1.1. 1997/1998 RIPARIAN INVENTORY PROTOCOL

The purpose of this study is to evaluate the effectiveness of the 1994 Forest Practices Rules as they relate to riparian forest stands. We hope to begin to answer the question:

> *Are the new (1994) forest practices regulations effectively maintaining and promoting riparian conditions that may in the future function as mature riparian forests?*

The definition of "mature riparian forest" is based on a set of assumptions. These assumptions include 1) riparian stand structure is more patchy than that of upslope forest stands, 2) riparian stands are composed of mixed species of conifers and hardwoods, 3) riparian stands contribute large woody debris (LWD) to stream and channel systems, and 4) riparian stand canopy is critical for providing shade and nutrient input to streams. In order to answer the primary question posed by the Forest Practices Monitoring Program, riparian stands will be inventoried once prior to harvest operations (pre-operation) and again after operations have been completed (post-operation).

Riparian forests are heterogeneous. Dominant features such as vegetation, age, and size classes are dictated by geomorphic landforms, groundwater levels, channel disturbances, and historic management practices. Land and stream are linked by stand contributions of channel shade and large woody debris and stream contributions of abundant water and a moderated microclimate. In order to capture this heterogeneity, the riparian stand inventory will include the stream channel, the riparian terrace, and a limited upslope-distance. The following information will acquaint you with the general ecological structure and function of riparian areas in Western and Eastern Oregon. The objectives, protocol, and detailed descriptions of the work to be done on the riparian inventory project are provided as a guide to your work this summer.

1.1.1. Riparian Structure and Function.

Riparian areas provide a complex environment for wildlife, vegetation, and aquatic organisms because they define the forest interface between aquatic and terrestrial ecosystems. As a result, riparian areas have been determined to be sensitive forest areas that provide protection to streams from upslope or adjacent management activities.

Structurally, riparian areas may be defined horizontally and vertically. Horizontal structure typically changes with increasing distance away from the channel and/or with any surfacing of subsurface groundwater (e.g., at the base of a slope intersecting the terrace). The effect of the horizontal plane is highly dependent on local geomorphology. Constrained reaches have little horizontal riparian land area while wider floodplains vary greatly horizontally. Meandering channels, old channels, beaver complexes, and wetland areas are common in such systems. Vegetation also varies horizontally. Early successional and disturbance prone species, such as red alder and willow, typically border stream channels in patchy pockets or uniformly depending on the local disturbance history. Trees, such as Douglas-fir and spruce, that require stable germination spots and drier soils, increase in number farther from the stream. Other aspects of riparian form and function such as microclimate also vary as one moves farther from the stream channel. This project will evaluate vegetative and geomorphic conditions along the horizontal plane.

Vertical riparian forest structure may be diverse and complex with a variety of species, sizes, ages, and decay classes or simplified with few species and few sizes. Local vertical diversity and complexity depend on georegional characteristics and disturbance and/or management history. The shrub, herbaceous, and dead wood layers are important components of the vertical plane because they help define different soil, groundwater, and potential wildlife habitat conditions. Microclimate is also affected by vertical distances from the stream with changes in humidity, wind, and temperature. We will be defining the vertical layer through tree, snag, and understory inventories in this project.

1.1.2. Monitoring Protocol

The primary goal of this monitoring project is to evaluate the effectiveness of the 1994 stream rules in terms of maintaining stand basal area, the potential for large woody debris recruitment in the future, and stream shade. A secondary goal will evaluate the potential for wildlife habitat expressed in understory shrub and down woody debris both pre- and post-operation.

1.1.2.1.Hypotheses:

A. 1994 stream protection rules provide for short-term and long-term recruitment of large woody debris.
B. 1994 stream protection rules maintain overstory hardwood and conifer canopy cover and understory shrubs such that the difference between pre- and post-operation stream shading is not greater than 25%.
C. 1994 stream protection rules maintain stand basal area at levels predicted through time to resemble 59% of the estimated basal area of the Douglas-fir site indices for upland areas.
D. 1994 stream protection rules provide for the maintenance of pre-operation down woody debris and snag levels in the RMA which may provide habitat for wildlife.
E. Riparian areas may be more productive (i.e. have more basal area) than predicted from adjusted upland site indices.

1.1.2.2.Objectives:

Primary:

1) To evaluate the effectiveness of the 1994 forest practices rules in providing for near-stream, short-term and long-term sources of LWD.
2) To evaluate the implementation of the 1994 stream protection rules in maintaining conifer and hardwood basal area requirements.
3) To evaluate the effectiveness of the 1994 stream protection rules in maintaining stream shade.
4) To evaluate the effectiveness of the 1994 stream protection rules in maintaining snags, down woody debris and shrub cover within the riparian area.
5) To evaluate basal area assumptions used in designing the 1994 forest practice rules.
6) Evaluate stand and tree characteristics in riparian areas relative to upland forests.

In order to accomplish these six larger objectives, specific objectives are identified. To accomplish objective 1 we will:

1. Determine the short-term changes in quantity and composition of in-stream and channel LWD from pre-managed stands to post-managed stands, including diameter, length, zone of influence, orientation to streamflow, decay class, and whether it is hardwood or conifer.
2. Determine the number, basal area, height, diameter, species, lean and distance from the stream of 100% of the trees within the first 20 feet (ft) of the RMA and of systematically randomly chosen trees in the last 80 ft in pre- and post-managed stands. Average age by diameter class will be measured post-operation by counting rings on stumps or by increment cores.
3. Determine the submerchantable conifer (1"-6" dbh) abundance (number) and species in pre- and post-managed stands within the entire plot area.
4. Evaluate potential post-operation short-term contributions to LWD by collecting aerial photographs on a large sample of streams bordering RMAs and linking photo records to ground data by stand type and georegion. Number of pieces, species, orientation, and contributing factor (i.e., blowdown) will be recorded.

To accomplish objectives 2, 3, 4, 5 and 6 we will:

1. Determine if the conifer/hardwood basal area in post-managed stands meets the standards established in the 1994 stream rules, compare basal area measured to assumptions used in the forest practice rules and analyze differences between basal area in pre- and post-harvest stands.
2. Determine stream shading and its composition in pre- and post-operation stands and compare stream shading levels between 1994 and 1987 stream management rules and compare solar pathfinder data with densiometer readings.
3. Identify and measure stand structures potentially used for wildlife habitat including snags, down logs greater than 6" dbh, and understory dominant and subdominant cover to determine if amounts, sizes, decay classes, tree types, and understory vegetation differ in pre- and post-managed stands.
4. Define relationships for height /diameter, distance from stream and size/species of tree, as well as other stand characteristics (stand density, relative density, etc.)

1.1.3. Proposed Analysis and Statistics:

- Case study presentation with grouping by georegion, stream size, and landowner. Comparisons of differences through analysis of variance between pre- and post-operation stands and between new and old riparian rules will be conducted where appropriate.
- Graphical comparative analysis.
- Descriptive statistics for variables measured.
- Descriptions of riparian forest structure in response to management by georegion, stream size and type, and landowner and, potentially, in general.
- General comparisons with (Hairston, Morman, and Taratoot) 1987 rules.
- Design = Randomized complete block, where blocks (streams) = replication. Randomization will be insured by the random selection of harvest sites from a pool of proposed harvest units provided by the FPFs and the use of random number tables in the field to determine the initial location of the first sample point from the edge of the harvest unit.
- First and second season sampling will be conducted on at least 25 expanded sampling plots to gain an estimation of the natural variability present within riparian areas and the intensity of measurement necessary to capture it (see Figure 1, p. 5). Concurrent season sampling, if

possible and useful, will be designed to maximize the sites sampled while still obtaining the data necessary to evaluate the objectives.

1.1.4. Site Characteristics and Sampling:

Sample sites will be RMAs associated with harvest units. Units should be scheduled for harvest within the next year that ideally 1) border small, medium and large type F streams, 2) have no roads within 100 ft of the stream, 3) do not abut forests managed within the last 50 years, and 4) contain no grazing. Given variability and reality in the field however, one or two of the above conditions need not necessarily be met in order for a site to be considered. If, for example, an old road runs through a RMA, we will still consider using the site, especially if the stand or management plan has interesting characteristics, such as a hardwood conversion area. The qualities are simply a statement of ideal conditions.

During summers 1996 and 1997, at least 25 sample sites will be intensively sampled on single, large plots. These first seasons will be used to attempt to determine riparian stand and stream structure variability and to compare the variables measured pre-operation to those measured post-operation. Based on the measured variability, actual sample plot size, stream lengths, and timing of measurement parameters will be determined to 1) capture the highest degree of variability while 2) minimizing sampling time and complexity and 3) maximizing sample size.

Sites will be sampled twice; once prior to harvest entry in 1996 and then after harvest activity in 1997. Riparian sample sites will be 500 ft long by 100 ft wide, running parallel to the stream on the left side of the stream if both sides are to be harvested or on the side under the RMA (Figure 1). In-stream aquatic woody debris sample length will extend along for the entire 500 ft. plot. Plot borders and lines will be established with a hip chain and flagging at 25 ft. intervals to aid in defining the sampling/cruise area. Lines running perpendicular to the stream are numbered 1-3 in a downstream direction. Lines running parallel to the stream are lettered A and B beginning closest to the stream. All corners and line intersections will be double flagged. Plots will be permanently marked at the downstream 20 ft. corner with aluminum tags and tree paint and will be referenced with GPS.

Sample plots will be divided into three zones. The first zone is located within and alongside the stream channel (X, Figure 1).

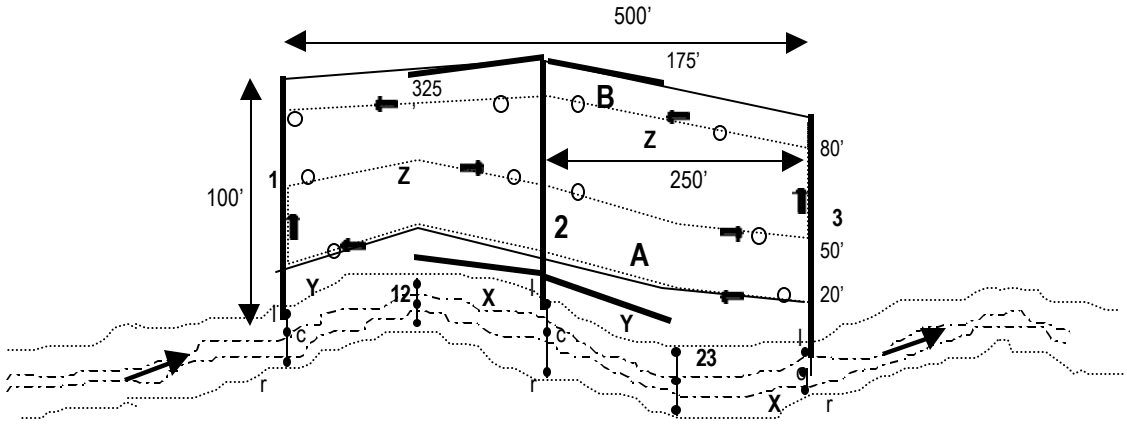

Figure 1. Schematic of sampling site. Diagram is not to scale.

Within this zone, existing aquatic LWD will be measured for diameter, length, conifer or hardwood, decay class, zone of influence, and direction in relation to the stream. Other channel characteristics such as stream gradient, stream orientation, dominant substrate, wetted channel width, and bankfull width will also be measured.

The second zone is located within the area from the stream channel to 20 ft. back from the stream for a total of 10,000 ft^2 (20 x 500) running parallel with the stream (Y, Figure 1). Within this zone, a 100% cruise of trees greater than 6" dbh will be conducted for characteristics describing potential sources of LWD including tree height, dbh, distance from the stream, degree lean to the stream, % slope, and species. Tree height and age (in 1997) will only be measured for one tree of each species in each diameter class. Diameter classes are 6-10", 11-15", 16-20", and 21"+. Trees smaller than 6" dbh will be counted and identified by species. During post-operation sampling, early regeneration success will also be evaluated within this zone using

Regeneration sampling will be done only on those sites that have already been replanted after harvesting. Otherwise, the submerchantable count of the plot will provide and adequate estimate of potential regeneration. Submerchantable and regeneration sampling will follow the same protocol in post-operation sampling. Density and number of seedlings and saplings will be estimated by sampling in 20 ft. diameter circular plots (314 ft^2). Sampling will be completed on a total of 30 plots on the 20 ft. line (A), the 50 ft. line, and the 80 ft. line for a total of 10 plots per line. Plot centers will fall every 50 feet. Lines will be sampled in a zig-zag pattern with the first plots on line A and the 50 ft. line beginning 20 ft. in from the plot edge and the first plot on the 80 ft. line beginning 40 feet in from the plot edge. This will allow for a sample intensity of 19% (9420 ft^2). Seedlings will be counted and identified by species where possible and conifer/hardwood elsewhere. A seedling is defined as a young tree with a diameter less than 1 inch at breast height and a height of at least 12 inches. Saplings will also be counted and identified by species. A sapling is a young tree with a diameter greater than 1 inch and less than 6 inches at breast height.

The third zone will be described in the area from 20' to 100' back from the stream channel for a total coverage of approximately 1 acre (Z, Figure 1). Individual tree sampling (ITS) will be conducted to select a 20% sample of all the trees within the plots to measure for potential contribution to future LWD. Characteristics defined in the 100% cruise will be measured. An expansion factor will be used to describe the entire stand. All snags will also be recorded and measured for height, dbh, decay class, lean to the stream, distance from the stream, and whether it is a conifer or hardwood.

Shade measurements will always be recorded on these lines at mid-channel (c) and on both banks (l and r) if the stream is wider than 15 ft. Solar Pathfinder and convex densiometer measurements

will be taken on lines 1, 2, and 3 and densiometer readings alone will be recorded on lines 12 and 23.

Riparian woody debris and dominant and codominant shrub cover will be measured along lines 1, 2, and 3 and for 150 feet of lines A and B for a total of 300 feet of line sampled both perpendicular and parallel to the stream (darkened lines in Figure 1). Shrub sampling on line A will occur 10 feet rather than 20 ft. from the stream so that shrub cover closer to the stream can be identified and so it is not directly affected by management during harvest. Woody debris will be measured to construct length, diameter, and decay classes as well as volume measurements. To do this, diameters at both ends and the length of each woody debris piece greater than 6" diameter and 4 ft. long crossing these lines will be recorded. Also, a 2 foot area around the line will be constructed and the length of the piece within this area and the diameter at the line cross point will be measured to obtain a volume measure.

1.1.5. Variables to Measure and Record:

After each variable, there is a brief description of the objective(s) that the variable measurement addresses or the purpose for measuring/recording the information.

ITS = Individual tree sampling at 20%
TW = within 500'x20' area
LT = line transect
CL = along center line (250')
PL = along perpendicular lines
SC = within stream channel for entire 500 ft length
Pre = measured pre-operation only
Post = measured post-operation only
Both = measured both years

- location of sample site (GPS/GIS), legal description of harvest unit, ODF district, FPF region, georegion, and elevation (Pre) - *organization and categorizing.*
- pre- and post-operation survey date and observer(s) (Both) - *data quality*.
- operation start/end date (Post) - *organization and categorizing*.
- harvest type (clearcut or partial cut) (Post) - *organization and categorizing*.
- harvest method (full suspension cable, tractor yarding, etc.) (Post) - *organization and categorizing*.
- harvest unit acreage (Post) - *organization and categorizing*.
- land ownership (industrial, non-industrial, local government) (Pre) - *organization and categorizing*.
- stream type, size, and name (Pre) - *organization and categorizing*.
- total stream length within the harvest unit (Post) - *organization and categorizing*.
- dominant substrate (Both) - *organization and categorizing*.
- drainage acres above harvest area (Pre) - *organization and categorizing*.
- distance to disturbance/harvest unit from stream (CL, Post) - *organization and categorizing*.
- photos of sites from reference point(s) (Both) - *organization and categorizing*.
- site remarks (Both) - *qualitative descriptions that may affect interpretation in the office.*

- slope, number of terraces, terrace height and width (CL, Pre) - *topographic information that addresses width and floodplain interactions and facilitates aerial photography interpretation*.
- aquatic large woody debris (LWD) average diameter, length, decay class, orientation to streamflow, zone of influence, species, and form (SC, Both) - *LWD*.
- stream gradient (Pre) - *LWD stability and comparison between small and larger streams*.
- bankfull width (Both) - *LWD stability and a starting point for topographic measurements*.
- wetted channel width (Both) - *LWD stability, summer flow conditions, and stream sizing*.
- height, dbh, species, and distance from the stream of randomly selected trees (ITS, Both) - *potential LWD*.
- age of randomly selected conifers/hardwoods (stumps) (ITS, Post) - *lost sources of LWD and stand dynamics (age classes)*.
- number of submerchantable conifers (dbh 1.0 - 6.0 inches) (LT, Both) - *potential LWD*.
- shrub cover and species (%, LT, Both) - *wildlife*.
- height, dbh, decay class, and distance from the aquatic area of all snags (T, Both) - *wildlife*.
- terrestrial down woody debris decay classes and dbh (per acre) (LT, Both) - *wildlife*.
- canopy cover/% shade by Solar Pathfinder/densiometer readings (PL, Both) - *stream shade*.
- stream orientation (Pre) - *insight on shade factors*.

1.1.6. Field Locations

Sample units will be selected from harvest plans submitted from the seven geographic regions identified in OAR 629-635-220. They are the (1) Coast Range, (2) South Coast, (3) Interior, (4) Siskiyou, (5) Western Cascade, (6) Eastern Cascade, and (7) Blue Mountain (Figure 2).

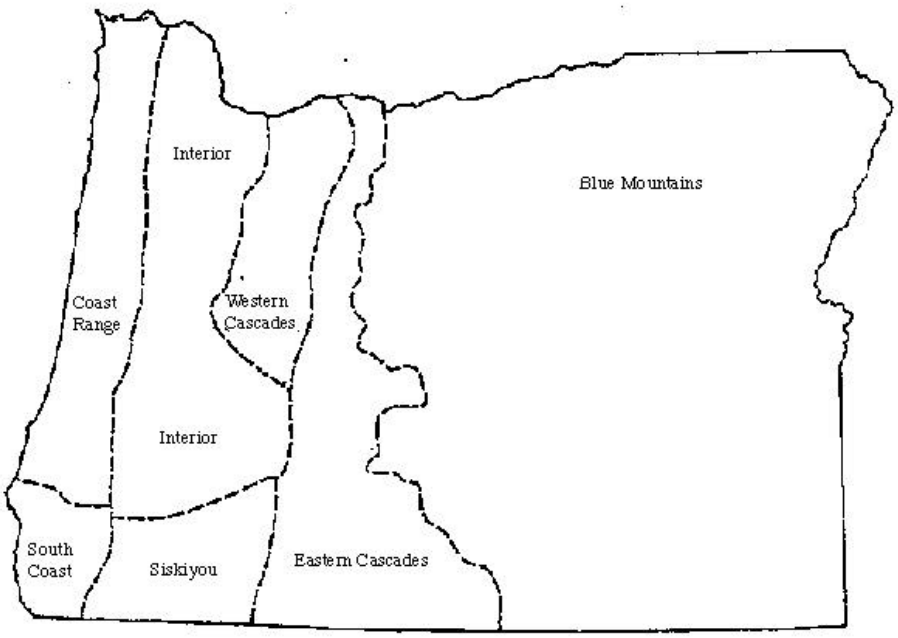

Figure 2. Geographic regions defined by ODF Forest Practice Rule 629-635-220.

Streams have been categorized by size and use in the new stream rules. Use and size categories are:

F = fishbearing
D = domestic water supply
N = neither fishbearing nor domestic water supply
S = small (0-2 average annual cfs)
M = medium (2-10 avg. annual cfs)
L = large (>10 avg. annual cfs)

We will focus on S, M, and L type F streams on nonindustrial (e.g., county, state, and or small landowner lands) and industrial ownerships, with the goal of having at each stream size and land ownership represented in each georegion for a total of 29 field sites.

Table 2. Actual sites from 1996 inventory. L/M = large or medium, S = small, Nonind. = non-industrial landowner, Ind. = industrial landowner.

Georegion	L/M Nonind.	L/M Ind.	S. Nonind.	S. Ind.
Coast Range	2	2	1	4
Interior	1	5	0	3
Western Cascades	1	3	0	1
Eastern Cascades	1	0	0	0
South Coast	0	0	0	0
Siskiyou	0	0	0	2
Blue Mountains	1	0	2	0

1.1.7. Preparation

1.1.7.1.Equipment and training

Keep supplies well-stocked and in good condition. Restocking equipment is available at the Salem office or by requesting the MC or MA to bring it with them when they come to the field. Losses of more expensive equipment will require purchasing time and form filing so be very careful to not leave equipment behind after monitoring and to flag or paint all easily dropped, costly pieces.

Training will have taken place within the first week of your employment and will consist of a short explanation of theory and protocol in the office and then field work with the protocol on real sites. The MA or MC will be in the field with you for the first two weeks to help collect data, answer questions, and refine the protocol. After these first few weeks you will have become experts in inventorying the riparian stands and should be able to work as a team. The MA will then alternate continuing to locate sites, spending time in the field with you helping on difficult or time consuming sites, and working on the other monitoring projects in Forest Practices. Do not hesitate to continue refining the protocol and data sheets. Please contact the MA though before making any major changes so that she can determine if the goals and objectives are still being met.

The following equipment is needed before beginning any field day for the riparian inventory survey.

Vehicle	Crew	Individual
radio	hip chain	hard hat
radio frequency guide	string	vest
CB	hip-wader boots	boots
district map/Oregon atlas	aluminum tags	first aid kit
first aid kit	nails	flagging
spare tire, jack, and tools	copies of unit map	marking paint
fire fighting tools (shovel, ax)	hammer/ax	compass
toilet paper	Solar Pathfinder	pencils
drinking water	convex densiometer	pencil sharpeners
extra vehicle key	D-tape	drinking water
Field Guide	stadia rod	insect repellent
summary of site information	Range Finder	lunch
extra flagging	GPS	field book
extra tags	camera	sunblock
extra nails	cheat sheet	sunglasses
extra data sheets	data sheets and binder	clinometer
extra hip chain string	random number table	pocket knife
rain gear	increment borer	beeswax
calculator		25' carpenter's tape
towel or cleaning rag		
file folders		

1.1.7.2.Site selection and sample locations

Sites will be selected based on a pool of sites identified to the MA by FPF and/or landowners. This pool will have already identified the site as a pre-operation unit with an RMA bordering a type F stream. Initially all sites will be accepted as monitoring site. As the sample pool grows larger, sites will be selected based on georegion and the stream size and land ownership categories so that we can have one example of each category (Table 1). If sites are not available in certain areas then other site types which may have already been sampled may be included to bring the sample population to 25-30. Site appropriateness will be based on a few ideal criteria. They are: 1) no roads passing through the RMA, 2) no adjacent management disturbance for the past 30-50 years, and 3) limited grazing. However, there is much flexibility inherent in these conditions. Other factors will be time until operations begin and landowner needs and/or desires. Once a site is selected, the MA will provide the crew with maps, directions, terrain information, and contact persons in the District office and with the landowner.

Once at the site, sample plots will be identified pre-operation by entering the harvest unit boundary at the stream channel and then, provided that the unit is larger than 600 feet, walking 50 feet up or down the stream into the RMA. This will provide a buffer zone from the unmanaged riparian area. From this point, a random number table will be consulted to determine the distance to the beginning of the sample plot. Numbers on the table that are too large for the unit size will be skipped until a random number is found that allows for 500 feet of sampling along the stream. This

distance will then be paced along the stream. Upon arriving at the end point, a flag will be placed to identify either the upstream or downstream end of the plot.

Post-operation sites will be relocated by using maps provided by the 1996 field crew and searching for black and pink striped flagging and the blue painted reference stake and/or trees. On each tree painted with a blue diamond/band at eye and stump height, there is a aluminum tag nailed into the tree. On this tag, as well as the data sheets, are coordinates to orient to the blue reference stake located at the 20 foot, downstream corner of the plot. The pre-operation flagging may have been destroyed or damaged in the harvest operation so the crew may have to re-lay out the plot, using the reference corner. If a reference corner cannot be located because of damage from the harvest operation, search for a piece of flagging. The flagging was usually marked with the line number and location along the line in increments of 25 feet. Use this reference to back track to the most likely location of the reference stake. Ultimately, use your best judgment in the field to ensure that you are inventorying the closest approximation of the pre-operation plot, including adjusting your idea of a "correct" plot to match an "incorrect" plot laid in last year. See protocol section for laying out the plot and sampling.

1.1.7.3.Timeframe

Pre-operation monitoring will occur from late June through the end of August 1996. Post-operation monitoring will occur from late June through the end of August 1997. Given the number of site notifications we receive from FPFs and landowners, field work will be scheduled on 4 10-hour days per week with one day every two weeks set aside for office time and data downloading. Overnight travel will be common, especially at distant sites and early in the field season when the protocol is still unfamiliar. A tentative calendar schedule is attached for your planning purposes. However, because of site conditions, this calendar is subject to change. When the calendar does change, you'll know at least three days in advance.

1.1.8. Pre-Operation Data Collection

1.1.8.1. Unit information. Unit information will be collected by the MA from the landowners or FPF and will be organized in the office.

1.1.8.2. General:

Only one side of each stream will be sampled. If only one side is to be harvested, sample that side. If both sides are to be harvested, sample the left side looking downstream.
Stream - stream name.
Observer - data observer and recorder's name(s).
GPS coord. - geographic positioning system's coordinates (lat. long.).
Stake Loc. - the location of the stake as referenced with a compass from two neighboring trees (°).
Legal Desc. - township, range, and section.
Georegion - Coast Range, Interior, Western Cascades, Eastern Cascades, South Coast, Siskiyou, or Blue Mountains.
Stream size - S, M, or L.
Side - the side of the stream data is recorded on. Left (L) or right (R) determined looking downstream.

1.1.8.3. Stream Characteristics:

Elevation - from 7.5 min topo maps. (ft)
Orientation - general compass reading down imagined midline of stream, recorded in a downstream direction. (°)
Gradient - averaged clinometer readings of each gradient break over sampling length, measured looking upstream. (%)

1.1.8.4. Shade/Channel characteristics:

Densiometer - % shade is measured by counting covered quadrant intersections on the mirror. Readings are taken in four directions, summing the total covered grid intersections, and then doing minor calculations. Densiometer readings are recorded at 5 points going upstream in center of stream. Point locations are every 125 ft. If the wetted channel width exceeds 15 ft. then shade readings with the **densiometers only** are recorded on each bank. l = left side, r = right side (looking downstream).
Solar Pathfinder - Solar Pathfinder readings are only recorded on lines 1, 2, and 3 (0, 250, and 500 ft).
% Shrub, Hardwood, and Conifer - Percentages of each category are estimated visually by observing that vegetation that cast shade on the stream at the point where shade was measured. Total canopy cover may exceed 100%.
Dominant Substrate - **CODE:** BD = boulder (10-40 in)
CB = cobble (2.5-10 in)
GV = gravel (0.08-2.5 in)
SD = sand
SL = silt
BR = rockface/bedrock.
Wetted Width - stream width from water's edge to edge. (ft)

Bankfull Width - width at top of bank's edge (where water would be at average full channel capacity). (ft)

1.1.8.5.Riparian characteristics:

Landform - description of the landform where you are standing. There will be a height and distance measurement for each landform.

Basic Fluvial Landform Definitions and formation processes:

Valley Wall: The vertical and horizontal constraining boundary of an entire river system. High in the drainage system lateral an vertical migration of the stream may be limited by the Valley Wall. These systems form steep-walled canyons or gorges. These streams are typically high gradient with cascades or rapids.

Floodplain: Relatively flat surface occupying much of a valley bottom and is normally underlain by unconsolidated alluvial sediment. Usually associated with stable lower gradient channels. Formed by a simultaneous processes of lateral migration and overbank flooding. A floodplain can become a terrace when channel incision prevents the river from inundating the surface annually or biannually.

A common error is to mistake a low terrace as a floodplain. If normal bankfull width does not fall above the break I slope it is a terrace. In many of the high gradient mountain streams you will be working in, you will more commonly encounter terraces.

Fluvial Terrace (Terrace): Abandoned floodplain formed when the river flowed at a higher level. Can be formed by deposition or erosion. Depositional terraces are formed from entrenchment of the river after a period of valley filling. The flat surface, or tread, is formed through alluvial deposition. The tread of an erosional terrace is formed by lateral erosion followed by deposition of a thin sheet of alluvium on top.

Terraces without a flood plain are typically found in intermediate streams between floodplain systems and higher gradient gorge systems. Floodplain systems may display older terraces between the Valley Wall and the floodplain. They are rarely intact along the entire length of a valley.

CODE: FP = floodplain (can have FP1, FP2, etc.)
T = terrace (can have T1, T2, etc.)
C2 = secondary channel
MCB= midchannel bar
R = road
OR = old road (abandoned)
VW = valley wall

Slope - averaged clinometer reading of the gradient brakes and landforms. May be zero or even negative for terraces and floodplains, for example. (%)

Distance - horizontal distance of each landform except for gradient breaks which should be recorded in slope distance. Floodplains may extend beyond the 100 ft. boundary. If floodplain landforms extend greater than 300 ft from the channel only measure to 300 ft. (ft)

1.1.8.6.Shrub:

Dominant/Codominant shrubs - % measured in ft/line length (i.e., 100 ft /500 ft line =20%) for each line where Lines 1-3 are the lines perpendicular to the stream beginning downstream and Lines A-B are the lines running parallel to the stream beginning closest to the stream. Only record

vegetation that crosses the line transect. Lines A and B will only be sampled for 75 ft on either side of Line 2 for a total of 150 ft. on each line and a combined total of 300 sampled feet running parallel to the stream. Shrubs sampled on Line A will also be actually sampled 10 ft. from the stream (i.e., 10 feet towards the stream from Line A). This will ensure a nonbiased sample of the understory vegetation within the first critical 20 feet both pre- and post-operation.

Exposed mineral soil - measured in % of ft/line length.
Probable cause is identified by word such as elk, beaver, wind throw, etc. Be careful distinguishing between duff and mineral soil.

1.1.8.7.Down woody debris (DWD):

DWD is measured on a total of 600 ft of line through the plot; 300 comprised of the three perpendicular lines and 300 subsampled on the parallel lines. Subsampled line reaches are located 75 ft on either side of line 2 (midplot) on both lines A and B. Woody debris that lies within a foot on either side of the lines is measured so that, in effect, a 2 ft. wide transect is constructed (this allows us to calculate area measurements). Do not measure pieces less than 6" diameter and/or 4 ft. long.
Line - line number/letter where DWD is located (see above for line descriptions).
D1/D2 - diameter at both ends.
Length - total length of the piece in feet. On decay class 5 logs, measure until it turns into forest floor.
CN/HD? - HD = hardwood
CN = conifer
U = unknown
Decay class - 1 = dead but fully intact, with bark, dead or dying needles
2 = extensive decay but with bark and holds form
3 = outer wood is decayed/soft but still holds form; hemlocks may still have bark
4 = cannot hold form (elliptical shape begins), no bark, can be broken through
5 = barely distinguishable from duff/forest floor
Direction - Does the wood lie generally perpendicular, parallel, or at a 45 degree angle to the stream channel? PD = perpendicular, PL = parallel, 45 = 45 degree angle.
<u>Area section:</u> This is to calculate the volume of wood per area in the sample plot.
Diam. - the diameter at the point where the line crosses the wood (or end within the 2 ft. transect). On decay class 5 logs, diameter may not be available. Leave an "x" or NA or some other indication. (inches)
Length - the length of wood present within the 2 ft. area. On pieces that cross the line perpendicularly and are entirely in the 2 ft., length will be 2 feet. On pieces that cross the transect at an angle or are only partially within the 2 ft. area, length will be greater or less than 2 ft. (ft).

1.1.8.8.Aquatic LWD:

LWD larger than 6" diameter and 4 ft. long must be measured. However, if less than 25% of a piece of wood is inside zones 1, 2, and/or 3, do not measure it. Aquatic woody debris is commonly found in debris jams. You do not need to measure every piece in a debris jam. Instead, measure the diameter of a few pieces in general size classes and estimate the number of pieces in those size classes. Then measure the length and height of the entire jam and the decay class. If there are distinct decay class differences within the jam, estimate the percentages of each distinct class

(i.e., 25% class 1, 75% class 3). Do the same for the conifer/hardwood category. Be sure to write descriptions in the Remarks column.
Piece - Sequential number
D1 = Diameter at either end. If the piece is cut, measure the direct diameter with the stadia rod (in.).
D2 = Diameter at other end (in.).
Length - piece length (ft.).
Decay class: 1 = intact texture, branches, bark, still some foliage, holds form
2 = intact texture, no branches, eroding bark, holds form
3 = smooth texture, trace bark, holds form, darker color
4 = abrasions, no bark, losing form, dark color
5 = vesicular texture, irregular shape, dark color
SP or R? - Is the log a "spanner" which spans the channel or a "ramp" which descends into the channel from the bank?
PL, PD, or 45? Does the wood lie parallel (PL), perpendicular (PD), or at a 45 degree angle (45) to the stream channel?
Zone of influence - Zones 1 and 2 describe portion of wood in stream and incised channel. Zones 3 and 4 describe portion of wood directly above the stream and channel and above the bankfull wetted width. (%)

Tree type.- HD = hardwood
CN = conifer
U = unknown
Form - DJ = debris jam
RW = root wad
B = branches
T = trunk
New/Old - relative age of the class 1 piece(s). New would have been contributed this past winter.
Remarks - unique characteristics important to the function, origin, or location of the wood.

Beaver dams:
- number along sampled reach.
Length - average dam length along sampled reach. (ft)
Activity - Y/N shows recent activity or abandoned.
Dens. - densiometer reading in mid-complex. (%)

1.1.8.9.20 Ft Cruise/Individual Tree Sampling (ITS):

Tree - sequential number.
DBH - diameter at breast height. (inches)
Spp - overstory species as follows:
Snag - is it a snag? Y/N
Decay class - 1 = dead but fully intact, with bark, dead needles, standing
2 = extensive decay but with bark and holds form, standing
3 = outer wood is decayed/soft but still holds form
4 = highly eroded looking, soft, short (<6-8ft), may be pushed over
5 = rarely found or counted, very short (1-2'), pile of decayed matter

Distance to crk.- distance from the stream.
Lean to water - degree lean of tree at base. Measured facing the stream. If degrees are >90 then face away, measure, and add to 90. (°)
Tree slope - slope at tree to base of slope. (%)

Height measurements: Heights will be measured on one tree species in each diameter class rather than for every tree. Diameter classes are: 6-10 in.; 11-15 in.; 16-20 in.; 21+. Measure the first tree you come to of each new species and each new diameter size group. Calculate all heights at each tree in the field so that accuracy can be immediately checked.

%a(+) - Used for tree height calculation. The % slope from your eye to top of leader for conifers or to middle of crown for hardwoods (where branches begin to divide significantly).
%b(-) - Used for tree height calculation. The % slope from your eye to the base of the tree for all trees.
slope dist. - the distance from you to the tree if you are on a slope.
slope - the degree of slope from you to the tree.
horizontal dist. - the distance from you to the tree if you are on a 0% slope or the calculated horizontal distance from slope distance and slope measurements. The formula, where *x* is your slope distance, *y* your horizontal distance, and θ your slope angle (in degrees) is:

$$y = \cos\theta x$$

Height - is the effective or total tree height (depending on if it is a hardwood or conifer). Height is calculated from the collected information with the following relationship:

$$H = (\%a + \%b)y/100$$

where %a and %b are described above and *y* is the horizontal distance.

1.1.9. Post-Operation Data Collection

1.1.9.1. *Unit information.* Unit information will have been collected by the MA from the landowners or FPF and will be organized in the office.

1.1.9.2. General:

Only one side of each stream will be sampled. Data sheets will already have the following information recorded for you from last years efforts. Do not worry about recording this information except for the observer name. It will help provide information about the site.
Stream - stream name.
Observer - data observer and recorder's name(s).
Stake Loc. - the location of the stake as referenced with a compass from two neighboring trees (°).
Legal Desc. - township, range, and section.
Georegion - Coast Range, Interior, Western Cascades, Eastern Cascades, South Coast, Siskiyou, or Blue Mountains.
Stream size - S, M, or L.
Side - the side of the stream data is recorded on. Left (L) or right (R) determined looking downstream.

1.1.9.3. *Stream characteristics:*

Will not be recorded post-operation. Variability in measurements will show more change than any measurable change in these features. However, if records are missing from the pre-operation datasheets, collect that information on those lines that is needed.

1.1.9.4. Shade/Channel characteristics:

Convex Densiometer - % shade is measured by counting covered quadrant intersections on the mirror. Readings are taken in four directions, summing the total covered grid intersections, and then doing minor calculations. Densiometer readings are recorded at 5 points going upstream in center of stream. Point locations are every 125 ft. If the wetted channel width exceeds 15 ft. then shade readings with the **densiometers only** are recorded on each bank. l = left side, r = right side (looking downstream).
Solar Pathfinder - Solar Pathfinder readings are only recorded on lines 1, 2, and 3 (0, 250, and 500 ft).
% Shrub, Hardwood, and Conifer - Percentages of each category are estimated visually by observing that vegetation that cast shade on the stream at the point where shade was measured with the Solar Pathfinder or the convex densiometer. Total canopy cover may exceed 100%.
Dominant Substrate - **CODE:** BD = boulder (10-40 in)
CB = cobble (2.5-10 in)
GV = gravel (0.08-2.5 in)
SD = sand
SL = silt
BR = rockface/bedrock.

Wetted Width - stream width from water's edge to edge. (ft)
Bankfull Width - width at top of bank's edge (where water would be at average full channel capacity). (ft)
Beaver dams:
- number along sampled reach.
Length - average dam length along sampled reach. (ft)
Activity - Y/N shows recent activity or abandoned.
Dens. - densiometer reading in mid-complex. (%)

1.1.9.5.Shrub:

Dominant/Codominant shrubs - % measured in ft/line length (i.e., 100 ft /500 ft line =20%) for each line where Lines 1-3 are the lines perpendicular to the stream beginning downstream and Lines A-B are the lines running parallel to the stream beginning closest to the stream. Only record vegetation that crosses the line transect. Lines A and B will only be sampled for 75 ft on either side of Line 2 for a total of 150 ft. on each line and a combined total of 300 sampled feet running parallel to the stream. Shrubs sampled on Line A will also be actually sampled 10 ft. from the stream (i.e., 10 feet towards the stream from Line A). This will ensure a nonbiased sample of the understory vegetation within the first critical 20 feet both pre- and post-operation.

Code	Genus	Common name	Code	Genus	Common name
AB	Arbutus	madrone	PL	Polystichum	sword fern
AC	Acer	maple	PO	Populus	popular
RA	Alnus	alder	PR	Prunus	cherry, plum
AM	Amelanchier	serviceberry	PT	Pteridium	bracken fern
AR	Artemsisia	sagebrush	PU	Purshia	bitterbrush
AT	Arctostaphylos	manzanita	PY	Physocarpus	ninebark
BB	Berberis	Oregon grape	QU	Quercus	oak
BE	Betula	birch	RM	Rhamnus	buckthorn
CE	Ceanothus	ceanothus	RD	Rhododendron	rhododendron
CS	Cornus	dogwood	RH	Rhus	poison oak
CO	Cerocarpus	mountain mahogany	RI	Ribes	currant
CR	Crataegus	hawthorn	RO	Rosa	rose
CT	Castanopsis	chinquapin	RU	Rubus	black berry
CY	Corylus	hazel	SB	Sambucus	elderberry
FR	Fraxinus	ash	SO	Sorbus	ash
GA	Gaultheria	salal	SP	Spiraea	spiraea
HO	Holodiscus	oceanspray	SX	Salix	willow
LH	Lithocarpus	tanoak	SY	Symphoricarpus	snowberry
MA	Malus	apple	TX	Taxus	yew
MY	Myrica	bayberry	UM	Umbellaria	laurel
OP	Oplopanax	devils club	VA	Vaccinium	huckleberry
OS	Osmaronia	Indian plum			

Buffer Width – Record the width of the buffer on lines 1, 2, and 3 as you walk away from the stream. The exact place where the buffer ends and the unit begins may be fuzzy. A buffer has

ended and active management has begun when you encounter your first stump even though there may be standing trees farther away from the stream.
Exposed mineral soil - measured in % of ft/line length. Be careful distinguishing between duff and mineral soil.
Probable cause is identified by word such as elk, beaver, wind throw, etc.

1.1.9.6.Down woody debris (DWD):

DWD is measured on a total of 600 ft of line through the plot; 300 comprised of the three perpendicular lines and 300 subsampled on the parallel lines. Subsampled line reaches are located 75 ft on either side of line 2 (midplot) on both lines A and B. Woody debris that lies within a foot on either side of the lines is measured so that, in effect, a 2 ft. wide transect is constructed (this allows us to calculate area measurements). Do not measure pieces less than 6" diameter and/or 4 ft. long.
Line - line number/letter where DWD is located (see above for line descriptions).
D1/D2 - diameter at both ends.
Length - total length of the piece in feet. On decay class 5 logs, measure until it turns into forest floor.
CN/HD? - HD = hardwood
CN = conifer
U = unknown
Decay class - 1 = dead but fully intact, with bark, dead or dying needles
2 = extensive decay but with bark and holds form
3 = outer wood is decayed/soft but still holds form; hemlocks may still have bark
4 = cannot hold form (elliptical shape begins), no bark, can be broken through
5 = barely distinguishable from duff/forest floor
Direction - Does the wood lie generally perpendicular, parallel, or at a 45 degree angle to the stream channel? PD = perpendicular, PL = parallel, 45 = 45 degree angle.
<u>Area section:</u> This is to calculate the volume of wood per area in the sample plot.
Diam. - the diameter at the point where the line crosses the wood (or end within the 2 ft. transect). On decay class 5 logs, diameter may not be available. Leave an "x" or NA or some other indication. (inches)
Length - the length of wood present within the 2 ft. area. On pieces that cross the line perpendicularly and are entirely in the 2 ft., length will be 2 feet. On pieces that cross the transect at an angle or are only partially within the 2 ft. area, length will be greater or less than 2 ft. (ft).

1.1.9.7.20 Ft Cruise/Individual Tree Sampling (ITS):

Tree - sequential number.
DBH - diameter at breast height. (inches)

Spp - overstory species as follows :

CODE	Common name Conifers	CODE	Common name Hardwoods
AF	alpine fir	AS	aspen
DF	Douglas-fir	BO	black oak
ES	Engelmann spruce	CC	cascara
GF	grand fir	CH	cherry
IC	incense cedar	CQ	chinquapin
JP	juniper	CW	cottonwood
LP	lodgepole pine	DW	dogwood
MH	mountain hemlock	M	bigleaf maple
MP	Monterey pine	MA	madrone
NF	noble fir	MY	myrtle
ODF	old growth Douglas-fir	OA	Oregon ash
PC	port orford cedar	RA	red alder
PP	ponderosa pine	RW	redwood
RF	red fir	SI	Sitka spruce
SF	silver fir	TO	tanoak
SP	sugar pine	VM	vine maple
WC	western redcedar	WI	willow
WF	white fir	WO	white oak
WH	western hemlock		
WL	western larch	IF TREE IS A SNAG:	
WP	white pine	CN	conifer
YE	yew	HD	hardwood

Snag - is it a snag? Y/N

Decay class - 1 = dead but fully intact, with bark, dead needles, standing
2 = extensive decay but with bark and holds form, standing
3 = outer wood is decayed/soft but still holds form
4 = highly eroded looking, soft, short (<6-8ft), may be pushed over
5 = rarely found or counted, very short (1-2'), pile of decayed matter

Distance to crk.- distance from the stream.

Lean to water - degree lean of tree at base. Measured facing the stream. If degrees are >90 then face away, measure, and add to 90. (°)

Tree slope - slope at tree to base of slope. (%)

Height and Age Measurements: Height and age will be measured on one tree species in each diameter class rather than for every tree. Diameter classes are: 6-10 in.; 11-15 in.; 16-20 in.; 21+. Measure the first tree you come to of each new species and each new diameter size group. Calculate all heights at each tree in the field so that accuracy can be immediately checked.

%a(+) - Used for tree height calculation. The % slope from your eye to top of leader for conifers or to middle of crown for hardwoods (where branches begin to divide significantly).

%b(-) - Used for tree height calculation. The % slope from your eye to the base of the tree for all trees.

slope dist. - the distance from you to the tree if you are on a slope.

slope - the degree of slope from you to the tree.
horizontal dist. - the distance from you to the tree if you are on a 0% slope or the calculated horizontal distance from slope distance and slope measurements. The formula, where *x* is your slope distance, *y* your horizontal distance, and θ your slope angle (in degrees) is:

$$y = \cos\theta x$$

Height - is the effective or total tree height (depending on if it is a hardwood or conifer). Height is calculated from the collected information with the following relationship:

$$H = (\%a - (-\%b)y/100$$

where %a and %b are described above and *y* is the horizontal distance.
Age - is the age in years counted by annual rings from the measurement point to either the present or the time of felling. Ages of trees calculated at stump height may be different from ages of trees where annual rings are counted at breast height. Where stumps are present within the inventory plot, recreate as best as possible, by comparison to neighboring trees of the same species, the diameter class of the stump. Count the rings on the stump and indicate that the measure was taken from a stump. For tree diameters or stands without stumps, collect an increment core for each species and diameter class at breast height. You may count the rings on the core in the field or, if the rings are indiscernible, store the cores carefully and bring them into the office for counting with a dye. Record that the cores were taken at breast height.
Loc. - ST = stump
BH = breast height

1.1.9.8.Regeneration

Regeneration sampling will be done to determine a site's future potential for LWD. Density and number of seedlings and saplings will be estimated by sampling in 20 ft. diameter circular plots. Plots will be laid in with a carpenter's tape extended to 10 ft. radius. Sampling will be completed on 10 plots on the 20 ft. line (A), the 50 ft. line, and the 80 ft. line for a total of 30 plots. Plot centers will fall every 50 feet. Lines will be sampled in a zig-zag pattern with the first plots on line A and the 50 ft. line beginning 20 ft. in from the plot edge and the first plot on the 80 ft. line beginning 40 feet in from the plot edge.
Line - the sample line
Plot # - number 1-10
Seed Spp - See tree codes for the 20ft/ITS cruise protocol.
Seed # - number of each seedling species.
Sap Spp - See tree codes for the 20ft/ITS cruise protocol.
Sap # - number of each sapling species.

1.1.9.9.Aquatic LWD:

LWD larger than 6" diameter and 4 ft. long must be measured. However, if less than 25% of a piece of wood is inside zones 1, 2, and/or 3, do not measure it. Aquatic woody debris is commonly found in debris jams. You do not need to measure every piece in a debris jam. Instead, write *DJ* in the *Piece* column and measure the length, width, and height of the entire jam. Then, divide the individual, major pieces into size classes (by length and diameter) and estimate the number of

pieces in those size classes. If there are distinct decay class differences within the jam, estimate the percentages of each distinct class (i.e., 25% class 1, 75% class 3). Do the same for the conifer/hardwood category. Be sure to write descriptions in the Remarks column.
Piece - Sequential number or DJ
D1 = Diameter at either end. If the piece is cut, measure the direct diameter with the stadia rod (in.). This column also serves as the length column (*L*) for the debris jam volume measure.
D2 = Diameter at other end (in.). This column also serves as the width column (*W*) for the debris jam volume measure.
Length - piece length (ft.). This column also serves as the height column (*H*) for the debris jam volume measure.
Decay class: 1 = intact texture, branches, bark, still some foliage, holds form
2 = intact texture, no branches, eroding bark, holds form
3 = smooth texture, trace bark, holds form, darker color
4 = abrasions, no bark, losing form, dark color
5 = vesicular texture, irregular shape, dark color
SP or R? - Is the log a "spanner" which spans the channel or a "ramp" which descends into the channel from the bank?
PL, PD, or 45? Does the wood lie parallel (PL), perpendicular (PD), or at a 45 degree angle (45) to the stream channel?
Zone of influence - Zones 1 and 2 describe portion of wood in stream and incised channel. Zones 3 and 4 describe portion of wood directly above the stream and channel and above the bankfull wetted width. (%)

Tree type - HD = hardwood
CN = conifer
U = unknown
Form - DJ = debris jam
RW = root wad
B = branches
T = trunk
New/Old - relative age of the class 1 piece(s). New would have been contributed this past winter either by natural disturbance or by harvest activities.
Remarks - unique characteristics important to the function, origin, or location of the wood.

1.1.9.10.Site maps

Maps will be unit maps used in the 1996 inventory seasons. Plot location has been marked on a USGS 7.5 min map and on the site maps provided by the landowner/FPF. We will have an Oregon atlas to aid in finding the units.

1.1.10. Data Processing

1.1.10.1.Missing information

If all goes as planned, there will be no missing information. Missing information is a significant liability during the pre-operation data collection period because we are often working a day ahead of the logging crews and if we miss information it may be gone forever within 24 hours. Missing information in the post-operation data collection period is also a cost because remote sites will need to be revisited and site vegetation characteristics will have changed from the period crucial to monitoring. Such errors can severely affect variables such as shade and shrub cover. Therefore, it is critical that you are complete and thorough in your data collection process. Short-cuts or skipping over sections toward the end of the day are sure ways to forget that the data was not collected until you've left the unit and are entering data two weeks later. Please avoid this at all costs. If some information isn't collected, please inform the MA as soon as possible so that she can either go measure it or work out a way to deal with the analysis without it.

1.1.10.2.Data security

Data security is critical. Please develop a system for storing your data sheets in the vehicle while you are traveling that consolidates them in one set location and for organizing them by stream immediately when you drop them off at the office. During your bimonthly office days, you may want to make copies of each data sheet and then file the originals with the MA. Use the copies then to download the data into the computers.

1.1.10.3.Master files

Master files will be located as both hardcopies and computer copies. Back your computer copies up on disk and your harddrive. Provide clear information to the MA about the storage location (i.e., drive), file names of all the data files created, and the most current, cleaned version. The hardcopies should be given to the MA to file.

1.1.10.4.Data entry

Data entry will be accomplished continually through the summer by the MA and during your office days twice a month. The goal is to have the data entered and cleaned by the end of the summer. Be sure that any changes that are made to the data after entry are communicated to the MA so that she can update her files if needed. Data will be entered into the Paradox database found on the department network. Please make backup copies during the day and definitely at the end of the day.

1.1.10.5.Analysis

Initial analysis will be the MA's responsibility and will begin in Fall 1996 to determine dominant species, group the stands by height and diameter, calculate basal area, calculate LWD and DWD volumes, and complete other data organization. Initial trends in pre-operation riparian stands will be developed to aid in the comparison with post-operation stands the following year. SAS programs will be written that will aid in the organization of post-operation data and the comparison of the two years. Analysis will continue through the summer of 1997.

EQUIPMENT

Equipment Inventory for Summer 1997.

Item	Size	Have	Notes
CB Radios		3	
Gloves	S	1	
	M	2	pigskin - moisture rest.
	L	3	pigskin - moisture rest.
	XL	2	leather driver's
Sharpies		24	black
Pencils		12	
China Markers		8 bx	black
Oregon Atlas		1	
Personal First Aid Kit		8	
Tree Paint		13	blue
Flagging		58	black/pink candy stripe
Hip-chain string		24	white
Hip-chain		4	feet
Camera		3	pocket, water resistant
Film		16	color slide, 200ASA
Calculators		4	scientific (trigonomic)
Densiometer		4	convex
Densiometer		1	GRS
Compass		4	Silva Ranger Type 15
Loggers tape			100' - dbh on backside
Tecnu		5	32 oz bottles
Hard hats		8	blue
Machetes		4	short
Machete sheaths		3	short
Clinometer		6	percent and degree
Field vests	M	2	orange
	L	4	orange
Clipboard		3	metal folding
Stadia rods		3	
HOBO Thermistors		90	
Laptop		1	
Flow meter		1	Marsh McBurnney
Wading rod		1	
Stopwatch		1	
Latex gloves	M	1	
	L	1	
Labels			
Bottles			
Item	**Size**	**Have**	**Notes**
Cubitainers			

Cooler		2	
Ice packs		8	
Beeswax		2	
Increment Borer		1	16 "
Write-Rain	1 pckg		thin stock
Fieldbooks		24	Rite in Rain
Data sheet printing			flood/riparian
Color photocopies		100	air photos

2. APPENDICES

2.1. RIPARIAN PROJECT APPENDICES

APPENDIX A: Data Sheets

1. Site/Shade

Oregon Department of Forestry
1997
Forest Practices Riparian Monitoring Project

Stream: **GPS coord.:** **Georegion:** p ____ of ____
Date: **Stake Loc.:** **Stream size:**
Observer: **Legal Desc.:** **Side:**

Stream Characteristics:
Elevation
Orientation
Gradient

Shade/Channel

	Line 1			Line12			Line2			Line23			Line3		
	c	l	r	c	l	r	c	l	r	c	l	r	c	l	r
Densiometer															
% conifer															
% hardwood															
% shrub															
Solar-Path Finder															
Dom. Substrate															
Wetted width															
Bankfull width															

Beaver dams:

#	Length	Active?	Dens. mid-complex

2. Regeneration/Submerchantable Trees

Oregon Department of Forestry
1997
Forest Practices Riparian Monitoring Project

p___ of ____

Regeneration

Stream Observers

Date Side

Line	Plot #	Seed spp.	Seed #	Sap spp	Sap #

Oregon Department of Forestry
1996
Forest Practices Riparian Monitoring Project

p___ of ____

Submerchantable Trees

Stream Observers

Date Side

Red Alder

Hemlock

Douglas-fir

Bigleaf Maple

Western redcedar

Other

3. 20FT Line Cruise

Oregon Department of Forestry
1997
Forest Practices Riparian Monitoring Project

p___ of ___

20 Ft Cruise
Stream
Date
Observer
Side of crk.

Tree	DBH	Spp	Snag	Decay Cls.	Distance to crk.	Lean to water ( )	Tree slope %	%a(+)	%b(-)	slope dist.	slope	hor. dist.	Height	Age	Loc.

4. ITS Cruise

Oregon Department of Forestry
1997
Forest Practices Riparian Monitoring Project

p___ of ___

ITS Cruise
Stream
Date
Observer
Side of crk.

Tree	DBH	Spp	Snag	Decay Cls.	Distance to crk.	Lean to water ( )	Tree slope %	%a(+)	%b(-)	slope dist.	slope	hor. dist.	Height	Age	Loc.

5. Down Woody Debris (DWD)

Oregon Department of Forestry
1997
Forest Practices Riparian Monitoring Project

Stream **Side of crk.**
Date **Observer**
DWD: p___ of ____

Line	D1	D2	Length	Decay class	C/H?	Direction	**Area**	Diam.	Length

6. Shrub

Oregon Department of Forestry
1997
Forest Practices Riparian Monitoring Project

Stream **Side of crk.** p ___ of _____

Date **Observer**

Shrub:	Line1	Line2	Line3	LineA	LineB
Dom. Shrub					
ft/line					
CD Shrub					
ft/line					
Buffer Width				[redacted]	

Exposed mineral soil

Probable Cause

7. Aquatic Woody Debris (LWD)

Oregon Department of Forestry
1997
Forest Practices Riparian Monitoring Project

Aquatic LWD: p _____ of _____

Crk. **Observer**

Date

							Zone of Influence					
Piece	D1	D2	Length	Decay cls.	SP or R?	PL vs. PD?	%in 1-2	% in 3-4	Tree type	Form	New/Old?	Remarks

K:\Datbase on ‘FP_ne0566’\Protocols\ripprotocol.doc