2007 Thinning Stewardship Projects
Third Party Monitoring
Clackamas Ranger District, Mt. Hood National Forest

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INTRODUCTION

The purpose of this monitoring project is to verify consistency from project planning to project implementation for timber plantation thinning on the Clackamas Ranger District of the Mt. Hood National Forest. This is done by evaluating if the Clackamas River Ranger District is meeting the ecosystem management objectives of the Mt. Hood National Forest LRMP (Land and Resource Management Plan) and the Environmental Assessment (EA) for the 2007 Plantation Thinning on the Clackamas Ranger District. The goal of this project is to monitor thinning areas and share the results with the aim to foster trust among various stakeholders.

Public interest groups, including the Clackamas Stewardship Partners (CSP), desire assurance that the Mt. Hood National Forest follows through on project design criteria developed in the Environmental Assessment. This monitoring project is being conducted to enhance current LRMP monitoring,

The objectives of this project were three fold.

1. Verify the implementation of project design criteria including:
    - Riparian no-cut protection buffers
    - Stand variability
    - Utilization of Skips and Gaps
2. Document status and trends of management actions for ecosystem productivity and conservation of biological diversity, in order to promote adaptive management.
3. Enhance communication and transparency with public interests by making monitoring results available and accessible.

Four thinning stewardship projects were included in this monitoring project covering a total of 55 units encompassing approximately 1,166 acres. The breakdown by project is shown in the following table:

Table 1: Thinning Stewardship Projects Monitored

Project Name	Number of Units	Acres
K-9 Thin Stewardship	18	355
Quarry Thin Stewardship	12	252
Rod ATV Thin Stewardship	13	276
Hot Thin Stewardship	12	283
Total	55	1,166

Key Questions

There are fourteen key questions the monitoring project addressed. These key questions will be utilized to evaluate if the U.S. Forest Service is meeting the criteria as outlined in the EA.

1. Which units were surveyed as part of this monitoring contract?
2. Are the silvicultural prescriptions likely to produce variable stand density between units?
3. Are the silvicultural prescriptions likely to produce variable stand density within units?
4. Are riparian no-cut buffers clearly designated in the field as outlined in the EA?
5. Are silvicultural prescriptions accurately designated in the field?
6. Are the minor tree species and the largest trees clearly specified in the contract and/or prescription to be retained?
7. Are snags clearly specified in the contract and/or prescription to be retained?
8. Are concentrations of Coarse Woody Debris (CWD) clearly designated in the contract and/or prescription to be retained?
9. Do Skips contain riparian areas, trees with elements of wood decay, insects/disease, rare plants, large trees, minor tree species, unstable ground, talus slopes, and/or concentrations of CWD?
10. Are special habitats protected as described in the EA?
11. Do Gaps contain riparian areas, trees with elements of wood decay, rare plants, unstable ground, and/or concentrations of CWD?
12. Are Skips and Gaps clearly designated as described in the EA and silvicultural prescription?
13. Do the projects meet desired goals of variability as described in the EA?
14. Do the silvicultural prescriptions for relative densities in the General Marking Guidelines/Prescriptions meet the relative density criteria specified in the EA?

MONITORING METHODS

An effort was made to develop a monitoring scheme that would allow the results to be easily reproducible. The initial step was to review the EA and associated thinning stewardship contracts. After this was completed, the field work was planned and implemented. Following are the processes used for monitoring.

Sampling Design

All 55 units in the four thinning stewardship projects were sampled. The field maps, included as Appendix A, show the areas sampled in each unit. Appendix B includes notes typed by referring to the field notes.

To determine how to sample each unit, the unit maps were evaluated and a sampling design was developed that would look at riparian areas and special sites in the unit or immediately adjacent to the unit. Consideration was also given to spread the sampling throughout the unit and sample a variety of the terrain within the unit.

Strip locations were determined prior to sampling a unit. As the survey was taking place, observations were made looking for special features that required special protection. For example, this included streams, wet areas such as sumps or seeps, steep terrain, etc. As these special sites were seen during the field inspection, deviations from the strips were made to inspect these special areas. When offsetting from the end of one strip to another, the survey was often along the unit boundary that was adjacent to a stream. Riparian areas were measured in areas where they appeared to be marginal in width.

Markings in the Field

Orange and white striped ribbon, along with blue and white striped ribbon, were hung together in the field to mark features to help others reproduce the monitoring results. This combination of ribbon was chosen because preliminary fieldwork indicated this would be a unique combination. A black permanent marker was used to mark on the ribbon.

The strips were marked with S1 for strip one, S2 for strip 2, S3 for strip 3, etc. Markings were placed at the beginning and end of strips and along the strip if it crossed the road.

The areas where riparian widths were measured were marked in the field as R1 for the first riparian area measured, R2 for the second riparian area measured, etc.

Special sites which needed to be flagged were marked in the field as SS1 for the first special site in a unit, SS2 for the second special site in the unit, etc.

Cruise Verification

Three of the plots marked in the field by the USFS were randomly selected from each of the four projects monitored. Glenda Goodwyne, a forester from the Clackamas Ranger District, traveled with Rick Barnes to the field to demonstrate the cruise procedures used by the USFS cruisers. Based on this information, the procedures used were as follows:

1. A variable plot was utilized, using a basal area factor (BAF) of 20 to determine which trees were in the plot. Trees were determined to be in or out at breast height (4.5 feet off the ground on the uphill side of the tree). Each of the trees in the plot were marked and numbered. Numbering started at due north and proceeded in a clockwise pattern. The trees were already flagged by the USFS unless there was a discrepancy between the original cruiser and check cruiser regarding the determination of in and out trees. The limiting distance was calculated for all border line trees by multiplying the diameter at breast height by 1.9445 (the plot radius factor for a 20 BAF) and measuring the distance from these trees to the plot center.
2. The diameter of each tree in the plot was measured four inches off the ground.
3. It was then determined which trees would be left and which ones would be harvested. This was done by:
    a. Reviewing the prescription and determining which species are to be harvested. The harvest species tree with the largest diameter at four inches off the ground was determined to be a reserve tree.

b. The prescription identifies the spacing off of these trees. For example, a DxD 15 would cut all trees within 15 feet of the largest tree. It was assumed the trees within this distance from the largest tree would be harvested.
c. The remaining harvest species trees in the plot were then evaluated to determine which harvest species tree was the largest. All trees within the DxD distance were assumed to be harvested. This step would be continued until all harvest species trees in the plot were accounted for.
d. All species not designated as harvest species were assumed to be left standing.

4. The diameter at breast height was measured for all trees assumed to be left standing. This was done to determine the quadratic mean diameter of the remaining stand. This is a key variable in calculating the relative density.
5. The cruise information was recorded on a cruise card. This included the tree number, species, diameter at 4 inches above the ground, diameter at breast height for all remaining trees, and which trees were assumed to be harvested and which trees in the plot were assumed to be left. The harvest trees were designated on the plot card using an "X" and the leave trees were designated by an "O".

A key metric noted in the EA is the relative density remaining after harvest. Relative density is calculated by dividing the basal area of the remaining trees by the square root of the quadratic mean diameter of those trees. The monitoring data collected in the check cruises in the field provides the data needed to verify these parameters.

The scope of this monitoring is focused on the condition of the stand after harvest so the diameter at breast height of the harvest trees and the height of the trees were not checked. Only data necessary to calculate the basal area, quadratic mean diameter, and relative density of the remaining stand were collected.

FINDINGS

The fourteen key questions identified in the introduction of this report will be utilized as a framework for addressing the findings of the monitoring project. The findings for each key question will be discussed herein, being project specific as appropriate.

1. Which units were surveyed as part of this monitoring contract?

All 55 units were surveyed as a part of this monitoring project. This included 18 units on K-9 Thin, 12 units on Quarry Thin, 13 units on Rod ATV Thin, and 12 units on Hot Thin.

2. Are the silvicultural prescriptions likely to produce variable stand density between units?

The prescriptions allow for a good variability between units. The prescribed relative density ranges from 25 in some units up to 35 in other units. In addition, the prescribed DxD (the prescribed distance from the largest tree for cutting all harvest species trees) ranges from 12 feet in some units, up to 20 feet in other units. In addition, the anticipated

residual basal area per acre ranges from 54 square feet per acre up to 150 square feet per acre. Glenda Goodwyne provided tables showing the planned relative density, the prescribed DxD, the residual quadratic mean diameter, the basal area to be harvested, as well as the residual basal area and relative density based on the post marking cruise. The data for each unit of the four thinning projects are shown in the following tables.

Table 2: K-9 Prescription Tracking Table

Unit #	Planned RD	DXD	Residual QMD	Cut BA	Residual BA from Cruise	Residual RD from Cruise
2	25	15	17			
4	30	15	12	80	60	22
6	35	14	13	130	110	36
8	30	14	15	70	93	25
10	25	15	16.4	100	90	22
12	25	14	13.8	150	97	26
14	25	16	17	120	105	26
16	25	15	15	170	130	33
18	No prescription, this unit is to obtain logs for fish projects					
20	25	15	17	90	110	26
22	30	16	18.4	60	110	26
24	30	14	13.6	120	140	37
30	25	14	13.8	95	150	40
32	25	15	17	80	100	24
34	30	15	18.2	75	120	28
38	35	13	16.7		130	32
42	25	15	19		110	31
56	30	14	18.8			

Table 3: Quarry Prescription Tracking Table

Unit #	Planned RD	DXD	Residual QMD	Cut BA	Residual BA	Residual RD
100	35	14	10.7		110	35
102	30	12	13.2		109	30
104	25	12	14		113	30
108	25	20	21		130	30
112	35	13	14		90	25
114	25	16	18.1		100	25
116	25	12	16.1		126	30
118	25	16	18.6		110	25
120	30	20	19.8		128	30
121	30	13	12		106	30
122	30	16	18.7		110	25
124	25	15	21.3		105	25

Table 4: Rod ATV Prescription Tracking Table

Unit #	Planned RD	DXD	Residual QMD	Cut BA	Residual BA	Residual RD
126	30	15				
132/ (Sand #4)	30/25	13/18	13.2/17			
133	25	18	15.5	80	87	25
138	25	18	18	74	111	25
140	25	14	17.5			
150	25	20	14.5	74	74	20
158	30	14	16.2	83	115	30
162/ (Sand #6)	14	14	16.5	94	84	25
164/166	13	13	15.8	113	147	35
170	15	15	15.9	98	116	30
172	15	15	14.2	87	84	25
174	15	15	14.8	56	76	25
182	13	13	13.1	104	107	30

Table 5: Hot Prescription Tracking Table

Unit #	Planned RD	DXD	Residual QMD	Cut BA	Residual BA	Residual RD
322	25	13	14.1	66	74	20
324	25	13	14.4	60	64	16
328	25	14	14.8	82	77	20
330	30	13	14.5	57	89	23
332	30	13	14.6	76	103	25
336	35	16	16.0	103	77	19
338	25	14	15.5	87	54	14
340	30	14	13.3	93	83	22
342	30	14	13.0	100	85	24
344	30	14	14.7	82	79	21
346	25	13	14.2	50	76	20
348	30	14	15.8	105	108	27

3. *Are the silvicultural prescriptions likely to produce variable stand density within units?*

Skips, Gaps, and Heavy Thins are used to provide variable stand densities within the units.

Skips are designed to be areas where no harvesting is to take place. In skip areas, all trees are to be left standing within 25 of orange painted trees. The minimum size of the prescribed Skips is ¼ acre which is 6 marked trees at 50 foot spacing. The maximum size of Skips is prescribed to be 1.25 acres or 30 trees at 50 foot spacing.

Gaps are designed to be an area of heavier thinning than the DxD prescription. Gaps are implemented in the field by harvesting all trees within 25 feet of yellow painted trees. The gap may include between 1 and 6 yellow painted trees at 50 foot spacing.

Heavy Thins are designed to be a heavier thinning than the DxD prescription and larger than a gap. Heavy Thins are implemented in the field by harvesting all trees within 25 feet of yellow painted trees. The minimum size of a heavy thin is 10 trees at 33 foot spacing and the maximum size is 50 trees at 33 foot spacing.

The following two tables show the prescriptions for Skips, Gaps and Heavy Thins for each unit in the four project areas.

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Table 6: Skips, Gaps, and Heavy Thin Prescriptions for K-9 Thin and Quarry Thin

K-9 Thinning				Quarry Thinning			
Unit	Skips	Gaps	Heavy Thin	Unit	Skips	Gaps	Heavy Thin
2	0	0	0	100	5%	5%	0
4	1.5 acres	0	1 acre	102	5%	0	0
6	0	0	0	104	5%	3%	0
8	10%	5%	5%	108	5%	0	0
10	0	0	0	112	5%	0	0
12	10%	5%	8%	114	0	3%	0
14	14%	6%	4%	116	0	3%	0
16	11%	8%	0	118	5%	0	0
18	No prescription – for fish logs			120	5%	0	0
20	12%	0	6%	121	10%	3%	2% in LSR
22	10%	10%	0	122	5%	3%	0
24	10%	0	10%	124	0	0	0
30	10%	5%	8%				
32	0	0	0				
34	10%	0	10%				
38	4%	0	0				
42	5%	5%	5%				
56	5%	5%	5%				

Table 7: Skips, Gaps, and Heavy Thin Prescriptions for Rod ATV Thin and Hot Thin

Rod ATV Thinning				Hot Thinning			
Unit	Skips	Gaps	Heavy Thin	Unit	Skips	Gaps	Heavy Thin
126	36 trees	22 trees	0	322	15%	5%	0
132	36 trees	21 trees	0	324	15%	0	10%
133	19 trees	0	0	328	15%	5%	0
138	36 trees	7 trees	0	330	10%	5%	5%
140	24 trees	0	16 trees	332	10%	5%	5%
150	18 trees	4 trees	0	336	7%	3%	0
158	18 trees	0	10 trees	338	5%	3%	0
162	42 trees	26 trees	0	340	5%	0	0
166	13 trees	0	0	342	5%	0	0
170	9 trees	4 trees	0	344	5%	0	0
172	23 trees	7 trees	0	346	5%	5%	0
174	12 trees	7 trees	0	348	5%	5%	0
182	19 trees	0	0				

Field inspections confirmed that Skips, Gaps, and Heavy Thins were designated in the field. The sampling intensity for this monitoring project was not adequate to confirm the quantities of Skips and Gaps were met in the field. However, the general sense from the extensive monitoring field work completed is the markings in the field reasonably represent the prescriptions identified in the tables above.

In addition to the variability created by the Skips and Gaps, the walk through survey consistently showed a great deal of natural diversity in the units. Some units have riparian areas from streams along side them, and in some cases the streams divide the units into two or three subunits. These stream riparian areas provide good diversity as they are typically different vegetation types than the thinning units. Examples of units with stream riparian areas include: K-9 Thin units 4, 10, 20, 22, 42, and 56; Quarry Thin units 100, 104, 121, 122, and 124; Rod ATV Thin units 158, 162, 164, 170,172, and 182; and Hot Thin units 332, 338, 340, 342, 344, and 348.

In addition to riparian areas, there are also openings, often created by wet areas inside the units. These areas are usually delineated out of the unit but are surrounded by the unit. The openings create good diversity within the stands. Some examples of these cases include: K-9 Thin units 8, 16, and 38; Rod ATV Thin units 132, 140, and 162; and Hot Thin units 340, 342, 346, and 348.

There are also many situations where the adjacent vegetation creates diversity. Examples include:

a. Old growth timber -- An example is the old growth stand lying north of Hot Thin unit 336.
b. A young plantation – An example is the stand of approximately 18 year old reproduction just east of Rod ATV Thin unit 158A.

c. A lake – An example is the small lake located south of Rod ATV Thin unit 158A.

In addition to the above mentioned conditions that create variable stand density, there are many other examples of natural conditions that create variable density. For example, in some cases there are ridges or high points within units that create stocking diversity due to aspect or soil conditions. An example is Hot Thin unit 322. The high point near the center of this unit naturally creates diversity. The stocking on the east side of this area has lighter conifer stocking than is present on the west side of the knob. Hot Thin unit 328 has a high point in the north eastern portion of this unit. The western side of this unit is fairly open, with few conifer trees and more ground vegetation. Disease has also created stocking diversity in a number of stands. A few examples include K-9 Thin unit 4, Hot Thin units 322 and 324, and Rod ATV Thin unit 322.

There are also many small natural small openings within most units. These opening are often occupied by vine maple, rhododendron, or other brush species.

In summary, there is a great deal of stocking diversity within the units. Some are created naturally and some have been created via silvicultural prescriptions.

4. <u>Are riparian no-cut buffers clearly designated in the field as outlined in the EA?</u>
The unit boundaries are clearly marked in the field for the K-9, Quarry, and Hot Thinning projects. There are blue unit boundary signs as well as red tags on the trees along the unit boundaries. Blue ribbon is hung to help find the unit boundaries as well. The Rod ATV Thin sale did not have the unit boundary tags placed at the time the monitoring field work took place. There was only blue ribbon hung along the unit boundaries for this sale when the units were inspected.

There was obviously a great deal of field work done to identify the streams and assure the unit boundaries were the appropriate distance from the streams. The sampling for the monitoring was designed to check riparian no-cut widths and to look for areas that were not properly protected. The streams were checked at many locations in the four project areas and, with very few exceptions, the riparian area width requirements were met. Overall, the work to mark the riparian no-cut buffers was excellent. The few areas needing improvement are as follows:

a. K-9 Thin unit 20: There is a creek running in a northwesterly direction that dissects both units 20 and 22. The no-cut buffers on the south side of this creek are not adequate. The USFS was notified of this shortcoming and have informed me they have adjusted the unit boundaries to provide for a 50 foot no-cut buffer.
b. K-9 Thin unit 42: There is a seep excluded on the northern unit boundary. This seep is creating minor scour that should be protected with a no-cut buffer. R10 and R11 on the field map show the location of this area. The east side of this area was protected with a skip. It is recommended the west side of this seep be protected in a similar manner.

c. Rod ATV Thin unit 132: There is a wet area excluded from the center of the unit. This area had a row of trees left along the west side, but the unit borders the wet area on portions of the east side of the reserve area. It is suggested that a row of trees be left along the east side of this wet area.
d. Rod ATV Thin unit 132: Scour begins near Traverse Point 59 on the unit boundary along the southwest portion of the unit. This area is identified as R4 and SS2 on the field map. It is only 33 feet from the unit boundary to the start of the scour. It is important this is corrected when the boundary tags are hung for this unit.
e. Rod ATV Thin unit 140: There are three excluded areas in this unit. The southern most tip of the middle excluded area at Traverse Point 7 should be extended to protect a wet area. This is shown as SS2 on the field map. Moving the boundary approximately 30 feet south when the boundary tags are hung will correct this problem.
f. Rod ATV Thin unit 140: Along the northern boundary, at Traverse Points 14 and 17, there are creeks with scour. These areas are designated as SS3 on the field map. The unit boundaries need to be adjusted when hanging the boundary tags to account for these streams at both locations.
g. Rod ATV Thin unit 140: The northeast corner of the middle excluded area needs to be expanded to protect a wet area. This location is shown as SS4 on the field map and is marked as Traverse Point 22 in the field.
h. Rod ATV Thin unit 158B: The northeast corner of Unit 158B, at Traverse Point 8, the unit boundary is approximately 34 feet from the creek. This area is identified as R4 on the field map. Only one ribbon needs to be moved to correct this problem when the boundary tags are hung.
i. Rod ATV Thin unit 158C: West of the road on the southern part of this unit the unit boundary is too close to the creek. At Traverse Point 18, noted as R6 on the field map, the unit is 41 feet from scour. Approximately 50 feet west of this area, noted as R7 on the field map, the unit boundary is 46 feet from the creek.
j. Rod ATV Thin unit 164C: A very small portion of this subunit lies east of the road. There is scour in a draw approximately 50 feet east of the road and is shown as SS1 on the field map. When hanging the unit boundary tags, this area needs to be inspected and a determination made as to the appropriate unit boundary. It may be necessary to exclude the area east of the road from the unit.
k. Rod ATV Thin unit 170A: At the northern most portion of Unit 170A, at Traverse Point 28 and identified on the field map as R3, it is 49 feet from the flagged unit boundary to the creek. Care will need to be taken when posting the unit boundary tags to assure proper protection of the stream.
l. There are a number of locations on the three projects which have boundary tags hung where the unit boundary tags were less than 50 feet from the stream but the nearest harvest tree was 50 feet or more from the stream. Examples of this can be found in Quarry Thin unit 102, Rod ATV Thin unit 132, and Hot Thin units 338, 340, 342, 344, and 348. It is recommended the Timber Sale Administrator be made aware of this and

review these situations with the purchaser to assure the areas within 50 feet of the stream are protected during harvesting operations.

m. Hot thin unit 348: At the junction of the temporary spur and road 6349, noted as R1 on the field map, the unit boundary tag is 45 feet from the creek. The spur can easily be located more than 50 feet from the creek but the Timber Sale Administrator will need to work with the purchaser to assure this happens.

By reviewing the deficiencies in stream buffers noted in "a" through "m" above, it should be noted the vast majority of these deficiencies are in the Rod ATV Thin sale. The final layout and posting of unit boundary tags had not been completed for this sale when the monitoring field work took place. The good compliance in the other three projects indicates care is being taken when posting the unit boundaries, modifying boundaries as necessary, to assure the appropriate stream buffers are in place.

5. Are silvicultural prescriptions accurately designated in the field?

With the exception of units located in previous timber sales, the silvicultural prescriptions are clear to follow in the field. The Skips are marked with orange paint, indicating all trees within 25 feet of these trees are to be left standing. The Gaps and Heavy Thins are marked with yellow paint where the yellow painted trees are to be left standing but all other trees of the harvest species within 25 feet are to be cut.

A few of the units are located in previous timber sales. Examples are Quarry Thin units 108, 120, and 122. These sales have faint orange paint left from the previous timber sale. In these units, a different color was used to designate the skip trees which are typically designated with orange paint. The color appeared to be a purplish color. The contract specifies in KT-CT.3.5.7 for Quarry payment unit 108, "In addition to the leave trees designated above, the following trees will be left standing and WILL NOT be used to determine spacing of the trees described in the above paragraph. *trees within 25 feet of a tree marked with orange paint above and below stump height…." There is similar wording for Quarry Thin units 120 and 122. There is a significant opportunity for a misunderstanding or dispute due to the contract reserving all trees within 25 feet of orange trees when there is orange on trees from the previous sale. Also at issue is the color used for skip trees. Purplish paint was used in the field and orange paint was specified in the contract. The Contracting Officer will need to work with the purchasers to make sure there is not a misunderstanding or a dispute arising from the alternative paint colors.

There are discrepancies between the prescriptions for Quarry Thin and the spacing specified in the contract. Those discrepancies are:

- Unit 108 prescription DxD is 20 feet, the contract specifies 15 feet.
- Unit 114 prescription DxD is 16 feet, the contract specifies 15 feet.
- Unit 118 prescription DxD is 16 feet, the contract specifies 15 feet.
- Unit 122 prescription DxD is 16 feet, the contract specifies 15 feet.

It is recommended these discrepancies be reviewed to determine if they are due to decisions made at the time of finalizing the contract or if they were an oversight.

6. Are the minor tree species and the largest trees clearly specified in the contract and/or prescription to be retained?

The contracts clearly specify which species are to be harvested in KT-CT.3.5.7. This section also specifies that the tree with the larger stump diameter is to be left when selecting trees.

- K-9 Thin reserves the western red cedar, dead standing trees, and non-coniferous trees, except red alder, in all units. All other species are designated for harvest. In addition, all trees with a diameter of 25 inches or greater measured 4 inches from the ground are reserved from cutting in all units.

- Quarry Thin reserves the western red cedar, dead standing trees, and non-coniferous trees, except red alder, in all units. All other species are designated for harvest. Also, all trees with a diameter of 25 inches or greater measured 4 inches from the ground are reserved from cutting in units 100 and 121.

- Hot Thin specifies only Douglas-fir is designated for harvest in Units 328, 330, and 332. Douglas-fir and western hemlock are designated for harvest in all other units. The contract reserves the western red cedar, dead standing trees, and non-coniferous trees, except red alder, in all units. Also, all trees with a diameter of 25 inches or greater measured 4 inches from the ground are reserved from cutting in units 322, 324, 328, 330, 332, 346, and 348.

7. Are snags clearly specified in the contract and/or prescription to be retained?

Contract clause KT-CT.3.5.7 # -- INDIVIDUAL TREE DESIGNATION specifies all dead standing trees are reserved from cutting in all units. In addition, the silvicultural prescription for all four thinning projects identifies concentrations of snags or down wood as suggested areas for placement of Skips.

An example of a skip that protects a snag was described in the notes for Rod ATV Units 150 and 164C.

In addition to protecting the standing dead trees, additional snags are being created with the stewardship projects under contract clause KT-GT.9-Stewardship Projects.

- K-9 Thin project number 003 specifies 855 trees are to be girdled to create wildlife snags in the short term and Down Woody Debris within 10 years. See pages 70 through 74 of the stewardship contract. Project number 004 specifies that there are 446 trees to be topped with the intent of creating wildlife snags. See pages 75 through 79 of the stewardship contract. Project number 005 specifies 210 trees are to be inoculated with a stem decay fungus. See pages 80 through 82 of the stewardship contract.
- Quarry Thin project number 001 specifies 330 trees are to be girdled. This girdling is meant to kill the tree and create a wildlife snag in the short term and Down Woody Debris within 10 years. See pages 62-65 in the stewardship

contract. Project number 002 specifies topping 279 trees. The topping is not to kill the tree but to create a wildlife snag. See pages 66 through 69 in the stewardship contract.

- Hot Thin project number 002 specifies 402 trees are to be girdled. The girdling is meant to kill the trees and create a wildlife snag in the short term and Down Woody Debris within 10 years. See pages 65 through 69 in the stewardship contract. Project number 003 specifies tree topping for 254 trees. The topping is not meant to kill the tree but to create a wildlife snag. See pages 70 through 73 in the stewardship contract. Project number 004 specifies the inoculation of 105 trees with a stem decay fungus. See pages 74 through 77 in the stewardship contract.

8. *Are concentrations of Coarse Woody Debris (CWD) clearly designated in the contract and/or prescription to be retained?*

Contract clause KT-CT.3.5.7# -- INDIVIDUAL TREE DESIGNATION (OPTION 1) states dead standing trees are reserved. It does not state what happens to material lying on the ground. On the last page of the contract area maps, note #2 states "Standing dead timber and dead down timber is to be left uncut." It is recommended this wording be included in KT-CT.3.5.7 to assure there is no confusion as to what happens to the dead trees lying on the ground.

The silvicultural prescription for all four of the thinning projects identifies concentrations of snags or down wood as suggested areas for placement of Skips. There were numerous examples of Skips being placed in areas with Down Woody Debris observed when completing the field work. Examples are noted in the field notes for:

- K-9 Thin units 20 and 42
- Quarry Thin unit 118
- Rod ATV Thin units 132,133, 138, 140, 162, 164, and 170
- Hot Thin units 324, 328, 336, 338, 340, and 342

9. *Do Skips contain riparian areas, trees with elements of wood decay, insects/disease, rare plants, large trees, minor tree species, unstable ground, talus slopes, and/or concentrations of CWD?*

During the field survey, there were numerous examples observed of Skips containing riparian areas, trees with wood decay, wet areas, disease trees, and hardwoods. The special features being protected by Skips that were observed during the field inspection and documented in the field notes are listed in the following two tables. The first table documents the features protected by Skips in K-9 Thin and Quarry Thin. The second table does the same for Rod ATV Thin and Hot Thin.

Table 8: Special areas being protected by Skips in the K-9 Thin and Quarry Thin

K-9 Thin		Quarry Thin	
Unit	Special features	Special features	
2	No Skips in this unit	100	
4	Seeps and Hardwoods	102	Knoll
6	No Skips in this unit	104	Red alder
8		108	
10	No Skips in this unit	112	
12	Wet areas	114	
14	Wet area and red alder	116	No Skips in this unit
16	Red alder	118	Hardwood
18		120	Hardwood
20	Wet areas and CWD	121	Hardwood
22	Wet area	122	
24	Wet areas and red alder	124	No Skips in this unit
30	Wet areas		
32	No Skips in this unit		
34	Wet area		
38	Seep		
42	Seep		
56	Stream riparian area		

Table 9: Special areas being protected by Skips in the Rod ATV Thin and Hot Thin

Rod ATV Thin		Hot Thin	
Unit			
126		322	Scour below culvert
132	Hardwoods, CWD and vine maple	324	CWD, root rot pocket, and minor species
133	CWD and vine maple	328	CWD, and wet area
138	Hardwoods and CWD	330	Wildlife tree
140	CWD	332	Wet area and vine maple
150	Western Hemlock (minor spp), snags, and vine maple	336	CWD and a draw
158		338	CWD and a draw
162	Hardwoods, WH (minor spp), CWD, and vine maple	340	CWD and a wet area
164	Hardwoods, CWD, snag, vine maple, draw	342	WCD and hardwoods
170		344	Hardwoods
172		346	
174	CWD	348	CWD, root rot pocket and vine maple
182	Hardwoods and a draw		

10. Are special habitats protected as described in the EA?

During the field inspections, special attention was paid to any special habitats. When walking the units, if there appeared to be a special habitat in the distance, the route was altered to allow inspection of these habitats to assure they were being protected. The unit boundaries were consistently placed in locations that protected special habitats. Special habits observed were documented in the field notes. Following are some of the special habitats that were avoided by good unit layout.

- K-9 Thin
  - Unit 56 avoided wet areas adjacent to boundary.

- Quarry Thin
  - Unit 120 avoided a stand of red alder that is providing diversity in the stand.
  - Unit 121 avoided a seep.
  - Unit 122 avoided an area with brush and scatter western red cedar.

- Rod ATV Thin
  - Unit 132 avoided a large wet area with an under-story of predominately bracken ferns and an over-story of predominately red alder.
  - Unit 138 avoided a wet area and left a row of trees on the edge to protect this area.
  - Unit 140 avoided a large opening with miscellaneous brush species with scattered western red cedar and western hemlock near the edge.
  - Unit 158 protected a small lake.
  - Unit 162 avoided a wet area which includes a large patch of vine maple.

- Hot Thin
  - Unit 324 avoided a natural opening created by a wet area and occupied by grass and brush species.
  - Unit 330 avoided an opening created by a slide.
  - Unit 336 avoided a nice patch of red alder adjacent to the northern unit boundary.
  - Unit 338 avoided a stand of old growth at the northern unit boundary.
  - Unit 340 avoided a wide draw with a wet bottom.
  - Unit 346 avoided a natural opening created by a wetland.
  - Unit 348 avoided a wetland meadow with grasses and miscellaneous brush species.

11. Do Gaps contain riparian areas, trees with elements of wood decay, rare plants, unstable ground, and/or concentrations of CWD?

There were no observations where Gaps contained riparian areas, excessive quantities of trees with elements of wood decay, rare plants, unstable ground, or concentrations of CWD. Overall, it appeared that a great deal of thought went into placing the Gaps and selecting the leave trees.

The prescriptions call for leaving the largest, healthiest trees with good crown. Observations in the field confirmed this was done. There were only a couple of instances seen where it may have been possible to leave a better tree. In addition, in some cases Gaps were utilized to accomplish other objectives. Examples include:

- Quarry Thin
  - Unit 114 left wildlife trees with all trees within 25 feet to be cut.
- Hot Thin
  - Unit 328 created a gap at the edge of a small opening to help enlarge this opening to create more diversity in the stand.
  - Unit 330 has an example of a gap leaving a forked tree for wildlife habitat and cutting all trees within 25 feet.
  - Units 332, 336, and 338 had Gaps located in root rot pockets. The Gap allowed the removal of material that was going to be dead in a few years regardless of harvest prescription.

12. Are Skips and Gaps clearly designated as described in the EA and silvicultural prescription?

Skips, Gaps, and Heavy Thins are clearly designated as described in the EA and in the General Marking Guidelines/Prescriptions.

The EA addresses Skips and Gaps on page 14 as follows:

> **Skips & Gaps** - The protection buffers along streams may be considered Skips. Skips would be created outside of protection buffers that would vary in size and would comprise up to 5% of each unit. Gaps would be created within riparian reserves but they would be 100 feet or farther from a stream. Gaps would be 0.1 to 0.25 acre in size and would make up 0-10% of the available riparian component. For units 122 and 124, Gaps would have similar size and distribution but would be 180 feet or farther from Big Creek.

The following table is from the General Marking Guidelines/Prescriptions which accurately specifies the general guidance from the EA.

Table 10: Skips, Gaps, and Heavy Thin Prescriptions

Land Allocation	Silvicultural tool	Quantity	Size
Riparian Reserve	Skips	Up to 5%	
	Gaps	0 – 10%	.1 to .25 acres
	Relative Density	30	
Late Successional Reserve	Skips	Minimum 10%	.25 to 1.25 acres
	Gaps	3 – 10%	.1 to .25 acres
	Heavy Thin	3 – 10%	.25 to 1.25 acres
	Relative Density	20 to 40	
Matrix	Skips	Up to 5%	
	Gaps	0 to 3%	.1 to .25 acres
	Relative Density	25 to 35	

The General Marking Guidelines/Prescriptions specifies that:
Skips are designed to be areas where no harvesting is to take place. In Skip areas all trees are to be left standing within 25 feet of orange painted trees. The minimum size of the prescribed Skips is ¼ acre, which are 6 marked trees at 50 foot spacing. The maximum size of Skips is prescribed to be 1.25 acres, or 30 trees at 50 foot spacing. The suggested areas/features for Skip placement includes:

- Wet areas
- Concentrations of snags or down wood
- Sensitive botanical species sites
- Unique habitats
- Trees with elements of wood decay
- Clumps of deciduous trees (hardwoods)
- Disease infection sites (Phellinus, Armillaria, dwarf mistletoe)

Gaps are designed to be an area of heavier thinning than the DxD prescription. Gaps are implemented in the field by harvesting all trees within 25 feet of yellow painted trees. The Gap may include between 1 and 6 yellow painted trees at 50 foot spacing. The largest, healthiest trees with good crown ratio are to be left.

Heavy Thins are designed to be a heavier thinning than the DxD prescription and larger than a Gap. Heavy Thins are implemented in the field by harvesting all trees within 25 feet of yellow painted trees. The minimum size of a Heavy Thin is 10 trees at 33 foot spacing and the maximum spacing is 50 trees at 33 foot spacing.

Field work was not done to an intensity that would allow determination if the prescribed quantity of Skips and Gaps were actually marked in the field. Observations did indicate the number of Skips and Gaps appear to be reasonably close to that prescribed .

13. Do the projects meet the desired goals of variability as described in the EA?
On page 13 of the EA is "Section 3.2.1, Variability." This section notes thinning would be conducted to introduce structural diversity through variable density thinning. The following is a list of practices to be used in the design criteria.

- Leave tree spacing would vary within units and between units.
- Skips and Gaps would be created in a variety of sizes. (Skips are areas where no trees would be removed. Gaps are areas where few or no trees would be retained. Gaps may also include areas of heavy thinning where 50 or fewer trees per acre are retained.)
- Leave trees would include minor species.
- Hardwood trees, such as red alder and big leaf maple, are present in many stands. Where they are in wet areas, they would be retained. In dry upland areas, red alder and big leaf maple would be retained where they are a minor species. In some areas these trees comprise a large component of the dry upland portion of a stand. In these cases, some of the hardwoods would be removed to accomplish the desired thinning and some would be retained.
- There would be a greater emphasis for hardwood retention in LSRs than in matrix.

- Leave trees would include trees with the elements of wood decay.
- Leave trees would include some live trees where their crowns touch certain key snags.
- All non-hazardous snags would be retained.
- All existing down logs would be retained and key concentrations of woody debris in the older decay classes would be protected.
- Some snags and down logs would be created.

The answers to many of the previous 12 key questions largely address this issue of variability as it relates to the above list of design criteria. When considering the answers to the previous questions, it can be concluded the project does meet the goals as stated in the EA.

14. Do the silvicultural prescriptions for relative densities in the General Marking Guidelines/Prescriptions meet the relative density criteria specified in the EA?

Section 3.2.5 of the EA (Page 14) specifies the relative density (RD) of 20 to 40 will be retained in Late-Successional Reserves. Section 3.2.6 of the EA (page 15) states a relative density of 25 to 35 will be retained in Matrix areas.

Both the planned relative density and the residual relative density, based on the post marking cruise, shows this criteria is being met in all units on the K-9 Thin, Quarry Thin, and the 10 units on Rod ATV Thin for which the residual RD is available.

The Hot Thin planned RD meets the EA criteria but the RD, based on the post marking cruise, indicates the RD is going to be below established criteria in units 324, 336, 338, 340, 342, and 344. The prescribed DxD spacing for these units ranges from 13 feet to 16 feet. These DxD spacing's are not unreasonable. There are root diseases present in all of these units, which naturally lowers the average RD.

15. Other comments/suggestions:

Cruising Procedures:

During the monitoring process, a total of 12 plots were measured for the purpose of checking the USFS cruising data. The plan was to utilize the results to gain confidence in the data provided. Unfortunately, of the 12 plots checked, the USFS only cruised one of the 12 plots. All of the other plots were count plots. This made it impossible to draw any conclusions from the check cruise data other than check the basal area.

My recommendation would be to have, at a minimum, 50 percent of the plots cruised. Even on count plots, the crew goes to the time and effort to drive to the field, walk to the plot location, mark the plot center, identify and flag the trees in the plot, make a determination of the trees that will remain after harvest, and flag these trees. Once all this work is done, it will take little additional time to record at a minimum:

- The species of all trees in the plot (including minor species)
- The diameter at breast height of all trees in the plot
- The height, grade, and defect of the harvest trees

- Indicate on the cruise card which trees are assumed to be harvest trees and which are to be left

This data would be very useful. It will provide better volume data for the appraisal as well as provide valuable data to determine if the prescription, as laid out in the field, actually meets the relative density targets outlined in the EA.

Measuring Point for DxD Spacing:

The measuring point to determine the largest tree to be left is 4 inches above the ground on the uphill side of the tree. This point is used because it can be checked after harvest. There are some inherent problems with using this point. The problems are:

- The diameter at this point is difficult to consistently measure because the butt swell changes very quickly at this point on the tree
- Lateral roots often affect the diameter of trees at this point.
- It can be difficult to measure when there is down woody debris lying next to the tree or in cases of heavy ground vegetation.
- Numerous examples were observed of trees forking 6 inches to 3 feet above the ground. This approach gives priority to forked trees because they have larger diameters at 4 inches.

It is recommended that the USFS consider using the diameter at breast height to determine the largest trees. This would necessitate the purchaser be required to mark the stand prior to harvest with USFS approval prior to cutting. This may or may not be an additional cost because many purchasers mark the stands prior to cutting. If the stands are going to be marked anyway, the diameter at breast height is much quicker to measure than 4 inches off the ground and can be done with more consistent results.

It is suggested this could be done without tracer paint. With DxD marking, it would not be possible to change trees designated for cutting without violating the spacing criteria.

SUMMARY

In conclusion, the USFS should be commended for their efforts to layout these four thinning projects in a manner that meets the criteria established in the EA. There were many examples where detailed field work was done to identify and protect the riparian areas and other critical habitats. The areas needing improvement was minimal given the size of the project.

There was also tremendous thought and effort put into developing and implementing criteria that would provide for greater diversity in these stands. After harvesting these stands will have a higher component of minor species and will have more variable density.

The USFS has already corrected some of the short comings found during this monitoring project. The combination of going to the time and expense to complete this monitoring project, and then quickly respond to comments, confirms their commitment to meeting the conditions of the EA.