**	**2009**	**2010**	**2010 Report**	**2011**	**2012**
Aspen Stand Restoration Photopoints	What are the visual changes in conifer density reduction and aspend stand enhancement?			9 sites, 72 photographs			
TES Species Restoration Effectiveness							
Emphasis/Measure	**Monitoring/Assessment Question**	**2008**	**2009**	**2010**	**2010 Report**	**2011**	**2012**
Desolation Mountain Yellow Legged Frog: Number of frogs, demographics, number of fish, presence of Bd (chytrid fungus)	What is the effectiveness of SNYLF habitat restoration measures (i.e fish removal) in alpine lakes and/or wet meadows (Desolation)?	x	x	6 lakes	Muskopf et al., 2010	x	probably
Lahontan Cutthroat Trout (LCT) Recovery: Number of Brook Trout/rainbow trout, Number of LCT	Does removal of brook trout and rainbow trout from Upper Truckee River or any other identified LCT recovery stream effectively reduce brook trout and rainbow trout long-term abundance?			5.8 miles	Moore and Santora, 2010	x	x
Urban Lot Management Effectiveness							
Emphasis/Measure	**Monitoring/Assessment Question**	**2008**	**2009**	**2010**	**2010 Report**	**2011**	**2012**
Urban Lot Condition Assessment on fuels, erosion issues/restoration potential, invasive species, hazard trees and encroachment issues.	What is the condition of individual urban lot parcels as it relates to vegetation, fuels, watershed and property management?	x	x	1704 parcels		x	x
	Erosion Control Grant Program Effectiveness						

Emphasis/Measure	Monitoring/Assessment Question	2008	2009	2010	2010 Report	2011	2012
Contribute funding to RSWMP Monitoring Program	What is the status and trend of urban outfall water quality, and the what is the effectiveness of urban stormwater treatment projects and BMPs?		x			x	x
Post Wild Fire Effects							
Emphasis/Measure	**Monitoring/Assessment Question**	**2008**	**2009**	**2010**		**2011**	**2012**
Measure a variety of parameters to assess vegetation condition and regeneration, fuels, tree mortality, snag retention, and effects of hydromulch treatment on understory vegetation.	What were the effects of the Angora wildfire on tree mortality, vegetation composition, and fuel loads, how do these change over time, and how do they vary in managed versus unmanaged stands? How are long-term forest carbon stocks in managed and unmanaged stands sensitive to variable rates of mortality and regeneration? What are the long term patterns of forest recovery, and vegetation response to pre-fire, and post-fire forest treatments?	x	x	68 common stand exams, plus regeneration plots	Carlson et al, 2010	x	x
Soil Hydrophobicitymeasurements and evaluation of erosion through visual surveys and aerial photography	What was the effect of the Angora wildfire on soil stability and hydrophobicity and when will soil hydrophobicity recover to back ground levels?	x	x	visual survey and hydrophobicity measurements	Howell et al., 2010		
Channel Condition: Measure a variety of parameters to assess channel morphology, riparian cover, and aquatic biological community (fish and macroinvertebrates).	What was the effect of the Angora wildfire on the condition of the Angora Creek channel and how will the channel recover over time?		x				
Water Quality - sediment and nutrient concentrations	What was the effect of the Angora wildfire on the water quality of Angora Creek, and how will water quality recover over time?	x	x	1 site		x	x

IV. RESULTS

Results are presented by topic (e.g. terrestrial and aquatic flora and fauna) and then by specific type (e.g. status and trend of invasive species). Monitoring activities for each of the 42 monitoring questions are presented in the results section (as well as in Table 1) even when a report has not been completed in order to provide a comprehensive representation of what was done in 2010. Eighteen reports were completed in 2010/2011, which address 26 of the 81 current monitoring questions.

TERRESTRIAL AND AQUATIC FLORA AND FAUNA

Status and Trend Invasive/Noxious Species

The LTBMU is currently addressing two monitoring questions related to the status and trend of invasive species (Table 1). In 2010, 398 invasive plant sites and 25 past project sites were monitored (Table 1). A draft 2010 annual invasive weed report was completed (Olin, 2010).

- *What is the status and trend of noxious weeds within the Lake Tahoe basin? How effective are efforts by LTBMU staff at reducing the number of acres of invasive/noxious plant infestations in the Lake Tahoe basin?* (Olin, 2010).

This was the ninth year of the invasive plant program. In 2010, there were 17 new noxious weed occurrences found on general NFS land administered by the LTBMU. In 2010, 398 invasive plant sites were visited; 73 of these sites were combined with other sites due to location and three sites were determined to be native plants. Monitoring and treatment consequently occurred at a total of 322 invasive plant sites. Of these sites, a total of 217 were treated and monitored two times (67%) and six sites were treated and monitored three times (0.9%).

Sites were treated manually if weeds were present, with the exception of sites that have infestations of species that do not respond or respond negatively to manual treatments. Manual treatments consisted of pulling, clipping, or digging weeds. Monitoring information was collected for all sites visited. Weed infestations were measured by calculating gross and infested areas. Gross area is the entire land area occupied by the infestation, regardless of canopy cover or a discontinuous distribution. Infested area is the gross area multiplied by the canopy cover of the weed. This is as if a line is drawn around each clump of weeds within a gross area, with the areas that do not support weeds excluded from the calculation. This gives a more accurate estimate of how much land is actually infested with invasive weeds. The infestations were given a length (in feet or meters) and a width (in feet or meters). These are multiplied together and then multiplied by the canopy cover of the infestation. In 2010, there were a total of 512.62 gross acres of noxious weeds and a total of 335.50 infested acres. In 2009, there were 259.54 gross acres and 4.18 infested acres. The increase in gross area from 2009 to 2010 was most likely a result of increased accuracy mapping that occurred in 2010 and potentially a result of differences in estimating canopy cover and using a larger gross area in 2010 than in 2009.

Status and Trend Rare/Sensitive Species

The LTBMU is currently addressing fourteen different status and trend of rare/sensitive species monitoring and/or assessment questions (Table 1). In 2010, 3 fungi plots, 68 target plant population sites, eight populations of *Draba asterophora*, 2 populations of *Lewisia longipetala*, three streams for fish surveys, amphibians at Hell hole, 35,795 acres for spotted swl, 31,889 acres for northern goshawk, 17,033 acres for osprey, 26 sites for bald eagle, three sites for peregrine falcon, six bat sites, and 12 willow flycatcher sites were monitored. In 2010/2011 five reports were completed including, LTBMU Sensitive Plant Species and Habitat Monitoring Report (Engelhardt and Gross, 2011a), Basin-wide Non-game Native Fish Survey 2010 Annual Report (Santora et al., 2010), 2010 Wildlife Program Annual Report (Zanetti et al., 2011), and Draft Implementation of the Conservation Strategy for Tahoe Yellow Cress (*Rorippa subumbellata*) 2010 Annual Report (Stanton and Pavlick, 2011) were completed. In addition to monitoring reports, a monitoring plan was completed for *Lewisia longipetala* (Engelhardt and Gross, 2011b).

- *What fungi occur in the Basin? What are the fungal diversity (species richness) trends in the Basin?* (Engelhardt and Gross, 2011a).

Long term fungi plot monitoring began in 2008. All three fungi diversity plots were revisited in 2008, 2009 and 2010. No fungi were identified in 2008 or 2009. In 2010 a total of 37 species were found, including two uncommon *Mycena* species. Fungal surveys are difficult because species can only be identified when they produce fruiting bodies and the correlation to underground extent of the organisms is largely unknown (Straatsma and Krisai-Greilhuber 2003). The occurrence and abundance of fungi is largely influenced by environmental conditions (Straatsma and Krisai-Greilhuber 2003) and the proportions and composition of species can differ annually (Smith et al. 2002). 2010 was the first year that fungi were observed in the long term monitoring plots, continued monitoring will provide an opportunity to improve on the LTBMU fungal diversity.

- *What is the status and trend in sensitive, special interest, and target plant species plant populations and communities within the Lake Tahoe Basin? What are their primary threats?* (Engelhardt and Gross, 2011a).

In 2010, 68 existing sensitive plant sites were revisited and 14 new sites were identified. Long-term monitoring was established and conducted at nine *Draba asterophora* populations. Long-term monitoring of *Lewisia longipetala* was established at one population each in 2009 and 2010; both populations were monitored in 2010. The majority of target plant species populations are either stable or of unknown status (Table 2), inferring that current management is not having a substantial negative influence on sensitive plant species. Twenty potential fen sites were visited in 2010; based on field assessments and soil analyses, 14 of these sites were confirmed as fens, bringing the total number of confirmed fens in the Lake Tahoe Basin to 47. Grass Lake was the only TRPA threshold site visited in 2010; one meadow plot was resurveyed and comprehensive moss monitoring was completed for the entire site. Ten meadow plots were revisited and four new meadow plots were established.

Table 2: Population trends† of target plant species known to occur on the Lake Tahoe Basin Management Unit.

Species	Status^	Total EO and Sub-EOs	New 2010	Stable	Increase	Decrease	Unknown
Arabis rectissima var. *simulans*	LTBMU	5	5	0	0	0	0
Arabis rigidissima var. *demota*	S, SI	14	1	1	0	3	9
Botrychium ascendens	S	6	1	0	1	4	0
Botrychium crenulatum	S	2	0	1	0	1	0
Botrychium minganense	S	2	0	0	1	1	0
Botrychium montanum	S	1	0	0	0	1	0
Bruchia bolanderi	S	7	0	0	0	0	7
Claytonia megarhiza	LTBMU	1	0	0	0	0	1
Dendrocollybia racemosa	S	1	0	0	0	0	1
Draba asterophora var. *asterophora*	S, SI	34	0	22	3	1	8
Draba asterophora var. *macrocarpa*	S, SI	7	0	3	2	1	1
Epilobium howellii	S	6	1	0	0	5	0
Helodium blandowii#	S	3	0	0	0	0	3
Lewisia longipetala	S, SI	8	0	4	2	2	0
Meesia triquetra#	S	22	0	0	0	1	21
Meesia uliginosa#	S	2	0	0	0	0	2
Orthotrichum shevockii	LTBMU	2	0	1	0	0	1
Peltigera hydrothyria	S	1	0	0	0	0	1
Scutellaria galericulata	LTBMU	3	1	0	0	0	3
Sphagnum spp.#	LTBMU	20	5	0	0	0	15

†Population trend was determined by comparing the total number of plants from the date the population was first observed to the total number of plants observed in 2009 or 2010 (whichever was the most recent census). All site visits were within two weeks of the date the population was first observed.

^S=Region 5 Forest Service Sensitive; SI=TRPA Special Interest; LTBMU=LTBMU Target plant species.

#Populations of these bryophyte species are listed as either unknown (the site was still present) or decrease (the site was absent).

- *What is the status and trend of Tahoe yellow cress?* (Stanton and Pavlick, 2011).

The 2010 report is the tenth Tahoe yellow cress (TYC) annual report completed since 2001. The annual reports provide a record of all conservation activities related to Tahoe yellow cress and are utilized at quarterly meetings of the Adaptive Management Working Group

(AMWG). This report is not finalized until the TYC Executive Committee grants approval at their annual meeting which has not taken place. All reports can be found on the Nevada Natural Heritage website at http://heritage.nv.gov/vlibtyc.htm. The draft version will be finalized after review at the Executive Committee Meeting,

Lake Tahoe peaked at 6,224.6 ft LTD in early July and then began a steady drop to 6,223.5 ft LTD. The AMWG revised the survey strategy in August 2010 and chose not to conduct the survey in September. The AMWG adopted an adaptive monitoring strategy as follows: The TYC lake-wide monitoring effort shall be linked to lake level. At lake level 6,226 ft LTD and above, monitoring should be carried out every year. Below 6,226 ft, surveys may be conducted every other year. Survey protocols and the annual survey data form have been standardized and all identified sites will be surveyed using these methods in years when the survey is conducted.

Recent field research efforts have focused on two main questions:
1) When is the optimal time to plant container-grown TYC during the regulatory survey window (June 15 to September 30) for TYC?
2) Does translocation of naturally-occurring TYC and outplanting of container-grown TYC result in the same rates of survival and reproduction?

Two years of data from 2008 and 2009 suggest the follow key findings:

- At sites with moderate to optimal habitat conditions, planting in June or July results in better plant performance than August or September
- Some sites appear to provide suboptimal habitat where reproduction fails regardless of planting time.
- Container-grown plants perform significantly better than translocated plants if habitat conditions are good to optimal.
- Translocated individuals will survive, but using container-grown stock gives a greater pay-off of increased growth and seed output.

- *What is the current status (relative abundance and distribution) of Lahontan tui chub, mountain whitefish, Tahoe sucker, Lahontan redside shiner and Paiute sculpin populations in the Lake Tahoe basin and how are they changing over time?* (Santora et al., 2010).

Seven species of fish were sampled this field season in three creeks, with a total of 2 miles of stream habitat surveyed. Four of these species are native, including the Lahontan redside shiner (*Richardsonius egregius*), Paiute sculpin (*Cottus beldingii*), speckled dace (*Rhinichthys osculus*), Tahoe Sucker (*Catostomus tahoensis*), and Mountain sucker (*Catostomus platyrhynchus*). Three species were non-native including brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), and rainbow trout (*Oncorhynchus mykiss*) (Table 3). Native fish species were generally uncommon, except Pauite sculpin in Trout Creek, and non-native trout species were the most common members of the fish communities. Native fish tend to be concentrated in downstream reaches near the lake, and decrease as the survey moves upstream.

Table 3. Fish species surveyed and distribution in creeks sampled during 2010.

Species	Trout Cr.	Incline Cr.	McFaul Cr.
Lahontan Redside Shiner	0	3	0
Speckled Dace	25	0	0
Tahoe/ Mountain Sucker	0	45	0
Rainbow Trout	63	128	0
Brook Trout	233	507	0
Brown Trout	340	1	0
Paiute Sculpin	269	0	0
Unknown Trout	2	15	0

Fish native to the Lake Tahoe basin and historically present (TRPA and USFS 1971) that were not sampled in 2010 include the Lahontan cutthroat trout (*Oncorhynchus clarki henshawi)*, mountain whitefish (*Prosopium williamsoni*) and tui chub (*Gila bicolor*). This indicates a significant impact on these species distribution. It is known that introductions of non-native species have greatly reduced populations of native forage fish within Lake Tahoe. Fish distribution in the tributaries may vary significantly from one season to the next as different species migrate to spawn and rear. For instance, some Lahontan redside shiners and Tahoe suckers use creeks to spawn and then return to the lake, while some populations remain resident in streams year round (possibly due to barriers like beaver dams).

Without hard evidence to support the historic presence or absence of species in the tributaries of Lake Tahoe it is difficult to assess the information gathered over the course of the basin-wide fish survey. There is now a dataset for the current extent of species in tributaries being created and built. Further surveys are necessary to provide a complete dataset of the entire Lake Tahoe basin. The Upper Truckee River and many east shore tributaries still need to be surveyed, and Trout and Cold Creek surveys need to be completed further up their drainages.

- *What is the status and trend of California spotted owl populations in the Basin?* (Zanetti et al., 2011).

Approximately 37,019 acres (14,982 hectares) were surveyed for California spotted owl by the LTBMU and its partners in the Lake Tahoe Basin in 2010. Ten spotted owl individuals are believed to have been found in 2010, although fourteen separate detection locations across several dates were accrued throughout the season. Spotted owls were detected at three of the PACs (Burton Creek, Cold Creek, and Lower Saxon Creek) two of which included nests (Burton Creek, Cold Creek). No new nests or nest trees were found in 2010. Though down 37% from the confirmed sixteen individual spotted owls recorded in 2009, this number makes inferences about territory boundaries and clusters of detections within 1-2 miles to assume the same owl or pair was detected on several occasions.

Four pairs and two juveniles (from one pair) were recorded in 2010, although a member of two of the pairs was detected alone on multiple occasions. Cold Creek was the only nest determined to be reproductively active, with 2 juveniles detected during the course of nest check visits. The Burton Creek pair received a nesting-confirmed designation, but reproductive status remained

unknown through several nest checks, and did not ultimately appear reproductively successful. Pairs were detected together in Saxon Creek and Cookhouse Meadow, but were not found to be nesting at any point.

A new territory was found at Cookhouse Meadow. There were detections of either the pair or an individual on seven different occasions. The roost tree was located but the pair did not seem to be reproductively active. Detections at the Grass Lake route are thought to be individuals from the Cookhouse Meadow pair.

Detecting biologically meaningful levels of change in the spotted owl population through monitoring in the LTBMU are deemed vital to the initiation of a viable conservation strategy. Although monitoring has loosely occurred via spot calling since 1981 with a standardized protocol in use since 2000, statistical analyses indicate that survey efforts in and around PACs, and thus the most high-quality habitat and active territory areas, have not been conducted consistently enough on a year to year basis to detect statistically significant population trends. In an attempt to develop and implement a meaningful monitoring program to meet a management objective that details protection of the spotted owl population throughout its contemporary distribution, the LTBMU will begin implementation of a population monitoring plan (MP) for spotted owls in 2011. Surveys will be conducted in current PACs, which have been selected based on historically active territories and available high-quality habitat. In 2009 and 2010 combined, nearly all PACs in the LTBMU were surveyed via standardized protocol. The remainder will be included in the 2011 MP surveying effort, which should complete appropriate survey coverage for quality habitat in the Tahoe Basin.

- *What is the status and trend of northern goshawk populations in the Basin?* (Zanetti et al., 2011).

The LTBMU and partner agencies conducted broadcast surveys within 56 survey areas for a total of 31,889 acres (12,905 hectares) in 2010. There were 59 detections of goshawks within or very close to the 2010 survey areas, as well as three at the Sugar Pine Point nest (which was not within a survey area) and 4 incidental detections outside of survey sites for a total of 66 detections; up 16% from 57 in 2009). Goshawks were detected within 47% (26 of 55) of the areas where broadcast surveys were conducted by the LTBMU and within 50% (2 of 4) of the areas where dawn acoustic surveys were conducted in 2010. There were 25 occupied territories (up 25% from 20 in 2009), and 10 reproductively active territories (equal with 10 in 2009), eight known reproductively active territories that fledged young (up 14% from 7 in 2009), Ten nests were discovered in the Basin this year: six new nests and four at previously detected nest sites. These nests resulted in 12 known juveniles fledged. Individual goshawks detected totaled 39, down 9% from 43 goshawks found in 2009. In terms of area surveyed during broadcast surveys, goshawk search effort by LTBMU field crews also decreased 43% in 2010 from the previous field season. However, goshawk detections continued on an upward trend in 2010 (66 versus 57 in 2009, an increase of 16%).

The reason for this downward fluctuation in the goshawk population in the Lake Tahoe Basin in 2010 is uncertain. Possible causes could be predation or disturbance by humans. A dawn acoustic survey on 13 April found two adults active in the Hellhole area and a survey of the area on 1

June discovered a new goshawk nest site within 400 meters of the 2009 nest. The nest itself looked somewhat dilapidated; almost worn through. Directly below the nest were fresh goshawk eggshells and an adult flight feather. Downy feathers were visible at the nest's edge probably indicating a recent depredation or that the nest had simply collapsed and released the eggs to the ground. Unfortunately, we have no data on predation rates in 2009 and 2010 to make a clear comparison.

Another potential cause of the decline in goshawk individuals could be related to disturbance by humans. The Saxon Creek nest was discovered near to a trail on 3 May during a California spotted owl survey. It is known that one chick perished due to disturbance from mountain bike traffic. A second example of possible nest failure from human disturbance is the nest at Sawmill Pond. This area is located in an island of habitat virtually surrounded by the city of South Lake Tahoe. It is a popular hiking and off-road vehicle area. Additionally, this area was utilized by USFS PSW as a small mammal trapping survey area; an activity that requires considerable frequent foot traffic. A nest that was found on 17 June with an incubating or brooding female was discovered two weeks later to have failed. A downy chick was found 20 meters from the nest. As with predation rates, this evidence is anecdotal and we have no data to compare among years.

- *What is the status and trend of osprey populations in the Basin?* (Zanetti et al., 2011).

The LTBMU and NDOW surveyed 17,033 acres (6,893 hectares) of suitable osprey habitat. In total, the LTBMU and NDOW surveyed 92 nest sites (86 historic and six additional trees) and detected 43 intact nests, 26 (60%) of which were active. However, there were five nests that had activity early in the season but later were inactive (likely failed or no reproductive effort). All of these nests were still classified as active, to be consistent with analysis methods in previous years. The total intact nests decreased 4% from 45 observed in 2009, while active nest detections were up 8% from 24 in 2009.

The osprey survey effort, expanded in 2005 in comparison to 2004 due to increased staffing and additional survey efforts performed by CDPR, continued through 2009. However, CDPR conducted no osprey surveys in 2010 due to budget-induced staff shortages. As a result, Emerald Bay and Rubicon Point osprey nests received substantially less monitoring effort this summer than in previous recent field seasons. This led to less certainty about ultimate nest determination as well as the chronological events occurring at nests in these productive areas throughout the season. Generally, CDPR biologists have been able to spend more time observing each individual nest than LTBMU personnel, leading to a level of richness in monitoring data that has often proven useful. Without CDPR monitoring efforts, the 2010 survey effort, especially in terms of total hours of observation, dropped substantially.

Without long periods of observation to allow biologists to record complete behavioral data and make inferences about nesting activity and success, brief observational opportunities generally available on lake-wide boat surveys cannot reach the same level of accuracy with respect to final nest determinations. Only one nest, EMB05, was designated with certainty as containing at least one juvenile, with two observed, although several more nests were thought to contain young.

Unfortunately, high quality data were not collected on fledging success due to the lack of lengthy nest observation opportunity and the month separation of surveys.

- *What is the status and trend of bald eagle populations in the Basin?* (Zanetti et al., 2011).

Sixty-one participants, stationed at 26 survey points around the Basin, observed 9 bald eagles (8 adults and 1 immature) at 12 locations during the official mid-winter bald eagle count. Bald eagle detections during a single mid-winter survey decreased in 2010 compared to the previous year's count, but is consistent with 2006-2009 survey data, as are observations of a single active nest that fledged two young. Fewer juveniles were observed during January's survey effort than typical in past years, which remains unexplained. Variation in survey results in 2010 compared to the past several years are not sufficient to warrant any concern over local eagle population demographics, as a once per year survey offers a limited precision in estimating population size.

Bald eagle nest surveys were conducted in conjunction with the osprey boat surveys. The nest in Emerald Bay (BAEA01/EMB16) was the only active nest observed in the Lake Tahoe Basin in 2010 and successfully fledged two young. This bald eagle nest location has been the only consistently active nest in the Tahoe Basin since 1997, and typically fledges young in years where reproductive attempts are observed.

- *What is the status and trend of peregrine falcon populations in the Basin?* (Zanetti et al., 2011).

Three sites were surveyed for peregrine falcon presence and nesting in 2010. Although peregrine falcons have been occasionally observed in the Lake Tahoe Basin during surveys and incidentally in previous years, a nest with productivity had not been confirmed between 1985 and 2008.

Luther Rock was visited a total of five times during 2010, four of which were official four-hour surveys. The additional non-protocol visit was made by one wildlife biological technician to attempt to sketch the existing rock climbing routes. This effort was conducted to assess and determine whether any areas of the cliff needed to be closed to public access during the breeding season. During this survey, an observed copulation and possible new nest site was found.

Luther Rock was the only site determined to have an active peregrine territory in 2010. Two adults were extremely active and vocal during visits; the pair was observed copulating, and making food exchanges and prey deliveries to the new nest site. One juvenile was observed through a spotting scope near the edge of the cliff; however fledging success was undetermined. The 2010 nest is approximately 200m south and 50m higher on the rock than the 2009 nest; this is outside any known active climbing routes and should remain undisturbed.

There were no detections at the Angora Peak or South Maggie's Peak sites. Following two visits at South Maggie's Peak, surveys were discontinued per protocol. An extra visit was conducted at Angora Peak due to nest-building activity during early season, though nesting attempts did not continue as the season progressed. Incidental peregrine falcon detections were made near Castle Rock and Angora Creek above Osgood Swamp.

- *What is the status and trend of Townsend big-eared bats in the Basin?* (Zanetti et al., 2011).

Six bat survey sites were visited in 2010. Audio data was collected to determine bat species diversity. The number of files collected of individual bat detections per survey was uniformly less in 2010 than 2009 at sites that were surveyed in both years. This may have been attributable to a late cool spring. Species composition has also differed at both Tahoe Treasure mines and the Newhall House. In 2009 big brown bat, silver-haired bat, hoary bat, Townsend's big-eared bat and Mexican free-tailed bat were much more frequently detected than in 2010. Bats most commonly found in 2010 were silver-haired bat, California myotis, long-eared myotis, little brown bat, and Yuma myotis. The Basin experienced snow far into the spring in 2010 with the last lake-level snowfall on 27 May. The effect of this unusual weather pattern may have discouraged some migrating bat species from entering the Basin and selecting their normal roosts. Townsend's big-eared bat were not detected at any of these locations.

The adit at Tahoe Treasure I is approximately 20 feet deep and dry. Tahoe Treasure II is believed to be much deeper and is protected by a metal grate to prevent would-be spelunkers from accessing it. It is possible bats are using the shallow mine, Tahoe Treasure I, early in the season and transferring to the deeper adit at Tahoe Treasure II when the water has dried sufficiently to make it accessible. In October of 2010 the Tahoe Treasure I adit was gated with a bat accessible gate.

Both Taylor Creek Visitor Center and the Boathouse Theater were subject to human disturbance on a regular basis, both from inside the building and outside. Despite these issues high numbers of bat recordings were collected at these sites, averaging 149 detections during eight surveys at Taylor Creek and averaging 58 detections at the Boathouse Theater during each of ten surveys. The fact that these sites have been used by humans while roosting bat colonies appear to thrive would indicate that bats are not disturbed by human activities. Yet the species composition of regularly rooting bats at this site may not include sensitive species that may otherwise utilize these spaces.

The Old Mill site at Fallen Leaf Lake is comprised of 2 buildings which have been abandoned for many years. One acoustic survey was done in early July; the next two surveys in August included both audio and visual surveys. The maximum number of bats exiting from the building was 5, on August 19, however this number could be low due to a failure in the lighting system for the infrared light. Species identified at Old Mill include: silver-haired bat, California myotis, and little brown bat.

- *What is the status and trend of willow flycatcher in the Basin?* (Zanetti et al., 2011).

The LTBMU and its partners surveyed an estimated 296 acres (119 hectares). Willow flycatchers were detected at Mattole Road, Meeks Meadow, Lake Forest, Pomin Park, Uppermost Upper Truckee, Taylor Creek, and Tallac Creek. The Mattole Road, Meeks Meadow, Lake Forest, and Pomin Park detections were incidental rather than during surveys.

The LTBMU completed surveys for willow flycatchers at four sites between June 14 and July 8, 2010. Due to high snow levels one survey was conducted outside of the survey window on July 8, 2010 while all other surveys were conducted within the established survey periods. No individuals were detected at any of these sites. However the LTBMU followed up on an incidental detection in the Spring Creek cabin tract off Mattole Road and found one singing male. This detection was later followed up by The Demography Study and a pair was located with a nest. The nest outcome was unknown but the territory is new for the Lake Tahoe basin. The Demography Study surveyed and monitored Tallac Creek and Taylor Creek reporting 2 nesting attempts with both nests successfully fledging 7 total birds. CDFG completed surveys at Round Lake, detecting an unknown flycatcher (unable to confirm the species identity). CDFG arrived at Lost Lake on June 22nd and completed one survey. While surveying Lost Lake, CDFG determined there were not enough willow components for nesting willow flycatchers. Due to the lack of habitat, this site was removed from the study as a potential nesting location.

The number of willow flycatcher territories is down from 6 in 2009. The number of adults is equal to 2009. The number of nests is down from 4 in 2009. The number of successful nests is down from 3 in 2009. The number of juveniles fledged is up from 7 in 2009.Weather plays an important role in willow flycatcher presence in suitable habitat and subsequent nesting probability within that area (Bombay et al. 1999). High snow levels late in the season as well as the delayed leafing out of vegetation such was willow (*Salix ssp*.) and mountain alder (*Alnus incana ssp*.) could have been the cause of willow flycatcher absence in our survey areas.

Status and Trend Community Monitoring

The LTBMU is currently addressing multiple monitoring questions related to the status and trend of seven types of ecological communities (Table 1). In 2010, one Research Natural Area (Grass Lake), 10 meadows, 20 fens, 11 streams, and 112 road crossings were monitored (Table 1). In 2010/2011 three reports were completed including address these questions including, LTBMU Sensitive Plant Species and Habitat Monitoring Report (Engelhardt and Gross, 2011a), Plant Community Characterization and Ranking of Fens in the Lake Tahoe Basin, California and Nevada (Sikes et al., 2011), and Aquatic Organism Passage (AOP) Assessment (Vacirca et al., 2010).

- *How many fens are found on FS land in the LTB? What is the status of these fens?* (Engelhardt and Gross, 2011a; Sikes et al., 2011).

There are currently 47 confirmed fens on Lake Tahoe Basin Management Land, with additional fens occurring on non-FS land.

The work completed by California Native Plant Society developed fifteen detailed fen site maps, showing a diversity of vegetation types from woody to herbaceous types in fens. The project ranked 49 confirmed fen sites in the Lake Tahoe Basin based upon eight Conservation Significance criteria, including inherent diversity considerations and management related criteria. One value of our Conservation Significance ranks lies in the recognition of vegetation diversity and other important botanical, site history, and environmental characteristics in some of the smaller and less well-known fens. The combined Conservation Significance ranks can assist

land managers in making restoration and other management decisions, by providing a means for direct comparison between sites. Depending on their purpose, managers may want to consider only certain relevant ranking criteria when comparing fens and setting priorities for management.

The most highly rated fens for Conservation Significance are Grass Lake East and Dave Immeker Fen, with several other fens of the South Basin Region being more highly rated than those in any other Fen Regions. The three subwatersheds (HU-12) of the Truckee River Watershed had the three highest average Conservation Ranks, in addition to being the subwatersheds with the most fens currently recorded. The average Conservation Significance rating for fens of the Angora Creek Subwatershed was the highest at 25.0 (based on 10 fens). The lowest average rating was 21.0 for both Incline Lake Subwatershed (based on 8 fens) in the Incline Village Fen Region and Fallen Leaf Lake Subwatershed (based on 2 fens) in the South Basin Fen Region. If comparing Regions rather than subwatersheds, Incline Village Region shares the same low average Conservation Rank as the Meiss Country Region.

This study successfully demonstrates new techniques for ranking the significance of fen sites in the LTB that could be utilized across other USFS lands and beyond in California to assist in long term conservation and management priorities. The study also contributes to the knowledge of vegetation within fens, including the identification of 10 new associations through classification analysis. Twenty out of the 30 associations in this classification are considered rare. New occurences were recorded for three rare mosses, *Bruchia bolanderi, Meesia triquetra,* and *Tomentypnum nitens,* and two rare vascular plants, *Carex limosa* and *Eriophorum gracile,* adding to the resource assessment of the region.

- *What is the extent of road – stream crossings across the Tahoe basin (primarily on Forest Service system roads)? Which crossings are barriers to local fish species, specifically native fishes? What are the threats to water quality from poorly designed crossings? Which culverts should be prioritized for replacement within the LTBMU Basin?* (Vacirca et al., 2010).

Stream crossings by roads can pose serious threats to fishery ecosystems. The cumulative effect of culverts, fords, and other structures throughout a stream channel can significantly change the streams geomorphology and impair fish passage by blocking valuable spawning and rearing habitat. In the summer of 2010 the LTMBU evaluated 112 road/stream crossings. Of these, 61 had full assessments completed and 51 were partial assessments due to factors such as no flow, no structure, the crossing was a bridge, or the crossing was on a decommissioned road. Of the full assessments, 53 were on Forest Service system roads and 8 assessments were on CA and NV highways. Approximately 82% (50 of 61) of the full assessment on all road crossings do not meet the criteria for fish passage (RED), and are barriers for at least one life stage of salmonid or sculpin. Only 11% of the fully assessed crossings met the passage criteria (GREEN) to fish for both juvenile and adult salmonid life stages. The remaining 7% of fully assessed crossings were undetermined (GREY) for salmonid or sculpin and are candidates for further evaluation. Twenty six sites of the 112 road/stream crossings were selected for Paiute sculpin analysis. Ten sites had full assessments completed and the remaining sixteen sites were partial assessments. Of the full assessments, 70% (7 of 10) of road crossings did not meet the criteria for sculpin passage (RED) while 20% of road crossings met the passage criteria (GREEN). One crossing (10%) was

undetermined (GREY). The LTBMU prioritized sites for replacement for road crossings and has created a map showing the locations of crossings surveyed coded by their determination.

AIR AND WATER RESOURCES

The LTBMU is currently addressing four monitoring questions related to the status and trend of air and water resources (Table 1). In 2010, 1 air quality site, 4 water quality sites, 37 BMP soil and water use evaluations as part of the Regional Best Management Practices Evaluation Program, and seven follow-up water rights verifications were conducted (Table 1). A 2010 BMPEP Monitoring Report was completed (Harris et al., 2011).

- *To what degree are best management practices implemented and effective in protecting soil and water resources?* (Harris et al., 2011)

In 2010, the Lake Tahoe Basin Management Unit (LTBMU) completed 39 Best Management Practices Evaluation Program (BMPEP) evaluations as part of the Pacific Southwest Region's effort to evaluate the implementation and effectiveness of BMPs designed to protect soil and water resources associated with Timber, Engineering, Recreation, Revegetation and Prescribed Fire activities. All 39 Regional target evaluations were conducted in 2010; of these, 37 (95%) of the evaluations rated the BMPs effective and two (5%) evaluations rated the BMPs not effective. Improvements have been made to the BMPEP evaluation and reporting process, as a result of an interagency training exercise hosted by the LTBMU. These include:

- It had been found that inter-evaluator variability could produce different ratings among evaluators of the same BMP in the field. This variability among evaluator ratings was addressed by requiring evaluators to more thoroughly document the particulars of observed BMP deficiencies, followed by having the evaluations reviewed and vetted through interdisciplinary (and higher-level) staff, prior to reporting the results and any recommendations to correct deficiencies. The additional levels of documentation and technical reviews are intended to minimize the variability of the final ratings.
- Staff efforts to develop, obtain, organize and review the relevant implementation documents are being improved. In part, this is being accomplished by creating "Implementation Teams" from the NEPA InterDisciplinary (ID) Teams for projects, so that all project mitigations, design features, and BMPs are fully implemented and tracked. And, in part, it is being accomplished by additional higher-level review and tracking of BMPEP field preparations and recordkeeping.

PROJECT EFFECTIVENESS

Fuels Reduction and Forest Health Restoration Effectiveness

The LTBMU is currently addressing five monitoring questions related to project effectiveness of fuels reduction and forest health projects (Table 1). In 2010, 13 transects at Heavenly Creek SEZ and two post pile burn sites were monitored for vegetation recovery (Table 1). A Draft Roundhill Fuels Reduction Project Soil Quality Monitoring Report was completed (Cody et al., 2011).

- *What are the impacts of mechanical vegetation management treatments on soil quality, and sediment and discharge loading potential for various site conditions?* (Cody et al., 2011).

The Roundhill Fuels Reduction Project was implemented during the field seasons of 2008 and 2009. The project included one stream environment zone (SEZ) unit that was treated with Cut-to-length (CTL) mechanical equipment and one upland unit that was treated using the same CTL equipment; however, the entire trees were forwarded out of the unit, rather than leaving the branch material on the ground and later masticating it for ground cover (aka "whole-tree forwarding"). Both units were monitored for soil quality effects resulting from project treatments. Monitoring metrics included saturated hydraulic conductivity (Ksat), bulk density, soil moisture and soil cover.

Key Findings:

- In the SEZ treatment unit, median Ksat values decreased from 5.43 in/hr before the project to 2.08 in/hr after the project treatments. Bulk density values for the entire treatment unit (i.e. all transects) did not exhibit a change resulting from project treatments. Soil cover was reduced very slightly, from 100% pre-project to 95% post-project. The Watershed Erosion Prediction Project (WEPP) model was then applied, and the WEPP results predicted that no measurable erosion or sediment delivery response would result from the treatment unit, based on actual site characteristics and measured post-project Ksat, bulk density, soil cover and canopy cover values.
- In the whole-tree (WT) forwarding unit, there were no statistically significant reductions in Ksat or increases in bulk density (or subsequent reductions in porosity). These parameters were virtually unchanged by project treatments. Soil cover was only reduced slightly, from 98% pre-project to 93% post-project, even though the slash from CTL treatments was removed from the site rather than left as ground cover.
- The soil quality monitoring effort conducted in the WT unit demonstrated that no adverse effects to soil quality resulted from project treatments, even in portions of the unit characterized by wetter soil conditions.

Future Monitoring Recommendations:

- Any future soil quality monitoring conducted by the LTBMU on coarse textured soils such as those present in the Roundhill Project treatment units should no longer include Ksat monitoring. Although Ksat changes have been detected as a result of treatments on coarse textured soils, bulk density changes have not been detected, and erosion and sediment delivery responses have not resulted. This suggests that Ksat is not a good indicator of soil quality impacts that would result in erosion or sediment delivery on coarse textured soils.
- We recommend that additional soil quality monitoring should be conducted in a treatment unit that is characterized entirely as moist soil conditions, to determine if the criteria for soil moisture "operability" could be revised in some soil types to be less restrictive, based on measured impacts to bulk density.

Roads and Trails BMP Retrofit Effectiveness

The LTBMU is currently addressing three monitoring questions related to project effectiveness of roads and trails BMP retrofit projects (Table 1). In 2010, 4.5 miles of trails were monitored (Table 1). A DRAFT 2010 Trails BMP Retrofit Monitoring Report was completed (Harris et al., 2011) that addressed one of these questions.

- *Has the implementation of Trail Decommissioning and BMP Upgrades reduced the potential for water quality impacts, and to what degree were BMPs successfully implemented and effective?* (Harris et al., 2011)

Trails monitoring in 2009 included the North Shore (post-project) and East Shore Beaches (pre-project) trails. Post-project monitoring of East Shore Beaches was performed in 2010.

Key findings:

- The results of this monitoring effort support the assumption that trail upgrades result in substantially lower observations of erosion and subsequent risk to water quality, based on qualitative assessments.
- Even before upgrades were implemented, the risk to water quality was relatively low when compared to the erosion and sediment transport potential from forest roads (pre-project sediment yield modeling for roads can often result in predictions of sediment yields in tons/yr. This conclusion is based on pre-project WEPP modeling which was performed on a selected sample of trails east shore trails, as well as modeling performed during the NEPA analysis for the North Shore Trail ATM Environmental Assessment. The conclusion that even in the worst case scenarios the potential for sediment delivery from trails is quite low is not surprising, considering the dispersed nature and relatively small foot print of trails (average width 3 to 5 feet).

Future Monitoring Recommendations:
Because of the inherently low risk to water quality presented by forest trails the LTBMU has decided to discontinue use of this protocol for future trails monitoring. Future monitoring will consist of routine trail condition surveys conducted by LTBMU engineering department staff. This routine surveying will not be reported, but rather used internally by engineering staff to assess and schedule trail maintenance needs. For the purposes of TMDL reporting, the metrics will consist of miles of trails upgraded and maintained on an annual basis, as well as miles of decommissioned trails. Based on the results of the data produced in this report our assumption is that once trails are upgraded, and maintained on a routine basis, we will have achieved maximum load reductions for this particular type of land use.

Ski Area Management BMP Effectiveness

The LTBMU is currently addressing one monitoring questions related to project effectiveness of ski area management (Table 1). In 2010, 6 water quality sites, Best Management evaluations, aerial interpretation of soil/vegetation cover, and 6 stream condition evaluations were completed (Table 1). A Heavenly Mountain Resort, Annual Report for the 2010 Water Year was completed (Cardno ENTRIX, 2011).

- *To what degree has the implementation of Ski Area BMPs been successful in protecting soil and water quality?* (Cardno ENTRIX, 2011)

This report was produced under contract by Heavenly Resorts, by Entrix, Inc, and provides an analysis of data collected to evaluate environmental conditions within Heavenly Ski Resort. Parameters include water quality, stream condition, hillslope stability, and BMP Implementation and Effectiveness ratings. This report is posted on the LTBMU website, and continues to show that the Heavenly creek sediment TMDL is being achieved, although some state standards for nutrients are being exceeded.

Stream Channel/Floodplain Restoration Effectiveness

The LTBMU is currently addressing six monitoring questions related to project effectiveness of restoration projects at multiple restoration sites (Table 1). In 2010, 30 vegetation transects at Blackwood were monitored, and in Reach 6, a sediment mapping and channel erosion analysis was completed, as well as photo point and aerial photo documentation (Table 1). Three reports were completed, Blackwood Creek Restoration Project 2010 Vegetation Monitoring Report (Engelhardt and Gross, 2011c), Cold Creek High Meadows Stream Channel and Floodplain Restoration Project, Annual Construction Report (Heller, 2010), and Blackwood Creek Phase IIIB Stream and Floodplain Restoration Project, Annual Construction Report (Oehrli, 2010).

- *Are Temporary BMPS being adequately designed, implemented and maintained during construction projects?* (Heller, 2010; Oehrli, 2010)

The LTBMU protocol addressing this question was discontinued in 2010. It was determined that construction implementation monitoring guidelines as described in Lahontan NPDES permits would be utilized instead, and monitoring would only occur for in-stream construction projects which require an NPDES permit. Required implementation monitoring reporting was completed per the permit requirements for Cold Creek Stream Channel restoration project (Heller, 2010) and the Blackwood Creek Reach 1 Stream Channel restoration project (Oehrli, 2010).

<u>Cold Creek Project</u>
Turbidity was sampled twice daily immediately below the project during project activities. The goal of the project was to maintain turbidity levels below 3 NTUs. This standard was exceeded during four days. Most of these exceedances occurred during fall storm events, and one was caused by the removal of the coffer dam and mobilization of material that had been stored behind the coffer dam.

<u>Blackwood Creek Project</u>
No turbidity sampling occurred during project operations, because flows were not present in the stream during this period. BMP deficiencies did occur during project operations, as documented in a Notice of Violation (NOV) issued by the Lahontan Regional Water Quality Control Board. BMP deficiencies were addressed, and no discharge to water bodies occurred as a result of either BMP deficiencies or storm events during or immediately post construction.

- *What is the change in vegetation structure and composition along Blackwood Creek where restoration project occurred? Did the restoration project change cover of invasive plant species along Blackwood Creek?* (Engelhardt and Gross, 2011c).

Fifteen monitoring sites (T1 - T15) were established in 2008 downstream of the Barker Pass Bridge and fifteen monitoring sites (T16 - T30) were established in 2010 upstream of the restored Blackwood fish ladder.

The first management objective of increasing woody and perennial growth form percent cover has not yet been met. A significant decrease in total vegetation cover was observed one year after the completion of Phase IIIA construction. This initial overall decrease in vegetation is not unexpected given the extent and intensity of disturbance associated with construction activities. While overall tree, forb, and annual graminoid cover declined, overall shrub and perennial graminoid cover actually remained similar to pre-project conditions. These surviving individuals should facilitate increased shrub and perennial graminoid cover in the future, as many riparian plants, such as *Salix* and *Carex*, spread asexually by suckers, sprouts, or rhizomes (Naiman et al. 2005). Given additional recovery time, this may lead to achievement of the first management objective of increased woody and perennial graminoid cover.

The second management objective, which stated the goal of maintaining or reducing the cover of noxious and invasive weed species in the project area, was met as of one year post-construction. While there was no significant change in percent cover of weed species following project construction, all three weed species known pre-project were found at fewer sites, and with lower percent cover, in 2010 compared to 2008. Although this is a positive initial result, additional years of monitoring are needed.

Conclusions regarding the amount and type of vegetation change at the different Phase IIIA structures should be made cautiously given the small sample sizes within each structure type. Significant changes were found only at debris jams, where perennial graminoid and total vegetation cover both decreased. Vegetation change collected only one year post-project at Phase IIIA, appears to be primarily indicative of the impacts of construction, as inadequate time has passed to allow for a true vegetation response to improved hydrologic and geomorphic conditions. Monitoring is currently planned to continue through nine to ten years post-project. Additional years of monitoring are essential to assess the long-term success in meeting the management objectives of the restoration project.

Meadows Restoration Effectiveness

The LTBMU is currently addressing two types of monitoring questions related to project effectiveness of meadow restoration (Table 1). In 2010, 8 meadows that were previously burned were monitored and 41 photo points were monitored at Big Meadow (Table 1).

Aspen Stand Restoration Effectiveness

The LTBMU is currently addressing one monitoring question related to project effectiveness of aspen restoration (Table 1). In 2010, nine sites were visited and 72 repeat photographs were taken (Table 1).

TES Species Restoration Effectiveness

The LTBMU is currently addressing two monitoring questions related to project effectiveness of Sierra Nevada yellow-legged frog (*Rana sierra)* and Lahontan cutthroat trout restoration activities. In 2010, six lakes and 5.8 miles of stream were treated for restoration. Two reports were completed, Sierra Nevada Yellow-Legged Frog Habitat Restoration Project Desolation Wilderness 2010 Annual Report (Muskopf et al., 2010) and Upper Truckee River Lahontan Cutthroat Trout Restoration Project Final Report – 2010 Field Season (Moore and Santora, 2010).

- *What is the effectiveness of Sierra Nevada Yellow-legged Frog (SNYLF) habitat restoration measures (i.e fish removal) in alpine lakes and/or wet meadows (Desolation)?* (Muskopf et al., 2010).

Eight lakes in Desolation Wilderness were identified for non-native salmonid removal using gill nets containing various size meshes. The eight lakes were chosen for manual eradication due to their proximity to a source population of SNYLF located on the El Dorado National Forest as well as recent sightings within the Lake Tahoe basin.

During all sampling efforts since July 2008, 3665 brook trout (*Salvelinus fontinalis*), 4 rainbow trout (*Oncorhynchus mykiss*) and one Lahontan Redside shiner (*Richardsonius egregius*) have been collected. A total of 3670 fish have been removed from the eight water bodies. After three years of active gillnetting, all lakes have shown significant decline or eradication in fish populations. While Margery, Jabu, Cagwin, and the unnamed pond were rendered presumably fishless by the end of the 2009 season, active gillnetting was still implemented in these lakes through the 2010 season. Throughout the project, no fish have been captured in Jabu Lake. No fish have been captured in Margery since the first set in September 2009. The last fish removed from Cagwin Lake was a brook trout during the 2009-2010 overwinter set. Ralston, Tamarack, and Lucille showed declines in fish captures throughout the seasons. No fish have been collected in LeConte Lake during pre-project monitoring (2005-2007) or during any year of implementation (2008-2010); however, at least one trout was seen visually during survey efforts in LeConte during the 2010 field season, but after 8 weeks of removal efforts, no fish have been captured.

The three lakes (Ralston, Tamarack, and Cagwin) that have had nets set in them since 2008 have shown a significant decrease in fish abundance through the years. Net sets during the fall of 2010 had no fish. The goal of complete eradication within one more season seems likely in all but Lake Lucille, which still contains various size classes. Although various size classes were capture during the 2010 field season, these numbers were very low which indicates that eradication efforts are working. Lake Lucille is the only lake in the project area that seems to provide adequate habitat for spawning based on the size class captured during the 2009 and 2010 field season. Of all the lakes within the project area, however, this lake might require an

additional year of implementation to insure complete eradication is obtained. In addition, the fish removed from the unnamed pond is most likely trout moving from Lucille. Therefore continued efforts will continue in the pond until complete eradication is obtained in Lucille.

Due to the significant decline in salmonids within the project area, where some lakes are now considered fishless, natural re-colonization is anticipated. Visual encounter surveys will be incorporated to survey efforts during the 2011 field season. If natural re-colonization does not occur post eradication, translocation discussions should be started between partner agencies and the science/research community.

- *Does the periodic removal of brook trout and rainbow trout from the Upper Truckee River or any other identified Lahontan cutthroat trout (Oncorhynchus clarki henshawi) recovery stream effectively reduce brook trout and rainbow trout long-term abundance?* (Moore and Santora, 2010).

The purpose of the project is to reclaim 10 miles of stream habitat for federally threatened Lahontan cutthroat trout (LCT) in the Upper Truckee River. There is a need to assist with the natural range expansion from the Meiss Meadow source population by removing undesired competition and genetic introgression from introduced brook trout (*Salvelinus fontinalis*) and rainbow trout (*Oncorhynchus mykiss)*. Cutthroat trout have been out competed by non-native trout throughout the western United States, and there is a dire need to preserve and expand existing populations. The Meiss Meadows population is the only self-sustaining population of LCT in the Lake Tahoe Basin, and successful implementation of this project will insure its future viability. In order to meet this need a combination of electrofishing and gill netting will be used to remove introduced brook trout.

In 2010, brook trout removal treatment occurred in approximately 5.77 miles of stream in the LCT expansion area including the Round Lake outlet tributary. In-stream water levels or base flows were significantly higher than previous years, but fish capture rates were in line with lower flow events in previous years. As a result of higher flow rates, the use of previous low water barriers to delineate reaches was no longer acceptable.

The upper 0.7 miles within the expansion area were treated in 2008 and 2009. An additional 0.3 miles of stream was treated for the first time in 2009 and re-treated in 2010 (reaches 13-16). A total of 9,343 brook trout were removed from the expansion area in 2010. There were a total of 509 LCT sampled with 441 returned to the expansion area. There were 68 LCT removed due to the possibility of genetic introgression with rainbow trout below barrier B34 on the Upper Truckee River and below barrier T1BA5 on the Round Lake outlet stream. In the Upper Truckee River, 78 rainbow trout were found below barrier B34, and two rainbow trout were found in the Round Lake outlet for a total of 80 rainbow trout removed in the expansion area. There were 211 speckled dace sampled and all returned to the expansion area. Mortality due to electrofishing included 14 LCT in the 0-5 cm size class.

LCT were present in fifteen of eighteen reaches treated in the Upper Truckee River expansion area in 2010. More LCT were present in the upper reaches than the lower reaches. This is attributable to the proximity to the Meiss Meadow reclamation area where a self-sustaining

population of LCT are naturally expanding their range. It is also assumed there is less competition from brook trout in the treated upper reaches, also contributing to higher LCT numbers. Fewer than three LCT were found in the lower 1.34 miles of the Upper Truckee River portion of the expansion area. No LCT were found in the last 0.38 miles of the lower section of the Upper Truckee River sampled in 2010.

Genetic samples were taken from LCT and rainbow trout to determine if introgression had already taken place. Samples were sent to Dr. Mary Peacock (University of Nevada, Reno) for genetic analysis and to further inform managers of the LCT population status in the Upper Truckee River. It is not known how or when rainbow trout arrived in the expansion area and until genetic analysis is completed, it is unknown as to the purity of LCT.

Fish removal in 2011 will continue in the expansion area. Upstream reaches in the expansion area have been sampled for multiple years and are proving to contain few to zero brook trout. In 2011 electrofishing will be implemented to further expand habitat for LCT. Due to the presence of rainbow trout, continued removal of all trout will continue in the future.

Urban Lot Management Effectiveness

The LTBMU is currently addressing one monitoring question related to project effectiveness of urban lot management (Table 1). In 2010, 1704 urban lot parcels were monitored were, 1350 in CA and 354 in NV (Table 1).

The Urban Forest Management Program is a resource management program that is unique to Lake Tahoe Basin Management Unit within the U.S. Forest Service. The program manages undeveloped lands acquired by the Forest Service that are located within and directly adjacent to developed private communities within the Lake Tahoe Basin. Acquired lands managed under the program range in size from .1 acres to over 100 acres in size, with the average parcel size being .3 acres. The U.S. Forest Service monitors urban parcels to determine their existing conditions. Data collected includes forest health conditions, soil and water quality conditions, presence of noxious weeds, encroachment activity, and identifies management needs. The data collected during monitoring visits helps to determine the effectiveness of completed project work and the need for management in the future.

Erosion Control Grant Program Effectiveness

The LTBMU is currently addressing one monitoring question related to project effectiveness of the Erosion Control Grants Program (Table 1). No monitoring activities occurred in 2010.

POST WILD FIRE EFFECTS

The LTBMU is currently addressing x monitoring questions related to post wild fire effects, specifically of the Angora fire (Table 1). In 2010, visual surveys of cover and erosion were conducted, hydrophobicity measurements were taken, funding was provided to UC Davis to support one water quality site, and pre-project stream channel geomorphic data was collected, additionally 68 common stand exams and regeneration plots were monitored (Table 1). Two reports were completed, 2010 Addendum to 2007 Angora Wildfire Hydrophobicity Field

Monitoring Report (Howell et al., 2010) and Angora Fire Vegetation Monitoring Annual Progress Report October 2010 (Carlson et al., 2010).

- *What were the effects of the Angora wildfire on tree mortality, vegetation composition, and fuel loads, how do these change over time, and how do they vary in managed versus unmanaged stands? How are long-term forest carbon stocks in managed and unmanaged stands sensitive to variable rates of mortality and regeneration? What are the long term patterns of forest recovery, and vegetation response to pre-fire, and post-fire forest treatments?* (Carlson et al., 2010).

Data from monitoring the Angora monitoring plots collected between 2008-2009 have been used in a number of reports, papers, and ongoing research. Tree mortality data was used to demonstrate that pre-fire forest fuels treatments ameliorated fire severity (Safford et al., 2009). In the 2010 report, Carlosn et al. use data collected from 2008-2010 to summarize changing vegetation conditions in the fire. They present rates of tree mortality and snag breakage, changes in fuel loads from 2008-2010 and tree regeneration. They also describe how fire severity and management affect patterns of post-fire understory cover and species richness.

Three years after wildfire, vegetation and ecosystem structure within the Angora fire continue to be influenced by fire effects as well as pre- and post-fire management actions. Tree mortality rates during fire were significantly related to pre-fire live tree density. In 2010, we observed that severely burned areas have higher fuel loads, more bare soil exposure, more understory vegetation cover, and higher rates of non-native plant presence. Stands which were properly treated for fuels before fire continue to exhibit lower fuel loading and higher understory richness. Logged plots have fewer coarse woody fuels, but more fuels in the 10 and 100 hour size classes. Natural tree regeneration is highly variable across the fire area, but is generally highest in moderately burned stands and lowest in severely burned stands. About 35% of sampled plots support no seedlings 3 years after fire, but strong seed crops for fir species in 2009 and pine species in 2010 resulted in strongly increased seedling densities in many areas.

Lessons learned from the Angora fire will influence future post-fire management strategies in the Lake Tahoe Basin. Continued monitoring of forest structure and diversity in and around the Angora fire will be fundamental to understanding how wildfire, forest management, and landscape variation influence the evolution of post-fire landscapes, and will help inform management decisions intended to protect forest health and human communities.

- *What was the effect of the Angora wildfire on soil stability and hydrophobicity and when will soil hydrophobicity recover to back ground levels?* (Howell et al., 2010).

This addendum presents the fourth year of data collection for hydrophobicity in the Angora Burn area. Visual observation surveys were also conducted again in 2010, once in early July and again in late October after a very large rain event. Visual survey traverses began at the end of Forest Mountain Road (the Boulder Mountain Hydrophobicity monitoring site), and extended parallel to Angora Ridge to approximately ¼ to ½ mile beyond the fire lookout. The purpose of the visual surveys is to note changes in vegetation cover, and identify and monitor the development of any erosion features. *Key Findings:*

- Most soils in the Angora burn area still exhibit a high degree of hydrophobicity. Hydrophobicity results from the control site indicate that the high soil hydrophobicity in the burn area is due to fire, and not a reflection of natural soil hydrophocity.
- Some minor erosion is still occurring in some areas of the burn, yet vegetative cover and forest litter continues to increase and stabilize the slopes, and areas of observed erosion occurred in different places than observed in previous years.
    - The intense storm of Oct. 23-24, 2010 produced approximately 8" of rain in 24 hours. This caused sediment to be moved throughout the burn area; however, evidence of long, continuous erosion in the form of rills and gullies was absent. The high degree of vegetative ground cover (average >50%) appears to have prevented long continuous flow paths from forming.
- Because hydrophobicity monitoring over the past four years has shown no significant change, and significant sediment delivery to stream channels no longer appears be a major threat, the frequency of monitoring (hydrophobicity and visual survey traverse) will be discontinued. Hydrophobicity monitoring and visual surveys are scheduled to be repeated in the same year as the next planned aerial photography flight of the burn area, in 2013.

V. CONCLUSIONS/FUTURE MONITORING

While this monitoring report is intended to serve as a LTBMU monitoring report, it has historically focused on biological and physical science monitoring efforts. In 2011 and 2012, the focus will be to try to incorporate additional departmental monitoring into this annual report. The update to the Forest Plan will assist in this as the monitoring plan for the Forest Plan is developed. Monitoring activities planned for 2011 data collection are linked to 39 of the monitoring questions the LTBMU is currently addressing (Table 1).

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