Excerpts from the:

HFQLG

MONITORING PLAN

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Monitoring Strategy

This monitoring plan is intended to:

1. Provide information useful to mangers applying the principles of adaptive management.

2. Assist the public in gauging the success of implementing the resource management activities as designed.

3. Assess the effectiveness of the resource management activities in achieving resource objectives.

Direction for monitoring is derived from the HFQLG FEIS, Chapter 6 and the Record of decision (ROD). This monitoring plan is comprised of three parts. Part I is the process developed to track viability concerns expressed in the ROD on page 8. Part II (Implementation Monitoring) has three levels of assessment, Ranger District project evaluations, topic specific questions, and interagency project reviews. The degree to which actions were implemented according to standards and guidelines contained in the FEIS, in the existing Land and resource Management Plans, or in site-specific direction is the focus of these assessments. Part III (Effectiveness Monitoring) assesses the degree to which implemented resource management activities meet resource objectives. Monitoring questions are structured around three significant issues in the FEIS.

Part I (Habitat concerns):

- Habitat connectivity, including hydrologic connectivity, would be maintained to allow movement of old forest or aquatic/riparian- dependent species between areas of suitable habitat.

- Over the course of the pilot project, suitable habitat for old forest- dependent species and aquatic/riparian-dependent species (including amphibians) shall not be reduced by more than 10 percent below 1999 levels.

Part II (Implementation monitoring):

Project evaluations

Up to three projects per Ranger District will have annual project evaluations. An interdisciplinary team will conduct and document the assessments.

IMPLEMENTATION QUESTIONS

Question 1): Do Silviculture and fuel treatments meet CASPO, fuels, and other stand objectives?

Question 2): Are the desired abundance and distribution of snags and logs achieved in DFPZs and Group Selections?

Question 3): Does the implementation of silvicultural prescriptions produce or retain desired stand elements such as logs, canopy cover, large trees, and early seral stage?

Question 4): Do silvicultural treatments meet CA spotted owl interim direction, and fuel and stand objectives over time?

These four questions use the same protocol and therefore have been listed together. Questions 2-4 are Effectiveness questions.

Objective: To assess stand and fuels characteristics of treated (harvested or burned) stands. Provide information useful in assessing the effects of the treatments on vegetation structure, fuels, and understory vegetation. Establish baseline for assessment of long-term effects and effectiveness.

Scale: Pilot Project Area.

Environmental Attributes:

Attribute	Standard of Comparison
Tree canopy cover	Stand/Plot
Tree size (diameter and height)	Stand/Plot
Surface fuels	Stand/Plot
Crown fuels	Stand/Plot
Ladder fuels	Stand/Plot
Understory vegetation structure and composition	Stand/Plot

Monitoring Protocols: Establish the set of pre-treatment plots for each fiscal year from a new pool of stands within approved projects. Districts should track stand treatments through the Stand Record System Database (SRS). Planned treatments, including fuel treatments, within each new project with approved NEPA document should be entered in SRS by May 1 of each year to be included in the pre-treatment pool. The GIS layer for the HFQLG project stands should also be updated annually. Querying the SRS database on May 1 of each year for stands within the HFQLG Pilot Project area with a planned harvest or burning treatment will identify the sample pool. The sample stands will be selected at random from the pool. The total number of stands sampled will be distributed equally among harvest and burning treatments and the seven pilot project districts.

Stand treatment accomplishments are to be recorded in the SRS database by October 6 each year in accordance with current policy for the annual R5 Silvicultural Accomplishments and Needs Report. The May 1 query of the SRS database for the new pre-treatments stands will also be used to determine the status of stands with accomplished treatments and schedule post-treatment sampling.

The sampling of the pre- and post-treatment stands will be contracted out to a firm with similar inventory experience. The environmental attributes listed for treated stand structure will be measured following the protocols as developed for the Forest Health Pilot except for the understory vegetation structure and composition. This monitoring effort will include more detailed measurements of the

understory vegetation than was done for the Forest Health Pilot. Specifics for how the above environmental attributes will be measured and inspected are included in the Forest Inventory and Analysis Guide as referred to by the Forest Health Pilot contracts (1997). Photo points will be established for each plot.

A set of control plots will be established for 50 percent of the treatment monitoring plots. These control plots will be selected from stands with characteristics (strata or CWHR) similar to randomly selected monitored treatment stands and with a similar slope, aspect, and elevation.

Sample Size: Jim Baldwin, PSW Statistician was consulted and recommended a minimum of 200 samples to give a reasonable confidence of the results at the pilot project scale. Due to limited funds, a minimum of 10 samples per district (70 total) is proposed, plus 5 control plots per district (35 total). This makes the total number of plots equal to 105.
Sampling Frequency: Each sample plot will be measured three times. Once previous to treatment, a second time at one year after treatment, and a third time at five years after treatment. Pre-treatment sampling will occur in 2001 through 2003 with 20 to 25 stands being selected each year for pre-treatment sampling plus 10 to 12 control plots. Post-treatment sampling will depend on the rate of accomplishment. The one-year after treatment sampling is estimated to occur two to five years after the pre-treatment sampling due to the time requirements to complete harvest contracts and follow-up burning. The following table shows the number and type sample plots visited each year under an optimistic implementation schedule.

Treated Stand Structure Monitoring - Estimated Schedule and Costs.

Year	Pre-treat	1Yr-Post	5Yr-Post	Total	Cost	$/plot
2001	35			35	$41,000	$1,171
2002	35			35	$41,000	$1,171
2003	35	18		53	$49,900	$942
2004		35		35	$42,000	$1,200
2005		35		35	$42,000	$1,200
2006		17		17	$26,000	$1,529
2007			18	18	$27,000	$1,500
2008			35	35	$43,000	$1,229
2009			35	35	$43,000	$1,229
2010			17	17	$27,000	$1,588
Total	**105**	**105**	**105**	**315**	**$381,900**	$1,212

Expected Variability: Moderate to high.
Quality Assurance: Quality control assignments (contract inspectors, contracting officer representative) need to be assigned.
Sampling Procedures:
Within the randomly selected stands, three fixed area plots will be established similar to those described in the 1997 FHP contracts and attached to the plots will be shrub and herbaceous layer transects consisting of five mil-acre plots within each larger overstory plot.

In each shrub mil-acre plot species, height, and percent cover will be recorded. In each herbaceous mil-acre plot, species and percent cover will be recorded. Any noxious weeds will be highlighted with the density and/or cover.

Stands selected for control sampling should be biased to match the distribution of vegetation types and strata/CWHR classifications of the treated stand sample set.

Re-measurement of sample plots should occur at the same general time of year as the pre-treatment measurements since the herbaceous and shrub species are seasonally dependent.

Analytical Procedures: Data will be processed using USFS R-5 FIAS software. Summaries of the pre- and post-treatment conditions for target attributes will be entered on the HFQLG Treated Stand Structure Monitoring Form (Appendix B).

Forest/District resource specialists, including a silviculturist, botanist, biologist, and fuels specialist, will evaluate the finding of the pre- and post-treatment inventories. They will take the findings recorded on the HFQLG Treated Stand Structure Monitoring Forms and score each stand regarding its compliance with the key stand attributes. The key stand attributes are linked to one or more of the treated stand structure implementation questions at the beginning of this section. The linked implementation question number is shown in parentheses ( ) after each stand attribute:

A. Has habitat for California Spotted Owl been maintained? (Q1, Q4)
B. Has habitat for California Spotted Owl been enhanced? (Q1, Q4)
C. Has habitat suitability for carnivores been maintained? (Q1, Q3)
D. Has habitat suitability for carnivores been enhanced? (Q1, Q3)
E. Has the amount of early seral forage been maintained? (Q3)
F. Has the amount of early seral forage been enhanced? (Q3)
G. Has the number of snags > 15 inches DBH been maintained? (Q1, Q2)
H. Has the number of snags > 15 inches DBH been increased? (Q1, Q2)
I. Has the amount of logs > 20 inches in diameter been maintained? (Q1, Q2, Q3, Q4)
J. Has the amount of logs > 20 inches in diameter been increased? (Q1, Q2, Q3, Q4)
K. Do the fuel conditions meet the DFPZ requirements? Eg. Computed four-foot flame height at 90-percentile weather. (Q1, Q4)

The answers to these questions will be recorded on the HFQLG Stand Structure Monitoring Form. Score yes as '1' and no and '0'.

Summarization of Results:
The evaluation results for each question will be summarized at the pilot project level to determine the rates of compliance plus the precision of each sample at the 95 percent probability level. The data will be entered into a database that can link to GIS to facilitate further analysis. A weighted average of the results for the key stand attributes linked to each implementation question will used to determine the overall compliance for each implementation question. The evaluation team will determine the appropriate weight for each key stand attribute for each implementation question.

Desired Confidence/Precision Level: Confidence of 95% and precision between $\pm$7.0 and $\pm$12 percent. The precision rate will depend on the compliance with individual attribute questions. Precisions levels of less than $\pm$ 10 percent are obtained when the compliance rate is greater than 70 percent.

Estimated Cost: The Treated Stand Structure Monitoring Estimated Schedule and Costs Table shown above displays the estimated cost for treated stand structure monitoring over the next ten years. The relationship between the cost and number of plots sampled per year is curvilinear with the cost per plot decreasing as the number of plots increases. The cost for the data collection contract is estimated $200 per plot or $63,000 for the 315 plots over the life of the monitoring effort. Contract planning, preparation, and administration plus analysis of data (silviculturalist, botanist, biologist, and fuels) are estimated to cost a total of $319,000. The total cost per year is estimated to range from $27,000 to $50,000 depending on the number of stands ready for sampling. The average cost per year is estimated to be $40,000.

Availability of Personnel:

a. Ron O'Hanlon will be the COR.
b. Data collection will be contracted.
c. Monitoring coordinators for silviculture, botany, fuels, and wildlife will analyze the data and provide assessments.

Question 6): Do activities meet soil quality standards?

Objective: To assess compliance with soil quality standards.

Scale: Data collection will be at the unit level across the pilot project.

Environmental Attributes:

Attribute	Standard of comparison
Soil Cover	Fine organic matter occupies > 50% of area
Large woody debris	5 logs/acre, at least 20" diameter x 10' long
Detrimental compaction	Not to exceed > 10% reduction in soil porosity
Detrimental displacement	Loss of either 2 inches or ½ of the humus-enriched topsoil, whichever is less, from 1 meter square or larger area

Monitoring Protocols: Annually develop a pool of units slated for mechanical harvest. From this pool randomly select units. Each unit would be transected with three 20 point transects (60 sample points per area). Transects would cross the slope somewhat on the contour to optimize collecting representative samples given that skidding operations predominately flow down hill.

Selected units would be schematically divided on a site map into three equal parts (subunit), bottom, middle, and top. Each subunit would be further subdivided into ten equal parts (subset). A subset will be randomly selected from each of the 3 subunits. Draw a line on the site map for each subunit that correlates with position of the randomly selected subset. These lines represent the location and direction of each transect. This becomes a permanent part of the site record. From the map, use a compass and record the azimuth of each transect. Estimate the ground distance across each selected subset. Distance between sample points is 1/20 of subset width. Convert this distance into paces. The distance between sample points will vary depending upon the width of each subset.

For each transect, use a compass and align with the previously determined azimuth. Sample the soil at each of the 20 paced locations. The starting and ending point of each transect will be recorded using Global Positioning System (GPS).

Attributes -
Soil Cover: Percentage of fine organic cover (at least ½ inch thick) will determined within a one square foot rod grid placed at the toe point. 50% cover is threshold for compliance with R5 Soil Quality Standards (SQS). Percentage of plots with over 50% cover will be tracked.
The percentage of organic cover (at least ½ inch thick) per the R5 Soil Quality Standards (SQS) will be estimated as to whether is it 50% or more (yes) or less than 50% (no) of the grid area. This will be translated into percentage of plots having 50% or more cover.
(ie: if 75% of the plots had over 50% cover the unit will be evaluated as having 75% cover)

Large Woody Debris: At every fifth sample point estimate a 37 foot radius (approximates a tenth acre plot). Record the number of down logs by decomposition class 1-5 that are at least 20 inches in diameter and 10 feet long. Since the distance between samples varies based on unit width, in small units it may be necessary to sample every sixth or seventh point instead of every fifth point to make sure that the $1/10^{th}$ acre plots are at least 75 feet apart so that they do not overlap.

Detrimental Displacement: Percentage of area with detrimental displacement will be determined when areas with 1 square meter or larger are encountered at any of the toe point locations.

Disturbance Codes: **D0**- no disturbance, no compaction; **D1**- disturbance evident, slight compaction, duff and A horizon in place; **D2**- disturbance evident, compaction evident, duff displaced; **D3**- compacted, duff and/or part of A horizon removed, slash and A horizon mixed; **D4** – Compacted, A horizon gone. **D5**- puddle

Detrimental Compaction: Qualitative and quantitative techniques are used in tandem. 1) Qualitative - Tile spade is used to measure resistance to penetration and combined with visual observation. 2) Quantitative - Soil cores are used to determine bulk density which is converted to soil porosity.

1) Sampling with a tile spade, each site will be characterized whether it is detrimentally compacted or not. A couple sites within each unit with no evidence of previous mechanical activity are sampled to establish a baseline to represent the undisturbed condition. Compaction data is collected at each sample point by excavating a 12-16" deep and 6-12" wide hole with a soil spade. The soil is observed and manually manipulated to assess whether detrimental compaction exists. Undisturbed soil typically would offer little resistance to spade penetration. It is usually loose and has a fine granular structure. Detrimental compaction has moderate to high resistance to spade penetration compared to the undisturbed sites. It also commonly exhibits platy structure. The tilth and friability of the soil are noticeably reduced. It may appear blocky or massive as opposed to loose and granular in the undisturbed site.

2) Soil cores will be taken every fifth sample point. The cores are intended to serve as check on the accuracy of the tile spade method. The cores will be taken at the 4-8 inch depth. Cores have a known volume. The dry weight is determined in a lab setting. The weight to volume ratio of a sample is the bulk density. Bulk densities are converted to soil porosity using a formula in the R5 SQS (FSH 2509.18) to determine whether it is detrimentally compacted.

Skid trail Density: 25% of the units sampled would be sampled for skid trail density. Measurement would occur using GPS. The unit perimeter and all skid trails would be GPSed. This will give the percentage of the units covered by skid trails.

Sample Size: Each unit would be transected with three 20 point transects (60 sample points per unit).
Sampling Frequency: Twice for each unit sampled, before and after treatment.
Expected Variability: Because the variability encountered will be unknown but necessary to estimate adequacy of the sampling effort, 40 units will be sampled in each of the first two years to estimate the amount of unit-to-unit variability. At the end of the first two years of data collection, an assessment of the adequacy of the sampling will take place.
Data Sheet Format: Appendix C.
Quality Assurance: For quality assurance 10% of the sites should be resampled annually by the soils monitoring coordinator (Randy Westmoreland) or monitoring team leader (Wayne Johannson).

Analytical Procedures: Mathematical breakdown of percentage of sites meeting the soil quality standards by environmental indicator with a narrative explanation. Data will be summarized in tabular and graphical formats.

Desired Confidence/Precision Level: As mentioned above the amount of variability between units is unknown and knowing a rough estimate of that variability is needed to recommend adequate sample sizes with adequate sample size being positively related to the amount of variability (i.e., larger variability requires larger sample sizes). The desired precision is +/- 10 percent of the mean at the 95% confidence level. At the end of the first year the adequacy of the sample size for estimating initial conditions will be examined. At the end of the second year the adequacy of the sample size for

estimating change will be assessed with those sites with both pre-treatment and post-treatment measurements.

Estimate Cost: Cost per unit sampled is $625. Sample 40 sites first year. Total cost is $25,000.

Sampling Locations and Schedules: Each year a new pool of units will be established. A subset of units to be treated mechanically will be selected. Selected units will be sampled prior to harvest. As selected units are harvested they will be sampled again. Depending on length of individual contracts it may take 2-3 years for post harvest sampling to occur.

Availability of Personnel: Dan Ford will be the lead in data collection. The soils monitoring coordinator (Randy Westmoreland) will supervise and direct data analysis.

Question 7): Were Threaten and Endangered Species (TES) plants surveyed and protected?

Objective: Evaluate implementation of protection measures.

Scale: Each project with TES plant occurrences.

Environmental Attributes:

Attribute	Standard of Comparison
Percent of treatment area that has potential habitat surveyed to protocol	Percent of area surveyed to protocol
Species presence	Species per acre or number of occurrences per species
Populations identified on project map	Percent identified
Populations protected	Percent protected
Mitigation implemented	Percent implemented

Monitoring Protocol: Focused TES office and field survey: Office review of project records to determine if species were present in project area and identified on map to be protected. Field review to determine if populations were protected and recommendations were implemented. The field survey should occur immediately after the project is completed and then again in 5 years.

Sample Size: Random selection of projects with TES plant occurrences.
Sampling Frequency: Initially after project completed.
Expected variability: Expectation is that all of the TES plant occurrences are protected and recommendations were implemented.
Data Sheet Format: Appendix I.
Quality Assurance: Annual training of temporary botanists by permanent botanists on Lassen, Plumas and Tahoe NF. Review data during annual summary report preparation.

Analytical Protocols: Summary table of percent compliance by project.

Desired Confidence/Precision Level: Sample sufficient to provide a confidence interval of 90% and a precision of $\pm$ 10%.

Estimated Cost: For each DFPZ or group selection project it is estimated that this would take a botanist 2-3 days to complete depending upon the number of occurrences and impacts. $500.00 per DFPZ or group selection project. For Fy01, estimated cost would be $6,000.

Availability of Personnel: Forest botanists on Lassen, Plumas and Tahoe National Forests will coordinate this activity.

Question 9): Were provisions of the Smoke Management Plan implemented?

Objective: Burns meet provisions of Smoke Management Plans as defined in the California Air Resources Board Title 17 and the EPA's Interim Air Quality Policy.

Scale: Project level burns

Environmental Attributes:

Attribute	Standard of Comparison
Impacts to Smoke Sensitive Areas (SSA)	Yes/no as determined by air quality district
Impacts to Mandatory Class I Airshed	Yes/no as determined by air quality district
Numbers of nuisance Complaints	Standard to be developed jointly with air quality districts

Monitoring Protocols: Conduct post-burn evaluations to assess adherence to Smoke Management plan provisions for all burns.

Analytical Procedures: Summary table of percent compliance by project.

Desired Confidence/Precision Level: Complete Census.

Estimated Cost: No extra cost

Sampling Locations and Schedules: Each project burn.

Availability of Personnel: Fire Ecologist

PART III - EFFECTIVENESS MONITORING

Question 15): Is there a change in forest carnivore habitat or forest carnivore abundance and distribution?

Objective: Develop a consistent definition of suitable habitat for martens in the HFQLG analysis area to be used to track changes in habitat suitability and monitoring changes in population distribution and abundance.

Scale: Watershed or larger

Environmental Attributes:

Attribute	Standard of Comparison
Cumulative changes in habitat and value (CWHR)	Landscape or Carnivore network
Changes in distribution	Presence/absence

Monitoring Protocols: Developed by Bill Zielinski of the Pacific Southwest Forest and Range Experiment Station. Using existing presence / absence data from surveys conducted for marten within the HFQLG area, develop an empirical model of habitat suitability using physical and vegetation variables. Remote sensing and other GIS data will be used to apply the model to predict the probability of marten occurrence across the region. The resulting map of suitability will be related to the base vegetation map used for tracking changes in habitat across the analysis area and will serve as a tool to assess changes in the amount and distribution of marten habitat during the pilot project.

Across the HFQLG analysis area, 8 study areas (each ~200 km^2) will be selected, 2 in mixed conifer dominated forests, 4 in true fir dominated forests and 2 in eastside pine dominated forests. The uneven sampling effort reflects the assumed importance of the three forest types to martens in the analysis area. Study areas will be selected to include regions representative of land management activities planned during the pilot project and known occurrence of marten within the areas. Within each study area, a regular grid of 49 sample sites will be established at 2 km intervals; each sample site will include 2 detection devices (sooted track plates and / or remote cameras) separated by ~100 m. Each sample site will be monitored for 21 days and checked at 4 day intervals. Sample sites will be positioned at 2 km intervals to maintain spatial independence among sites (by minimizing the likelihood that any site is visited by the same individual) and each site will include 2 detection devices to maximize the likelihood of detecting resident animals. Sample sites will be georeferenced using GPS and vegetation data will be collected at each site. During FY2001, 4 study areas will be surveyed; the remaining 4 study areas will be surveyed during FY2002. The sampling schedule will be repeated during FY2003 and 2004, and again during FY2007 and FY2008, to provide 3 temporal replicates as the basis for monitoring.

Justification: This design will allow monitoring marten response to land management activities at several spatial scales. Across the HFQLG analysis area, the proportion of sample sites receiving marten detections will serve as an index of population size. Based on a total sample of ~400 detection devices, significant decreases in the proportion of sample units receiving a detection can be detected with varying statistical power. For example, assuming occupancy rates of 50% in true fir forest, 25% in eastside pine, and 15% in mixed conifer forests, a 30% decrease in the population index would be detected with 80% confidence >85% of the time (based on Zielinski and Stauffer 1996). Within each forest type and study area, the same index of population abundance can be assessed, though statistical power will likely be less due to smaller samples (Cohen 1988). In addition to monitoring changes in the proportion of sample sites receiving detections, this design will

also allow examining the influence of habitat alteration on patterns of detections. Lastly, new survey data collected for monitoring population abundance will be used to test and refine habitat suitability models described above. The approach described here differs from the standard survey protocol because this method is designed to monitor an index of population abundance, not simply to document marten presence as the Zielinski and Kucera (1995) protocol was originally developed.

Estimated Costs: $80,000 in FY01 and $65,000 in FY02.

We have estimated costs for FY2001 – 2002 based on the monitoring timeline presented above. Similar costs will be incurred in FY2003, 2004, 2005, and 2006.

Available Personnel: Field data collection will occur with contracting and Ron O'Hanlon as the COR and over site by Rick Truex.

Literature Cited

Carroll, C. 1997. Predicting the distribution of the fisher (Martes pennanti) in northwestern California, U.S.A. using survey data and GIS modeling. M.S. Thesis. Oregon State University, Corvallis, OR.

Cohen, J. 1988. Statistical power for the behavioral sciences. Second Edition. Lawrence Erlbaum Associates, Hilldale, NJ.

Zielinski, W.J. and T.E. Kucera. 1995. American marten, fisher, lynx, and wolverine: survey methods for their detection. Gen. Tech. Rep. PSW-GTR-157. USDA Forest Service, Pacific Southwest Research Station, Albany, CA.

Zielinski, W.J. and H.B. Stauffer. 1996. Monitoring Martes populations in California: survey design and power analysis. Ecol. Appl. 6:1254-1267.

Question 16): How do selected vertebrate species respond to resource management activities?

Objective: Evaluate impacts of resource management activities on early seral/open forest habitat species by comparing projected species' responses with realized responses. Selected species are landbirds and deer.

Scale: Landbirds - Watershed or larger
Deer - Project

Environmental Attributes:

Landbirds -

Attribute	Standard of Comparison
Landbird	Number of species
Utilization of the area selected for treatment; pre and post type of habitat (vegetation)	Number of individuals of each species

Deer -

Attribute	Standard of Comparison
Changes in utilization	Stand

Monitoring Protocols:
Landbirds: The Lassen Volcanic National Park and the Almanor District, Lassen National Forest have joined with Point Reyes Bird Observatory to inventory selected areas. Monitoring would occur primarily on the Lassen National Forest with selected transects within areas outside the study area as a means of testing variability. Transects would encompass most habitat/vegetation types that are representative of the project area as a whole. The protocol for monitoring has been developed and validated statistically. This consists of point-counts on defined transects. Point counts are time limited (5 minutes) and points are approximately 1/8 mile apart. Vegetation plots (fixed radius plots) are completed for each point. This method is consistent with that used in other inventories throughout the Sierra Nevada. Monitoring would occur for three years with follow up surveys in the last 2 years.

Deer: Areas of known deer use within a project or stand proposed for treatment would be identified for each deer herd within the HF-QLG project area. Seven to ten stands would be pre-selected for monitoring. One stand per deer herd that would not be affected would serve as a control or reference point. Census of use would occur prior to initiation of the project following the standard techniques for pellet count surveys. Additional "spotlight surveys" will be done for each area following the standards used by the California Department of Fish and Game. Control plots will be set up similar to the sample plots, be of similar habitat, and be specific to each herd being sampled.

Analysis Procedures:

Landbirds: Samples within areas affected by QLG related projects will be compared to similar habitats[1] (controls). The comparison will include:

1. Significant differences in species diversity.
2. Significant differences in species richness (number of individuals of each species).
3. Significant changes in species diversity and richness at selected plots over time (compared to changes in the control plots).

[1] This will include relations to vegetation type, aspect, and elevation.

Analysis Confidence Level: The purpose of the change is to monitor significant changes (shifts) in the composition of bird populations at the 95% level of confidence. Because of the natural fluctuations in bird populations a 15% tolerance level is considered acceptable.

Deer: Established plots will be sampled and compared to control plots outside of areas affected by QLG projects. Control plots will be set in those areas that provide suitable habitat for deer. The analysis will look for significant differences between test and control plots. The hypothesis is that DFPZs and related activities will reduce the significance between monitor and control plots over time.

Desired Confidence/Precision Level: The analysis should measure, over time, any changes between the test and control plots. The confidence can be set at 95% or higher. The precision should be low ±5% as the opportunity for bias and other influences is generally limited.

Estimated Cost:

Landbirds: $25,000.

Deer: $1,500.

Availability of Personnel: The land birds will be a Challenge-Cost/Share with an outside party. Gary Rotta will do the deer.

Question 18): How do stream attributes (channel, riparian, macro- invertebrates) change over time?

Question 19): What is the trend in channel and riparian attributes and macroinvertebrates in sub watersheds with the highest concentration of HFQLG activities?

These two questions use the same protocol.

Objective: Track changes in attributes in "treated" sub-watersheds relative to change defined by reference watersheds.

Scale: Stream reaches. "Treated" reaches will be selected from within watersheds with the greatest amount of HFQLG activities (as determined by project level cumulative watershed effect analysis). A randomly selected group of "Reference" reaches will be sampled each year for comparison.

Environmental Attributes:

Attribute	Standard of Comparison
Shade	0-90 %
Percent pool tail fines	0-40 %
Particle counts	D50, percent <2mm (0-40%)
w/d ratio	5-40
Bank angle	Average 85-140%; 25% <90% angle
Bank stability	40-95%
Temperature	Summer max air vs. water, and absolute values
Large wood	within 10% of reference streams
Benthic invertebrates	O/E, multi-metric (diversity, richness, dominance, etc.)

Monitoring Protocols: Channel and Riparian protocols described in FINAL DRAFT "Pacific Southwest Region Stream Condition Inventory Handbook", Version 4.0, 1998. Macroinvertebrate Protocols are described in "R5 Stream Bio-Assessment Protocols (draft) 2000.

Sample Size (reaches): Two reaches from each RD per year selected for before and after project sampling; for a total of 14 sample reaches per year. Districts will select reaches each year. Selection can include both a vegetation management project and a riparian restoration project. Intent is to select reaches where a substantive amount of activity occurred upstream. Samples from each stream type (based on channel types and ecological region) will be consolidated to give average values for each Attribute and then compared, to data from like stream types in the group of 38 established reference streams listed in Chapter 6, Monitoring Strategy of the EIS.

Sample Size (attributes): Sample size varies by metric, sizes established by pilot testing of sample protocols (R5 and PSW during 1995-7

Expected Variability: Moderate (average). Some attributes are easily defined and measured, having low variability, while others are subjectively measured and would be expected to have moderate to high variability.

Sampling Constraints: Response reaches if present in watershed. Sampling during low flow period. Note: Eagle Lake and Hat Creek RDs may have seasonally flowing streams selected for monitoring. In that case, attributes relevant to this flow regime will be selected; invertebrates will not be collected from these streams.

Data Sheet Format: Included in R5 Stream Condition Handbook.

Procedure Checklist: Included in R5 Stream Condition Handbook.
Quality Assurance: At least 2 reaches should be replicated each year to assess measurement error. Project coordinators will provide training to those collecting data prior to initiating data collection each year.

Analytical Procedures: Comparison (1) attributes before and after project implementation; (2) attributes from "treated" streams with reference condition (by channel type) (3) assessment of temporal variation by comparing reference attributes collected in difference years. Note: macroinvertebrates will be compared to regional reference condition if available (scheduled for development in FY 2001).

Desired Confidence/Precision Level: Confidence is 95% and precision is $\pm$ 20%.

Estimated Cost: $1000 per reach, plus $125 for macro lab analysis. Estimate 22 reaches = $24,750 per year.

Sampling Locations and Schedules: Reference streams listed in monitoring plan, schedule of sampling by random selection (about 20% of streams per year).

Availability of Personnel: Watershed and Aquatics coordinators (Terry Benoit and Ken Roby) will coordinate this task. Decisions on who will collect data (temporary workforce, contract, cooperative agreements. etc.) will be decided on an annual basis.

Question 20): What is the effect of the proposed treatments on a) modeled water yield and b) soil moisture characteristics?

Objective: To estimate changes to water yield resulting from management activities and to assess differences in soil moisture resulting from silvicultural treatments.

Scale: Water yield will be modeled at the subwatershed scale (average 11,000 acres). Soil moisture will be sampled at the treatment unit.

Environmental Attributes:

Attribute	Standard of Comparison
Evapotranspiration	Water yield model: >10% decrease
Surface runoff	Water yield model: >10% increase
Potential groundwater recharge	Water yield model: >10% increase
Soil moisture	>10% increase

a) Water yield model -

Monitoring Protocols:

Sample Size: Water yield model: No more than 4 subwatersheds that represent general geologic, climatic, and topographic conditions.
Sampling Frequency: Once.
Expected Variability: Low.
Sampling Constraints: One subwatershed each from the Lassen plateau and the eastside, central and westside of the Plumas. The final selection to be made by a technical committee made up of at least one hydrologist from each Forest and the contractor.
Data Sheet Format: Report of findings.
Procedure Checklist: None.
Quality Assurance: Review of data during annual summary report preparation.

Analytical Procedures: Model calibrated with available data.

Desired Confidence/Precision Level: Confidence is 95% and precision is $\pm$ 10%.

Estimated Cost: $25,000 contract cost.

Sampling Locations and Schedules: To be determined by the technical committee.

Availability of Personnel: To be contracted with Terry Benoit as COR.

b) Soil Moisture -

Monitoring Protocols:

Sample Size: 4 Subwatersheds will be selected from the Lassen plateau and the eastside, central and westside of the Plumas. One Subwatershed will be sampled each year. Sampling will involve 6 samples per site, with 3 samples inside the treated area and 3 samples outside. There will be 5 evaluation sites per subwatershed for a total of 30 sample sites within each of the subwatersheds. The sites will be located in both DFPZs and group selections. One to two subwatersheds will be sampled annually till done.

Expected Variability: Moderate.
Sampling Constraints: Sampling will use an inside/outside and before/after scheme. Paired sample sites will be located inside and outside the areas to be treated to facilitate pre- and post-treatment sampling (the year prior to treatment and the year following treatment). Soil moisture will be measured at three depths - 20, 30, and 40 inches (provided soil is that deep), between August 1 through September 30. The paired sampling sites would have similar vegetative and soil characteristics. Sample sites will be permanently marked and mapped to facilitate pre- and post-treatment sampling.
Data Sheet Format: Appendix G.
Procedure Checklist: Appendix G.
Quality Assurance: Review of data during annual summary report preparation.

Analytical Procedures: Percent difference between inside and outside selected treated areas with narrative. Soil moisture will be measured using electronic moisture meters. The results of each 3-sample cluster shall be averaged. Comparisons will be made between inside/outside and before/after results. An annual summary report shall be prepared containing both tabular and graphical summaries of the data.

Desired Confidence/Precision Level: Confidence of 95% and precision + 5%.

Estimated Cost: N/A

Sampling Locations and Schedules: 30 evaluation sites per watershed, 4 watersheds.

Availability of Personnel: Soil scientist, Wayne Johannson to collect field data. Terry Benoit will perform analysis.