ELLIOTT STATE RESEARCH FOREST

Descriptions of Research Treatments

This attachment contains proposed descriptions of the scope and attributes of what is intended to constitute intensive, extensive and reserve research treatments in stands on an ESRF within the context of the research principles, design, and attributes described above. It is intended to be used as the starting point for designing implementation of research treatments and experimentation that will occur within the context of the future decision-making structure of the forest in support of research. In all cases there will be monitoring protocols established including remote sensing, emerging instrumentation and technology, and historical records to determine if we are meeting key benchmarks before moving forward.

Reserves in the Management Research Watersheds (MRW) and Conservation Research Watersheds (CRW)

1 Efforts will be made to maintain the current proposed CRW as one of the largest contiguous reserves in the southern Coast Range (See Figures 8. and 9).

2 No logging in forests greater than 65 years as of 2020.

3 Assess plantations (forests 65 years and younger) in the CRW and MRW for conservation and restoration within the context of the surrounding landscape.

4 Design and implement an experiment to explore methods for increasing the likelihood of achieving old forest structure, increasing species diversity and creating complex early seral forests from dense single-species plantations.

5 The research protocols will include treatments and controls and will be implemented over a range of forest ages up to 65 years as of 2020.

6 The timing of the treatments will depend upon the experimental design and stand age; however, anticipate the experimental treatments will complete in the CRW in approximately two decades. The MRW may take longer, given the stepwise implementation.

7 Following initial treatments, the only disturbances going forward will be natural and not include logging.

Figure 8. Relative size of the largest wilderness areas on the Oregon Coast and the proposed CRW

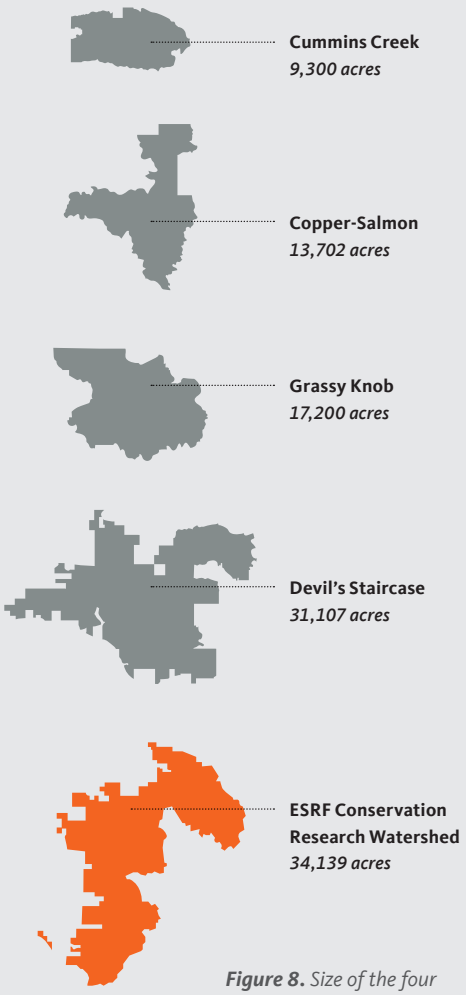

Figure 8. *Size of the four largest wilderness areas in the Oregon Coast as compared to the Conservation Research Watershed. The CRW and Devil's Staircase Wilderness Area are adjacent and represent a 65,246 acre reserve, the largest in the Oregon Coast Range.*

8 Natural disturbances such as drought, disease, wind and insects will occur without salvage.

9 Suppress fire, but will not salvage if mortality does occur.

10 Potentially treat riparian areas on a limited basis during thinning to reduce density and promote the development of older forest structure. No individual trees older than 65 years in 2020 will be harvested or felled.

Figure 9. Forest Reserves in the Oregon Coast Range

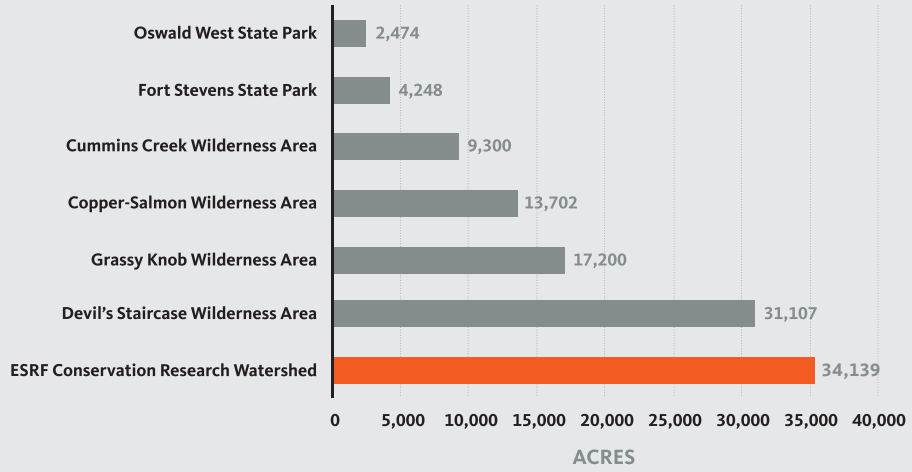

Figure 9. *Number of acres of the largest state parks and wilderness areas in the Oregon Coast Range as compared to the proposed Conservation Research Watershed in an Elliott State Research Forest.*

EXAMPLES OF RESEARCH CONCEPTS AND OUTCOMES ASSOCIATED WITH RESERVE TREATMENTS:

- Emulate natural disturbances
- Incorporate tribal perspectives and traditions
- Vary the level of retention of the existing forest canopy in the plantations and riparian forests
- Vary distribution of retained trees in a dispersed or aggregated fashion in the plantations and riparian forests
- Apply treatments across the spectrum of forest ages up to age 65
- Natural thresholds of the size and quantity of standing dead and downed wood
- Carbon uptake and release with natural disturbance
- Climate impacts in unmanaged forests relative to actively managed forests
- Active management as compared and contrasted with natural disturbance processes

A more comprehensive list of potential research questions and opportunities that are compatible with our experimental approach on the Elliott State Research Forest can be found in the draft Research Charter in Appendix I.

Intensive Treatments in the Management Research Watersheds

1 Even age management using clearcut harvesting techniques suitable for the terrain.

2 Follow all Oregon Forestry Protection Act rules except for self-selected, more stringent requirements in the ESRF riparian areas in headwalls and all streams.

3 Post-harvest application of site preparation and vegetation control practices to ensure seedling establishment and initial growth. This can include a variety of experimental methods to increase our knowledge about the role of vegetation control on seedling establishment and growth. This may consist of the aerial application of herbicides if in compliance with OFPA. Aerial spraying will be used only when necessary and other types of herbicide application are operationally impractical. Over a 60 year period, an intensively treated stand could potentially receive 1-2 applications of herbicide. We need to conduct research using broadly applicable practices so our work can extend beyond the borders of the ESRF. In addition, we are committed to transparency in our herbicide applications and monitoring of them. OSU will engage in monitoring water quality in areas where aerial spraying takes place. Should any evidence be found that herbicide applications in specific target areas are adversely affecting nearby aquatic areas, the practice will be changed in that area.

4 Animal control techniques will not involve the use of rodenticides.

5 Establish plantations at densities that ensure relatively quick canopy closure using species and seed sources best suited for future predicted climate conditions.

6 Maintain stand densities at levels that provide vigorous trees and maintain high wood production through thinning operations. With commercial thinning typically occurring between 35-50years.

7 Determine regeneration harvest and commercial thinning by growth patterns (mean annual increment), vulnerability to disturbances, and markets. With a minimum rotation age of approximately 60 years.

8 Based on context, treatments may vary in rotation length, type of site preparation, species planted, and other

processes. Riparian buffers will be a minimum of 120 feet on fish bearing streams and 50 ft on non-fish bearing streams. These values could be increased or decreased based on identifying key debris flow torrents and the large wood delivery target to fish-bearing streams.

9 As a baseline, all activities will comply with the Oregon Forest Practices Act, the federal Clean Water and Endangered Species Acts.

EXAMPLES OF RESEARCH CONCEPTS AND OUTCOMES THAT MAY BE ASSOCIATED WITH INTENSIVE TREATMENTS:

- Resilience and resistance to minimizing tree loss to drought and diseases over decades
- Social values as represented by differences in perceptions and behaviors
- Economic and carbon analysis of increasing rotation length
- Market analysis and impacts of tree size
- Carbon fluxes and pools through time
- Logging technology and forest engineering
- Site preparation and seed sources
- Species and genotypes for climate resilience and resistance
- Clear-cut harvest impacts hydrological changes, erosion and mass wasting events
- Recreation use levels/patterns and perceptions over time
- Density management and wood yield over time
- Response of aquatic ecosystems

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Extensive Treatments in the Management Research Watersheds

1 On **average**, extensive treatments will seek to produce harvest volumes that approximate 50% of the fiber production of stands managed according to intensive experimental treatments. This means that some treatments with lower retention (20%) will have more than 50% relative yield, and those with high retention (80%) will have a less than 50% relative yield. The goal is to have the yield average 50% at the sub watershed level.

2 Extensive treatments are limited to stands that were established following the 1868 fire or regeneration harvests that have occurred primarily since the 1950's. If there are obvious discrete stands and individuals within younger stands that are very old and we make a commitment to not harvest these. However, aging large trees is not precise enough to specify an age to the year. Even with increment cores, determining tree age is not an exact science, especially when some of the oldest trees do not always "look" their age. We also recognize that due to safety issues in camp sites and logging operations and other unforeseen circumstances trees that predate the 1868 fire may need to be removed on rare occasions. However, we are committed to working with the stakeholders to achieve our commitment to the oldest forests and individual trees as part of further planning and project-level implementation of the research platform. The adaptive management approach calls for the development of a list of criteria or "trigger points" that would trigger changes in experimental protocols. Our intention is that members of the advisory board will be a part of developing these criteria or trigger points.

3 Retain the number of live trees needed to meet various experimental goals (and may or may not include established Riparian Management Areas in overall retention goals to study the integration of those areas into upland management objectives). As a result, the percent retained will range from 20-80% of pre-harvest density and should occur in a variety of spatial and age class patterns (including aggregated and dispersed) to encourage a wide range of conditions that align with the integration of objectives.

4 Size of the experimental units will represent the ecosystem's natural disturbance patterns, including the appropriate mix of clumps and open patches, snags, and down wood while recognizing operational constraints. This design will function as a test of pressing questions such as reduced fragmentation on biodiversity and other attributes such as harvest efficacy and safety.

5 Tree age will vary within a stand, with most having a minimum of two age or canopy position age classes. Return intervals for harvest will depend on monitoring growth and meeting the objectives for a range of conditions, including complex early seral to old growth forests.

6 Focus retention areas and prioritize retention preference based on the following:

- **A** A landscape analysis that identifies what is limiting biodiversity today and into the future using a variety of metrics, including species richness, species at risk, genetic diversity, and landscape diversity).
- **B** Prioritize retention of large, mature (complex canopy structures) trees (based on a combination of factors, including DBH, bole and bark characteristics, tree height, and crown and branching characteristics that are underrepresented.
- **C** If the number of large standing dead and down trees are low relative to controls, experimentally test ways to increase their abundance.
- **D** Incorporate designated marbled murrelet management areas and northern spotted owl habitat (not already located in designated reserves) into the highest (60-80%) retention category unless otherwise allowed by an existing HCP approved pursuant to the federal Endangered Species Act and explicitly incorporated into an experimental protocol designed to quantify the impact of extensive treatments on species abundance.

7 Experimentally test if aggregating retention on unstable slopes is critical to providing attributes including mitigation of landslides, delivery of large wood to streams, habitat for owls, murrelets, and other terrestrial species, and corridors for movement within and among watersheds.

8 Limit and selectively use herbicides only where necessary to manage invasive species or as a last resort to promote tree regeneration.Targeted application of herbicides will be used in extensive if regeneration is not successful. Use of fixed wing planes or helicopters will not be practiced due to large number of retained trees.

9 Plant only where regeneration goals cannot be met otherwise.

10 In the landscape analysis, assess and monitor the spatial pattern of retention areas using a combination of factors; including, but not limited to: population dynamics of at-risk species, maximizing opportunity for biodiversity, aesthetics, promoting wildlife habitat favoring early seral conditions, retention of hardwood trees, wood production, harvest methods, and harvest unit size.

11 Riparian forests that emulate their critical roles in natural disturbance and are fully integrated with upland management, thereby meeting the goals outlined in the riparian management plan. These extensive forests will have different configurations of the riparian ecosystem that maintain critical ecological processes.

12 While the goal to enhance biodiversity may be the same in all cases, the extensive treatments will be adjusted because the initial conditions are highly variable. For example, the initial conditions as represented by age on the ESRF are highly variable; therefore, the experimental treatments will require flexibility to maintain relevance.

EXAMPLES OF RESEARCH CONCEPTS AND OUTCOMES THAT MAY BE ASSOCIATED WITH EXTENSIVE TREATMENTS:

- Emulate and measure response of natural disturbance
- Tribal perspectives and traditions
- Level of retention of the existing forest canopy
- Distribution of retained trees in a dispersed or aggregated fashion
- Treatments across the spectrum of forest ages
- Thresholds of size and quantity of standing dead and downed wood
- Selective and no use of herbicides
- Tree and shrub regeneration
- Prescribed fire to generate pyro-diversity
- Riparian integration with upslope conditions
- Logging systems under varying levels of retention
- Economic thresholds and markets
- Monitoring objectives and protocols

A more comprehensive list of potential research questions and opportunities that are compatible with our experimental approach on the Elliott State Research Forest can be found in the draft Research Charter in Appendix I.

EXAMPLES OF ATTRIBUTES THAT WOULD NOT CHARACTERIZE AN EXTENSIVE TREATMENT:

- Conversion of a forest from a diverse to a less-diverse condition by not retaining key existing legacies
- A selective harvest without accounting for whether the objective of regeneration has been accomplished so that the long-term desired characteristics of the stand are not sustained
- Establishing merchantable volume as the primary or dominant management objective
- Routine or pervasive use of herbicide
- No plan for or monitoring of desired forest, riparian or wildlife attributes
- No landscape level plan

The following tables and figures provide further detail on the allocation of proposed sub watershed Triad treatments and stand level research treatments as of August 2020.

Figure 13. Potential Sub watershed Triad Treatment Assignments

KEY

- CRW
- Extensive
- Triad-E
- Triad-I
- Intensive
- MRW Partial

Figure 13. *Map illustrating the western reserve (CRW) and one potential allocation of sub watersheds Triad Treatments in the eastern half (MRW). Each triad treatment will test different arrangement and types of forest management practices described more fully in the research design brief or in figure 4 below. Partial watersheds have multiple landowners and are not wholly contained in the ESF boundary.*

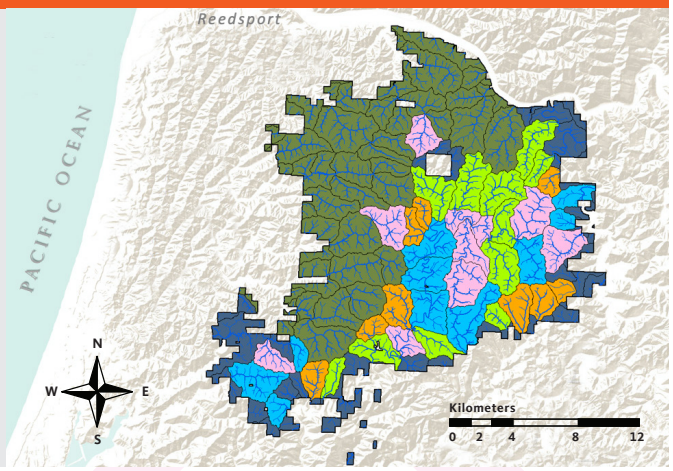

Figure 14. Potential Stand level allocation of extensive, instensive and reserve treatments

KEY

- MRW Reserve
- Intensive
- Extensive
- CRW
- Extensive Reserve (GT152)
- GRMA

Figure 14. *Draft allocation to illustrate one potential suite of allocations on the Elliott State Research Forest. This is primarily to serve as an example of our goal to find a suite of forest management approaches that integrate fiber production, biodiversity, recreation and aesthetic objectives.*

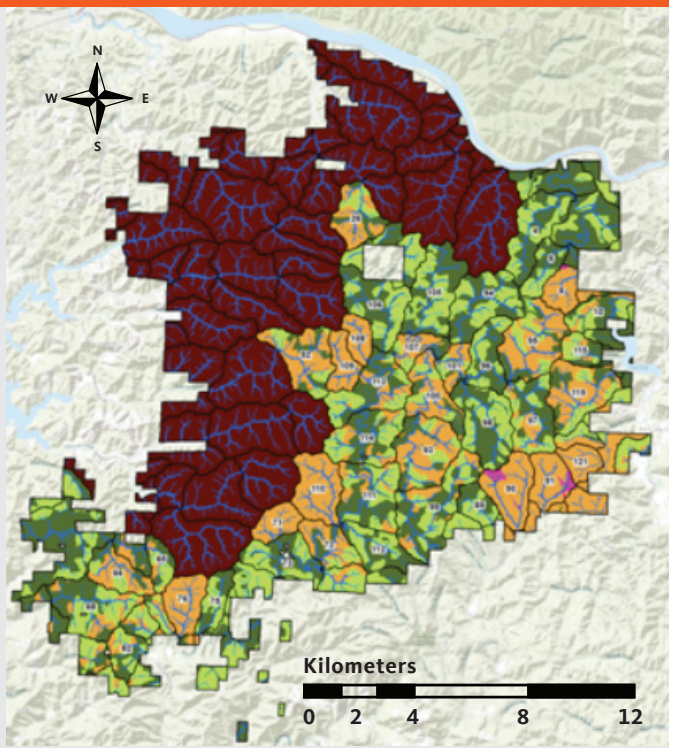

Figure 4. Four Triad Treatments

Figure 4. *Four Triad treatments that will be applied at the sub watershed level in the Elliott State Research Forest. All of the sub watersheds (400-2000ac) in the Multiple Research Watersheds will receive one of these four treatments. Note that these are sample proportions, not spatial layout. The treatments are designed to have a roughly equal yield of wood supply using different combinations of reserves, extensive and intensive forest management, with the assumption that extensive has half the productivity of intensive.*

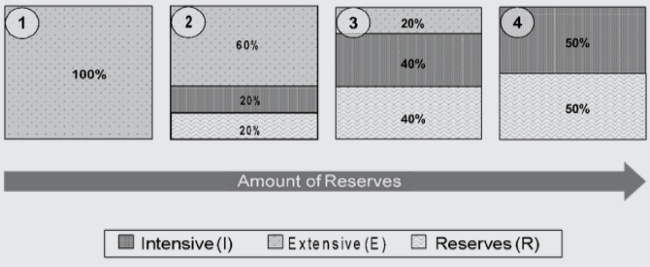

Table 4. Acres per proposed watershed level Triad treatment allocation

Watershed Level Triad Treatment	Gross Acres	GRCA Acres (not including stands in reserve)	Total Acres
Extensive	5,930	636	5,294
Triad-E	9,779	1,197	8,583
Triad-I	10,320	1,229	9,094
Intensive	10,862	1,261	9,602
MRW Partial	11,490	1,038	10,454
CRW	34,139	3,700	30,439
Total Acres	**82,520**	**9,061**	**73,467**

Table 4 *shows estimated acres per Triad treatment allocation based on the September 2020 draft allocation. GRMA is Generic Riparian Management Area and was estimated by fixed buffer widths of 100ft and 50ft on fish bearing and non fish bearing streams respectively. There are no GRMA's in reserve as there will not be harvesting in reserves. Definition of Triad Treatments can be found in figure 4. included again below for reference.*

Table 5. Acres per stand level treatment allocation in the Management Research Watershed (MRW) and the Conservation Research Watersheds (CRW) on the Elliott State Forest

Watershed Level Triad Treatment	Stand Level Research Treatments Acres Net of GRMA				Generic Riparian Management Area	Gross Acres
	CRW	MRW Intensive	MRW Extensive	MRW Reserve		
Extensive	0	0	5,148	146*	636	5,930
Triad-E	0	1,714	5,145	1,722	1,197	9,778
Triad-I	0	3,638	1,816	3,638	1,229	10,321
Intensive	0	4,797	0	4,804	1,261	10,862
MRW Partial	0	4,448	1,660	4,344	1,038	11,490
CRW	34,139	0	0	0	0	34,139
Total Acres	**34,139**	**14,597**	**13,769**	**14,654***	**5,361**	**82,520**

Table 5 *shows estimated acres per stand level treatment in each Triad treatment allocation based on the August 2020 draft allocation. GRMA is Generic Riparian Management Area and was estimated by fixed buffer widths of 100ft and 50ft on fish bearing and non fish bearing streams respectively. There are no GRMA's in reserve as there will not be harvesting in reserves. Definition of Triad Treatments can be found in figure 4. included again below for reference.*

**These 146 acres in extensive Triad treatment are too old for any harvest and therefore have been designated to reserve.*