JULY 2020

RESEARCH TREATMENTS INCLUDING RIPARIAN AREAS ON THE

Elliott State Research Forest

DRAFT

Oregon State University

COLLEGE OF FORESTRY

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JULY 7, 2020

A message from T. H. DeLuca, the Cheryl Ramberg-Ford and Allyn C. Ford Dean of the Oregon State University College of Forestry

Vision for an Elliott State Research Forest

Oregon forests have sustained life for millennia. By merely closing our eyes, we can imagine rolling hills and rising mountains, deep green forests and pastel meadows; salmon runs churning rivers and birds making the most extraordinary sounds. With some careful effort, we can find a patchwork of spaces that provide this experience in the first person. As European presence occurred across the western United States, and the expansion of populations and cities, the ability to grow trees for timber became a critical component of Oregon's rural communities and of expanding economies across the region.

In seeking to create an Elliott State Research Forest, we are reflecting on the immense capacity that exists for forests of Oregon, and beyond, to provide the values we need to sustain ecosystems and economies. We believe that carefully crafted research and scientific inquiry in a dedicated area can inform the conservation and management decisions required to protect endangered species and ultimately lead to their delisting. With broad engagement in designing such a process, economic growth in a genuinely sustainable manner could stabilize and revitalize communities that have been flailing for decades and are always at risk to the boom and bust of policy changes.

We cannot do this with our eyes closed or an unwillingness to dialogue. We must all recognize that this is a unique time for Oregon, the Pacific Northwest (PNW) and the world. We are experiencing the fruits of our unbridled consumption of fossil fuels in the form of human-induced climatic change. The impacts of these changes are evident in the increasing occurrence of extreme weather events, increased scale and effects of wildfire, and an accelerated loss of species. Forest management has a significant role in helping to bring back balance to the PNW and once again take a front seat in the environmental movement, but this remains to be seen. Science and discovery must lead in informing forestry's future.

Forestry must accept its role and responsibility in managing forests for the good of people and the environments upon which they depend. The responsibility is not a small task; people demand many values of their forests, including clean water and air, habitat for species to thrive and survive, climate regulation, places to recreate and gain the benefits of time in nature, and yes, fiber production.

The Elliott State Research Forest represents an enormous and unique opportunity to apply science to sustainably provide its myriad values and guide and inform forest management everywhere in an ethical, and life-sustaining manner. The opportunity includes the study of innovative practices, investigating climate resilience of these practices, demonstrating the forest is far more than timber to be logged, and maximize the value and sustainability of ecosystem goods and services provided by the coastal slopes of western Oregon. The efforts will be for the betterment of people and society, whether they are aware of them or not.

Over a century ago, the discipline of forestry was introduced to the western US as a response to the cut-out-get-out logging of the 1800s that only viewed forests as stumpage value. Forestry as a discipline was radical, and it was the first environmental science put into practice on the landscapes of the western United States. The framing of American forestry was through millennia of indigenous management that led to the development of dramatic and beautiful forests. The condition that we often hold up as 'natural,' was actually a construct of indigenous human design, expert use of fire and conservative, yet broad scope utilization of forest resources. Importantly, it was managed for sustainability and as a part of their community identity. The establishment of American forestry was to address the scars left by wasteful, hasty logging practices and to ensure forests for future generations -- to protect ourselves from ourselves.

A century later, economic demands shifted the focus of forestry from conservation and correcting past inadequacies to centering on the net present value and financial returns. Non-economic values often associated with sustainable forest management were frequently cast in a subordinate role to efficient fiber production and addressed within that context—not quite as bad as the cut-out-get-out principles of the 1800s. The listing of at-risk species sharpened this contrast and led to increasingly polarized views of appropriate goals for active forest management and healthy working landscapes. Fast forward to today, and history defines the forestry profession. Forestry is inappropriately categorized and perceived as one of several extractive industries that are struggling (and failing) to adapt to a changing world. This characterization must change. But, forestry must also change.

In the future, forestry must maximize biological diversity, minimize fragmentation and enhance habitat for species of concern while still meeting fiber demands of a growing population. Forestry and its science should draw upon the wisdom, knowledge and history of indigenous partners to learn how to ethically approach and apply management so that nature and people may thrive. Forestry needs to support and sustain rural economies with skilled jobs that support families and livelihoods. Forestry needs to protect and promote the health and well-being of rural communities through ecosystem services and places to recreate. The

practice of forestry must maximize its contributions to societies to offset global warming. Forestry can accomplish this by yielding sustainable, renewable and value-added timber for homes. At the same time, provide cost-effective mass timber products for commercial wood buildings that displace carbon-emitting steel and concrete construction. To ensure we practice forestry in a manner that provides these multiple values on a sustainable basis will require operational scale research in representative settings. Research that can seed enhanced methods and practices that can be implemented on forest lands across the Pacific Northwest and beyond.

Can we create such a path forward for a forestry's future? Yes, absolutely, and the size, location, and multiple values that define the Elliott State Forest present a singular opportunity to study, develop science, and demonstrate how to attain this future.

To transform the Elliott State Forest into the "Elliott State Research Forest" will require forethought and adherence to a management platform that will support research initiatives today and into the future with the controls and replication that define the rigorous expectations for thoughtful science. As others in this process suggest, we must be capable of undertaking science that helps address how we can achieve broad-scale conservation goals and ameliorate climate change on forest landscapes. We must do this while also producing fiber for a growing world population. Undertaking science of this scale is the central challenge that the Elliott State Research Forest must meet to fulfill its potential. While there are many issues to address before the ongoing conversations narrow to a recommendation to the Land Board, I believe there are [five] pillars essential to accomplishing the vision for the OSU College of Forestry to oversee an Elliott State Research Forest:

1. The values people hold for the Elliott State Research Forest and forests everywhere drives the research. The prime motivation is the sustainable and ethical provision of all of the values. We base decisions on the principles of diversity, equity, and inclusion of values and people.

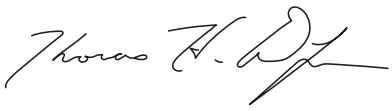
2. A cross-section of treatments that represent a spectrum of operational settings from reserves and conservation-oriented thinning to more intensive management must support the research design. The TRIAD research design currently being considered has excellent potential for creating a platform capable of supporting a variety of research over an extended time. The challenge is to align these different treatments with stand attributes and species concerns without introducing bias that will compromise that research.

3. While the forest must be self-supporting, harvest will not take place for the purpose of generating revenue. Only when there is certainty and transparency that revenue from harvests is a derivative of maintaining and implementing the research design platform can stakeholders and the public be assured that OSU management reflects public expectations for what the research forest is supposed to represent.

4. TRIAD treatments need to maximize the values of older forests by minimizing impacts to the structure, composition (including species of concern) and function of older forest stands. The research design should protect past unmanaged, naturally regenerated stands. However, this has to be accomplished without limiting the scope of future research to test the relationship of management actions in different age classes to a variety of response variables.

5. The structure and values associated with how we make decisions relating to the management of the Elliott into the future are as important as the research design we agree to implement. I aim to achieve a transparent structure, collaborate with a cross section of stakeholders, and create clear lines of decision-making authority and accountability to ensure the development and execution of a forest management plan is always supportive of the research goals for the forest.

We stand at the edge of a new frontier with a choice to make. We can move forward into as-yet uncharted territory and work together to place forestry at the forefront of a sustainable future, or and accept the status quo. As we know, forestry as a practice is far more than just a means of acquiring timber. Forestry, in its essence, is a conservation science and an adaptive practice that considers ecosystems holistically and seeks to meet multiple objectives and provide for future generations. Being adaptive means being able to evolve to meet challenges and opportunities. The evolution of the forestry profession requires thorough scientific inquiry, application and evaluation. The Elliott State Research Forest represents our path into this new frontier. It will require that those who care deeply for this forest, forested landscapes across the Pacific Northwest, and for the practice of forestry, remain committed partners to our College well into the future.



Tom DeLuca
Cheryl Ramberg-Ford and Allyn C. Ford Dean of the Oregon State University College of Forestry

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RESEARCH TREATMENTS INCLUDING RIPARIAN AREAS ON THE

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Foreword

In 2019, the College of Forestry set forth a series of guiding principles for research on the Elliott State Research Forest (ESRF). Described more fully in the draft Research Charter (Appendix 1), these principles envision the Elliott as a place where research focused on sustainable approaches to forest management is of primary importance. As outlined in the guiding principles, research conducted on the Elliott should be enduring across generations, at a large scale that is tailored to the landscape while maintaining relevance through continued stakeholder collaboration. These principles form the basis for the implementation and execution of research treatments on the forest over time. We do not intend for this document to be the comprehensive Elliott State Research Forest proposal. This document is not the final, comprehensive proposal. This document provides as much detail about the research treatments as we can within the ESRF exploratory process and the currently available data. The final comprehensive proposal will include sections that address governance, recreation, carbon, decoupling from the Common School Fund, habitat conservation and others.

The intended audience of this document is the State Land Board (made up of the Governor, Treasurer and Secretary of State) and the Department of State Lands. They are advised by the Department of State Lands Elliott State Forest Advisory Committee.

Oregon State University

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Overview of the Elliott State Research Forest Research Platform

The goal of the research platform on the Elliott State Research Forest (ESRF) is to use a systems-based approach (Figure 1.) to investigate the integration of intensively managed forests, forest reserves, dynamically managed complex forests and the aquatic and riparian ecosystems that flow within them. Most importantly, the size of the ESRF will enable us to explore and quantify the synergies and tradeoffs associated with different arrangements of these treatments at a landscape scale through time. We can implement and study forestry on an appropriate temporal and spatial scale while assimilating wood fiber production with other values and services that address the well-being of terrestrial, riparian, and aquatic ecosystems. To honor the rich legacy of this land, an Elliott State Research Forest should do nothing less than reimagine the future of forestry.

Through time, the focus of forestry and forest research has drifted towards the extremes of forest conditions, plantations, and protected areas, without investigating new approaches for meeting sustainability goals. Forest research to optimize wood production centers on plantations created by repetitive, intense disturbances in the form of clearcutting and rapid tree establishment. At the other end of the spectrum, researchers study unlogged, naturally regenerated, young, mature, and old-growth forests to better understand processes and functions such as carbon sequestration, water quality, biodiversity, and human dimensions. By focusing on these endpoints, the crucial question of what lies between plantations and unlogged reserves is left unanswered. We propose to fill this knowledge gap by conducting research on integrating a suite of social and biophysical objectives and attributes such as carbon sequestration, timber production, recreation, and habitat for imperiled species. We propose to do this across the ESRF over multiple generations with the sincere belief that this integration is the future of forestry.

We envision a robust experimental design consisting of integrated plantations, unlogged reserves, streams, riparian forests and forests that are dynamically managed for the complexity of species and canopy layers (Figure 2.). As the forests on the ESRF age and research progresses, we will see at-scale results that quantify combined effects and tradeoffs among ecological, economic, and social values. The ESRF will consist of two major designations; Management Research Watersheds (MRWs) and Conservation Research Watersheds (CRWs). The research treatments applied to the CRW and MRW will deliver the knowledge needed to support forestry's next evolution.

The Elliott State Forest is well-positioned to support this integrated research. Currently, 42,000 acres of the forest are Douglas-fir plantations, established primarily between 1955 and 2015. These relatively intensively grown stands reflect the practice of forestry over the last six decades. Production-oriented (herein *intensive*) research treatments in these forests will allow us to investigate management options that primarily emphasize the production of wood fiber at rotations of 60 years or longer. At the same time, we can assess methods to reduce the impact of this harvest regime on other attributes such as biodiversity, habitat, carbon cycling, recreation, and rural well-being.

Figure 1. Conceptualizing the Elliott State Research Forest as a social-ecological system

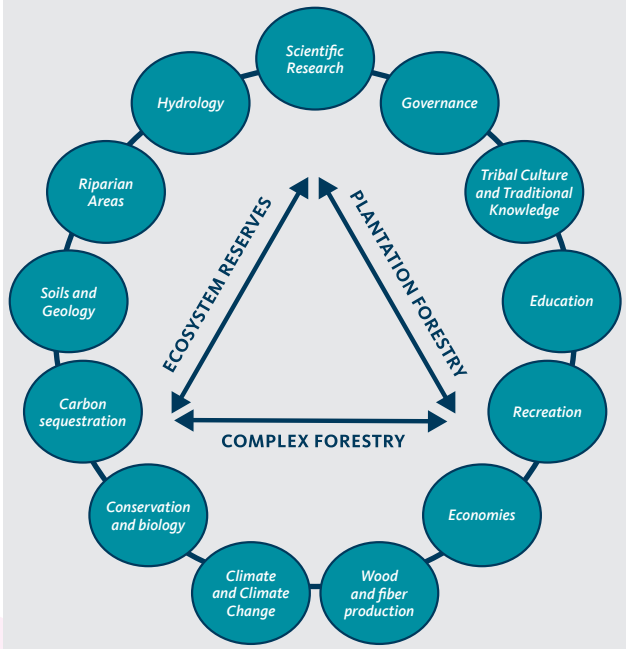

Figure 1. *Conceptualizing the Elliott State Research Forest as a dynamic system with an array of interconnected elements. Note that our research is embedded within the ecological and social systems.*

Reserve experimental treatments will be derived primarily from the unlogged, naturally regenerated stands that comprise 35-40,000 acres (or up to 49%) of the landscape. The reserve treatments include former plantations, recognizing the need for a focused effort to recruit *future* old stands. Such treatments will have two starting points: a) Exploring treatments to restore and enhance conservation value in established plantations that will transition to reserves; b) Conserving unmanaged mature forests as they move through natural successional processes. These unlogged forests are ideal for monitoring ecosystem attributes such as biodiversity, recreation, carbon cycling, and water in the absence of any timber harvest. Thus, they serve as benchmarks for research treatments and managed habitat.

While intensive and reserve treatments provide opportunities to study the extremes, a third research treatment will seek to increase forest complexity to help achieve multiple values across the landscape. The goal of these widespread dynamically

managed forests (herein *extensive*) will be to explore the implementation of a new set of alternatives in a continuum between intensive plantation management and unlogged reserves. The research design on this continuum of extensive alternatives will aim to enhance diverse forest characteristics and better integrate them with riparian forests to meet a broad set of objectives and values in any stand. We can accomplish this goal by retaining (or creating) structural complexity while ensuring conditions exist to obtain regeneration and sustain the complex forest structure through time. **Extensive alternatives represent the most significant opportunity for learning and expanding the frontiers of timber management by aiming to simultaneously achieve biodiversity objectives and timber demand at the stand scale.** The extensive treatments are where a vision for a genuinely sustainable approach to land management - reflecting social values and needs as well as ecosystem function - will be tested.

A triad framework for landscape-level research exploring the range and juxtaposition of intensive, extensive, and reserve experimental treatments will provide solutions to long-standing and emerging forestry issues. Research of this scale allows us to address questions of biodiversity, climate change, carbon sequestration, impact on rural economies, recreation, and cultural values, among others. At this scale, it may allow us to pursue research questions we can't even imagine today (Triad treatments are illustrated in Figure 1. and the triad framework is defined in Research Charter in Appendix I, also see Figure 3.).

With novel and increasingly uncertain future environmental and social conditions, we need to imagine alternatives to forestry. We must research alternatives to specified rotation lengths, stem density, species diversity, age diversity, configurations of riparian buffers, and conduct research to assess how these choices respond to the systems within and outside of the forest through time. We need to look forward by exploring all options and tradeoffs -- not just those we have grown accustomed to. Exploration is the essence and function of a research forest and will not happen through merely establishing isolated reserves in a landscape of traditionally managed forests.

The ESRF represents an enormous and unique opportunity to study, at appropriate spatial and temporal scales, novel practices, and the climate resilience and resistance of ecosystems managed under these practices. The ESRF will attempt to honor the millennia of stewardship these forests underwent from generations of Indigenous peoples by demonstrating that the forest is far more than timber to be logged and maximizing the value and sustainability of wood products.

Adaptive approach to research implementation

Undertaking the design and implementation of a research program of this magnitude and complexity is daunting. Accordingly, a phased research implementation plan, coupled with adaptive management protocols, modeling, ecosystem

Figure 2. Percentage of area allocated to proposed experimental treatments on the proposed ESRF

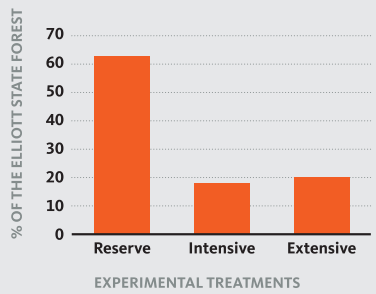

Figure 2. *Percentage of area allocated to proposed experimental treatments on the proposed Elliott State Research Forest. The reserve treatments are a combination of a large approximately 35,000 acre area and several thousand smaller pieces ranging from 20 to 800 acres. Intensive will be primarily even age plantations and Extensive will be dynamically managed for age and species complexity. The riparian areas are contained within each of these treatments for this analysis.*

Figure 3. Percentage of reserve, intensive and extensive treatments in the TRIAD framework

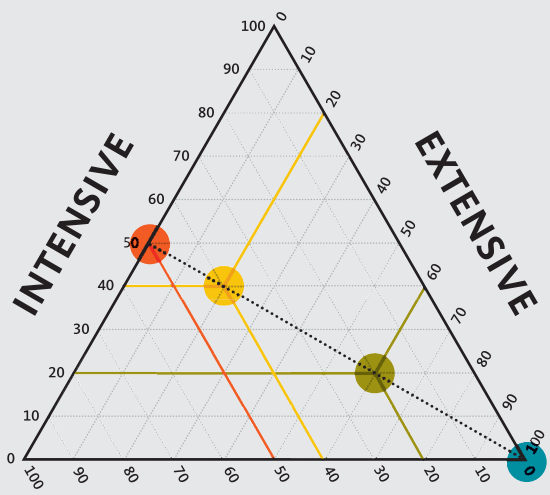

Figure 3. *An illustration of the four experimental treatments that will be applied at the sub watershed level in the Elliott State Research Forest. All of the sub watersheds (400-2000ac) in the Multiple Research Watersheds will receive one of these four treatments. The treatments are designed to have a roughly equal yield of wood supply (represented by the dotted line) using different combinations of reserves, extensive and intensive forest management, with the assumption that extensive has half the productivity of intensive. Maintaining constant wood supply across the ESRF is not only an important part of the research design, but imperative if the ESRF is to be self-sustaining. The revenue generated from forest harvests is intended to cover the costs of operating a research forests (including recreational and educational programs for the public).*

science, and stakeholder input, will be used to reduce uncertainty and ensure the viability of the research through time. The phased approach (progressive increase in research activity across the ESRF over time) will include selecting a suite of watersheds from the Management Research Watersheds (MRWs) to conduct trial treatments and then utilize data analysis, modeling and stakeholder input to adapt and refine the research plan. The length of time that this adaptive process will take is difficult to predict as this time, but our best estimate is somewhere between 10-20 years given the slow rate that trees grow, and ecosystems respond. The adaptive approach (increasing depth of activity within the first phase of the ESRF over time) is briefly envisioned as follows:

A Conduct an in-depth landscape analysis of the ESRF

B Identify and test the criteria for selection of 16 sub-watersheds (4 replicates of the 4 treatment categories)

C Based on these data, allocate treatments to each stand within the sub-watershed in proportion to the initial experimental design

D Develop a list of criteria that would trigger changes in experimental protocols

E Explore what changes are experimentally and socially acceptable if triggers are met. (Both d and e should be an open and transparent discussion, i.e., with external peer and public input)

F Design and implement monitoring protocols that include previously established triggers in initial sub-watersheds and several untreated watersheds

G Initiate treatments within the first 16 sub watersheds

H Monitor criteria that trigger changes in experimental protocols; revisit e.

I Adapt treatments for remaining watersheds as needed based on monitoring results, analysis, and stakeholder input

There are several numerous benefits to a stepwise implementation plan. These include:

- Increased input from the broader research community and local and regional public entities with each progressive step.
- Collection of multiple years of pre-treatment monitoring data on at least 7 of the 10 sub-watershed replicates to inform future applications of treatments.
- Development of a better understanding of the system we are experimenting within and the ability to design a study that is adaptive and flexible enough to withstand changes in social, economic, and ecological conditions over the very long life of a forest.

Over time, as we add more watersheds to the matrix of experiments, the phasing will continue. We anticipate a similar process and outcome for the former plantations in the Conservation Research Watershed experimental treatments. Since there is only one phase of active management planned (thinning plantations), the timeline may not be as long. We will describe other attributes of timing and implementation of activities on the ERSF in the forthcoming documents on governance.

Aquatic and Riparian Area Research Strategy

We cannot implement and study forestry on a landscape scale without addressing the concerns of terrestrial, riparian, and aquatic ecosystems as an integrated system. Riparian forests provide several critical functions, including large wood recruitment, controls on stream temperature, litter input, flow regimes and reducing stream sediment loads that are important for maintaining native aquatic biota in headwater streams. We will use observational and experimental research across the Elliott State Research Forest (ESRF) landscape to explore how different management strategies affect these processes will inform future forest policy and management practices.

Fundamental aquatic and riparian conservation studies will be set in the context of a research forest that includes studies on terrestrial and aquatic ecosystems. The studies will recognize both as interconnected components of a larger system. Riparian ecosystems potentially encompass a wide range of habitats and conditions across the landscape, including fish bearing and non-fish bearing streams, perennial and intermittent streams, adjacent forests, saturated streamside soils, headwalls, side slopes, ridges, and the biota contained within. Because previous research has primarily sectioned the landscape into seemingly discrete areas such as designated riparian areas along fish-bearing versus non-fish bearing streams, there is a knowledge gap around an integrated whole-ecosystem response to alterations in streamside and key upland forests. How do we sustainably integrate across the forest landscape, including headwalls and intermittent streams, when managing for aquatic biota? By studying a suite of forest management approaches and seeking practices compatible with forest values, we can envision a future where forest management doesn't lead to the degradation of our aquatic and terrestrial ecosystems.

Core Strategies

The Elliott State Research Forest will advance knowledge of riparian areas and aquatic systems through passive management and active restoration experiments. The core framework for studying riparian areas is part of the land-use allocation of watersheds across the forest into Conservation Research Watersheds (CRWs) and Managed Research Watersheds (MRWs). In the approximately 35,000-acre CRW, all actions will aim to research long-term, landscape-level conservation outcomes. In the Management Research Watersheds (MRW), a range of research treatments are applied at a watershed scale, with multiple replicates, to support the investigation of a wide variety of response variables.

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Typically, in actively managed forests, designated riparian conservation areas (RCAs) of a given width are delineated and explicitly managed for conservation of aquatic and riparian functions. The ESRF and proposed research design scale creates a unique opportunity to measure the long-term effects of varying levels of integration of RCAs with upland forests on species recovery. Within the reserve treatment areas that are not actively managed, the relevance of designated RCAs is less evident. Currently, approximately 61% of the ESRF is proposed to be placed in reserves, where restoration thinning of approximately 14,000 acres of existing Douglas-fir plantations may occur over the next 10-20 years and where no harvests will occur on roughly 37,000 acres of naturally regenerated older forests. Therefore, in the near term, the aquatic, riparian and upslope ecosystems within the unlogged reserves will be the same fully integrated system that has been in place since the last significant disturbance over 100 years ago, without need for RCAs. Designated RCAs are most applicable in the approximately 18.5% of the landscape under Intensive management, with even-age clearcuts on a 60 year or greater rotation. The older, more diverse designated RCAs will be less integrated with these young upslope homogenous plantations. With their retention of legacies, longer rotations, and canopy complexity, the extensive treatments on 20% of the landscape will be managed to facilitate better integration with the RCAs.

The research design for the forest intends to move beyond forest management alternatives alone and also explore restoration actions designed to improve the ecological function of RCAs (including forests and associate streams). Further, because we are approaching research in the ESRF from a whole system perspective, the riparian and aquatic research program will encompass the assessment of research outside riparian areas (such as research on road restoration and decommissioning, recreation, harvest on steep slopes, earth movement, and natural disturbances). Upslope activities will include components to preserve their integrity and understand resilience and resistance of RCAs associated aquatic ecosystems.

Key Attributes of a Riparian Conservation Strategy

A **Land Use Allocation:**

- **A** The large area of forest placed in reserve in the CRW anchors the conservation strategy by establishing a contiguous area managed for long term ecological functions in support of full integration of terrestrial and aquatic ecosystems. Here, research-related actions will be limited to those that are likely to benefit the long-term conservation of native biota (e.g. restoration of forest complexity). In the MRW, research will utilize a framework including reserve forests and forests influenced to a varying degree by timber harvesting. The MRW will be capable of testing the ability to integrate and quantify these strategies' capacity to accommodate a broader suite of values and variables.

- **B** **Riparian Conservation Areas:** The aquatic and riparian conservation component of the system-based research strategy will rely on a set of designated RCAs. These RCAs design will maintain and restore vital ecological processes that influence the aquatic ecosystem in the Intensively managed and Extensively managed treatments. In the Reserves, the designated RCA will only be applicable for a limited time when thinning occurs over the next 10-20 years. Activity within RCAs will be limited to forests where prior management actions have resulted in conditions that require limited intervention to test restoration of ecological processes (such as over-stocked plantations, or the absence of large conifers or hardwoods). The activity may occur throughout the entire width of the RCA. The criteria and characteristics of restoration and experimental treatments in RCAs will always be to maintain and restore the ecological process. The aim of the treatments will not be to produce timber volume. All treatments will occur within an experimental context with monitoring, data collection and analysis, and reporting within an adaptive management framework.

B **Non-fish bearing streams:** These streams are the most abundant portion of the riverine network of the ERSF, comprising more than 80% of the stream miles on the ESRF. Non-fish bearing streams are critical to maintaining the aquatic ecosystem's productivity by providing cool water, wood, sediment, fish prey, and nutrients to fish-bearing streams. These streams provide habitat for a suite of native amphibians, insects, birds, bats and other organisms, and they function as a corridor for energy and nutrient flux within the watershed. Research on these streams will focus on: (1) Their ecological role and influence on fish-bearing streams; (2) How they may serve as movement corridors within and among watersheds for terrestrial organisms, energy and carbon; (3) How to treat previously managed forest areas adjacent to these streams to change the vegetative composition and structure. By doing so, it will create opportunities to study the influences on riparian soils and use by terrestrial and riparian organisms, the behavior of landslides and the effects on fish-bearing streams, and the production of invertebrates and nutrients that transport to fish-bearing streams.

C **Steep Slopes:** Steep slopes are a key attribute of the ESRF landscape. As integrators of local and watershed-scale processes, streams in the ESRF are ideal locations to research how steep slopes, directly and indirectly, affect ecological processes in aquatic ecosystems. There are opportunities to better understand the integration of steep slopes and the streams confined by them and how this relationship changes with time and space. Do key processes

leading to the production and delivery of large trees and sediment/nutrient pulses to the aquatic systems occur more quickly in steep landscapes? And if so, what implications does this have for the retention of carbon, nutrients and biota in headwater ecosystems? We are particularly interested in quantifying the role of large wood in sorting sediments and creating functional habitat in steep landscapes. This process is generally understood but lacks long-term empirical data. Studies will seek to provide knowledge of short and long-term impacts of headwater stream retention and headwater stream failure (landslides). While conducting this research, we will monitor the landscape using the High Landslide Hazard Location database produced by the State of Oregon, followed by more site-specific examinations to address the hazards brought by specific operations.

D **Roads:** Roads are imposed on the landscape to maintain access to remote sites for several uses, including recreation, firefighting and removing wood products. Roads also represent a significant human impact on the larger forest system in terms of chronic long-term disturbance, fragmentation, sediment yield, and access for invasive species. Regardless of the use, gaining access via roads disrupt ecosystem processes essential for the proper functioning of aquatic and riparian ecosystems. This disruption is especially evident where there are hydrologic connections between the road and aquatic networks such as sediment-laden runoff and rapid peak flows. Given the density of roads and streams on the ESRF and the presence of listed species, ways to mitigate impacts of strong hydrologic connections are areas of potential significance and wide application in the Northwest.

While still early in development, the OSU proposal for an ESRF envisions studies on the degree of hydrologic connections of current and legacy roads and their primary locations on the ESRF. Monitoring will identify candidate roads for modification with the goal of testing methods for reducing hydrologic connections through road restoration, and long-term monitoring of subsequent impacts on habitat. In support of this, the ESRF will maintain an inventory of the road network to identify current and legacy roads that present a risk to the aquatic and riparian system and seek to implement modifications to the road system prioritizing segments that pose the highest risk to aquatic resources.

We will examine the possibility and effectiveness of partial road decommissioning in the context of providing access for firefighting and recreation consistent with reserve goals and State Land Board guidance. The road network in the CRW and MRW reserve watersheds will likely decline over time, and new, permanent roads may be constructed as part of a strategy to decommission road segments that are a problem. Still, we must implement such a strategy in the context of the forest research plan.

Attachments

The following attachments are included below to provide context and additional clarification to the research design, treatments, and riparian research strategy described in the narrative above. These attachments provide more detailed information on research objectives to accommodate the challenges imposed by existing forest inventory and age distribution, landscape and ecological constraints, and the variability that may accompany how treatments may be implemented across different stands.

Attachment A describes the process used to determine the spatial extent and location of treatments in the first iteration of the proposed experimental design that incorporates intensive, extensive, and reserve components.

Attachment B intends to provide initial guidance for the implementation of treatments. Treatments will be determined over time and across the assigned Management Research Watersheds. These decisions will happen within the context of the management and decision-making structure established for the research forest and outlined in governance protocols.

Attachment C describes the steps we are taking to conduct a landscape analysis to allocate and integrate the riparian areas with adjacent research treatments and determine RCA width requirements in intensive and extensive research treatments.

Attachment D intends to provide initial riparian area treatments and details on stream types, stream buffers in the CRW, MRW, and the West Fork of the Millicoma River.

Attachment E provides additional maps and graphs on the proposed research design of an Elliott State Research Forest.

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ATTACHMENT A:
TREATMENT ALLOCATION PROCESS

Attachment A outlines the processes used to determine the spatial extent and location of treatments in the proposed TRIAD experimental design.

Elliott State Forest Age Pattern

The Elliott State Forest has a bi-modal age class distribution (Figure 4.) that can be explained by three general scenarios. Note that these may not represent the stand history of every single stand but the primary activities in the recent past.

1. Forests that regenerated naturally following fire, wind events, or landslides that were regenerated following clearcut harvests starting in 1955 (aside from one early harvest in 1945) to generate revenue for the Common School Fund. Some of them may have had a pre-commercial or commercial thinning. Regeneration methods varied over this period, starting with a reliance on natural regeneration, followed by aerial seeding, and hand planting starting around 1970. These practices resulted in approximately 41,000 acres of forest, consisting primarily of Douglas-fir with some alder, western hemlock and western redcedar. Understory diversity is limited. These stands are 65 years or younger as of 2020.

2. Forests that regenerated naturally following fire, wind events, or landslides and had about 30% of the tree volume removed when the forests were approximately 75 to 125 years to improve the growth of remaining trees and generate revenue. These harvests occurred primarily between 1957 and 1977. Several of these forest stands have subsequently been clear cut and converted to Douglas-fir plantations, but we suspect, based on some old records, that somewhere between 5,000 to 10,000 acres may still exist. These stands are primarily 100 to 160 years in 2020.

3. Forests that regenerated naturally following fire, wind events, or landslides. The primary stand-replacing fire occurred in 1868, but other more localized fires and other disturbances may have happened. There are a little over 40,000 acres of naturally regenerated forests, but it is uncertain how many acres were partially logged (treatment outlined in scenario 2) due to spotty historical records. However, if one assumes that approximately 5-10,000 acres of these older forests were partially harvested, then that leaves 30,000-35,000 acres of unmanaged forests. The age range of these forests is from 80 to 230 years, with 71% of this forest type between 130 to 160 years.

4. Snags from the 1868 and other fires and other disturbances were systematically felled and sometimes removed from the Elliott State Forest to reduce fire danger. The activities occurred in areas that may not have been logged otherwise. Therefore, even the unlogged forests may not be an accurate baseline for the level of standing and down deadwood. We do not have records of the extent of this practice, but it warrants consideration.

Figure 4. Elliott Forest Age Pattern

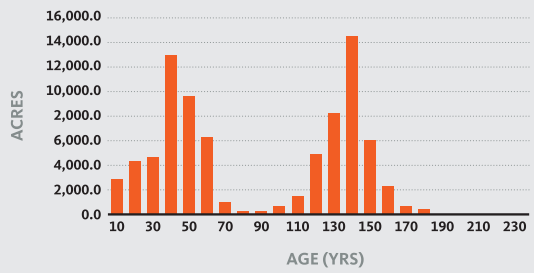

Figure 4. *Age distribution on the Elliott State Forest by age class as of 2020. Allocation based on June 2020 DRAFT treatment allocation. Under 65 years of age are forests that regenerated following a clearcut. Stands over 65 years of age regenerated naturally primarily from wildfire.*

Draft methods for assigning sub-watersheds and then stands to research treatments

1. **Obtain the most recent set of information with accurate stand locations and ages.** This includes working with indigenous communities to ensure appropriate care is taken to avoid culturally significant areas and spiritual places. Identify recent management practices such as locating the approximately 10,000 acres of the 1868 burned areas that were partially harvested between 1957 to 1977.

2. **Look for bias in the placement of historic management units on the forest, based on elevation, aspect, and slope percentage.** Forest regeneration harvesting began in 1955 about 65 years before the 2020 adjusted ages, so we consider anything below 65 years as managed for this analysis. Depending on the degree of bias in the placement of these stands, we will determine if stratification is necessary before assigning treatments to the sub-watersheds.

3. **Assign sub-watersheds and stands within watersheds to the treatments by optimizing the following:**
   - **A** Prohibit any harvesting in stands that predate the 1868 fire. There are approximately 400 acres or 0.5% that remain from the nearly 5,000 acres of forests that predated the 1868 fire, when the Elliott State Forest was established. They are the remaining link to the past, are culturally and socially significant, and serve as an essential control to scientific study.
   - **B** Focus harvests in stands that have had prior clear-cut harvests and regenerated with a focus on wood production (primarily less than 65 years old in 2020 since harvests started in approx. 1955).
   - **C** Limit harvesting of stands greater than 65 years in 2020 to extensive treatments. No forests older than 65 years

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in 2020 will be assigned the intensive treatment. We will include only forests that were clear-cut, starting in approximately 1955, in the intensive treatments going forward.

D Extensive harvests in stands greater than 65 years will be preferentially done in stands closest to 65 years in 2020, and the older stands (90-160 years), once identified, that have had a prior thinning.

4 **Review and adjust assignments and this initial set of criteria based on:**

A continuing to work with indigenous communities to ensure that appropriate care is taken to avoid culturally significant areas and spiritual places;

B updated inventory, landscape analysis including the aquatic component and the ecological importance of headwater (non-fish bearing streams); and,

C other relevant information that is unavailable today.

5 The process is intended to be iterative and adaptive and will take place in the context of the decision-making structure and protocols established for managing the forest over time.

Following these criteria, the following figures and tables illustrate the age distribution across treatment types in the first iteration of the Elliott State Research Forest's research design.

Table 1a. Number of acres per treatment by age class

Age (yr)	Reserve	Intensive	Extensive	GRCA in Intensive and Extensive
Under 65	15,905	13,624	10,406	2,089
Over 65	35,573	0	4,271	658

Table 1a. *Number of acres per treatment by age class based on the proposed June 2020 Draft allocation for the ESRF. Stand under 65 years are forests that regenerated following a clearcut. Stands over 65 years regenerated naturally primarily from wildfire. Generic RCAs were estimated by fixed buffers of 100 and 50ft on fish bearing and non-fish bearing streams respectively. No designated riparian areas are included in reserves since harvesting will not be allowed one the existing Douglas-fir plantations (under 65) are thinned.*

Table 1b. Percent of total acres per treatment by age class

Age (yr)	Reserve	Intensive	Extensive	GRCA in Intensive and Extensive
Under 65	19.27	16.51	12.61	2.53
Over 65	43.11	0.00	5.18	0.80

Table 1b. *Percent of total acres (82,528) per treatment by age class based on the proposed June 2020 Draft allocation for the ESRF. Stand under 65 years are forests that regenerated following a clearcut. Stands over 65 years regenerated naturally primarily from wildfire. Generic Riparian Management Areas (GRMA) were estimated by fixed buffers of 100 and 50ft on fish bearing and non-fish bearing streams respectively. No designated riparian areas are included in reserves since harvesting will not be allowed one the existing Douglas-fir plantations (under 65) are thinned.*

Figure 5. Intensive

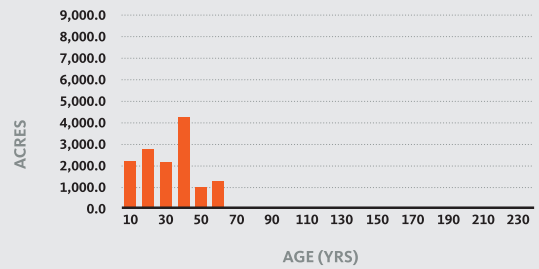

Figure 5. *Proposed acres of forest in intensive treatment in the MRW by age class as of 2020. Allocation based on June 2020 DRAFT treatment allocation. Under 65 years of age are forests that regenerated following a clearcut. Stands over 65 years of age regenerated naturally primarily from wildfire.*

Figure 6. TRIAD Reserve

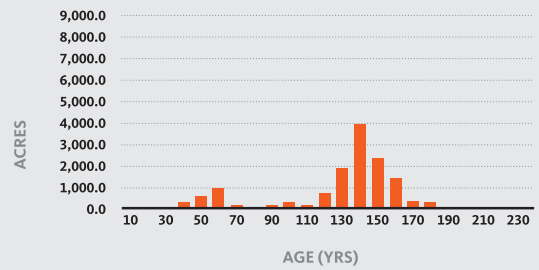

Figure 6. *Proposed acres of forest in reserve treatment in the MRW by age class as of 2020. Allocation based on June 2020 DRAFT treatment allocation. Under 65 years of age are forests that regenerated following a clearcut. Stands over 65 years of age regenerated naturally primarily from wildfire.*

Figure 7. Extensive

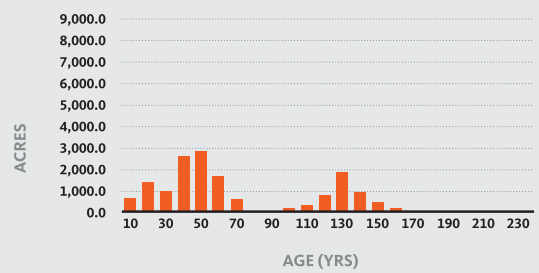

Figure 7. *Proposed acres of forest in extensive treatment in the MRW by age class as of 2020. Allocation based on June 2020 DRAFT treatment allocation. Under 65 years of age are forests that regenerated following a clearcut. Stands over 65 years of age regenerated naturally primarily from wildfire.*

ATTACHMENT B: DESCRIPTIONS OF UPLAND 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.

Guiding Principles for research on the ESRF

Adapted from the guiding principles established in the Draft Research Charter in 2019 (included in full in Appendix I), the following guiding principles for treatments ensure consistency with the vision for a long-term research program.

- **Unbiased research:** All research treatments will be applied to advance and sustain science-based research that does not introduce statistical bias. Fundamental to this vision for a research forest is the use of unbiased locations of treatments and controls, adequate unit size to avoid edge-related influences, manipulative experimentation to understand the processes controlling the response, and sufficient longitudinal observations to assess both short- and long-term response. The statistical analysis will attempt to further improve the comparability of treatments, e.g., through analysis of covariance.

- **Enduring:** Long-term monitoring and adaptation will be incorporated to determine if it is possible to sustain a system-based approach to exploring the integration of plantations, forest reserves, aquatic and riparian ecosystems, and actively managed multiple-strata forests through time. Designed treatment protocols will sustain ecological function and biota by retaining valuable biological legacies that represent complex early successional through late-successional attributes.

- **Tailored:** Research treatments will represent and reflect the diverse age class and disturbance history of the forest, and to the maximum extent possible, utilize previously managed stands.

- **At Scale in Space and Time:** Experimentally test the ability to emulate the natural range of natural disturbances that were historically typical of the Oregon Coast Range (and natural disturbances that may not have analogs in the past). This is made possible by adjusting patch sizes with internal heterogeneity, and associated habitat (e.g., complex early seral, snags, large down wood). Apply research treatments across a large enough area to better understand the impacts of crucial landscape attributes such as fragmentation, connectivity, and juxtaposition on ecosystem impacts. Maintain these experimental treatments through time to observe the full suite of outcomes, including impacts on nutrients, wildlife, fish, aesthetics, and cultural values.

- **Collaborative:** Actively engage and collaborate with the greater research community and a cross-section of stakeholders to ensure the research treatments achieve desired goals of the ESRF and are based on sufficient data to design appropriate experimental protocols.

Experimental Research Treatments

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 1. and 2.).

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.

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.

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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.

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

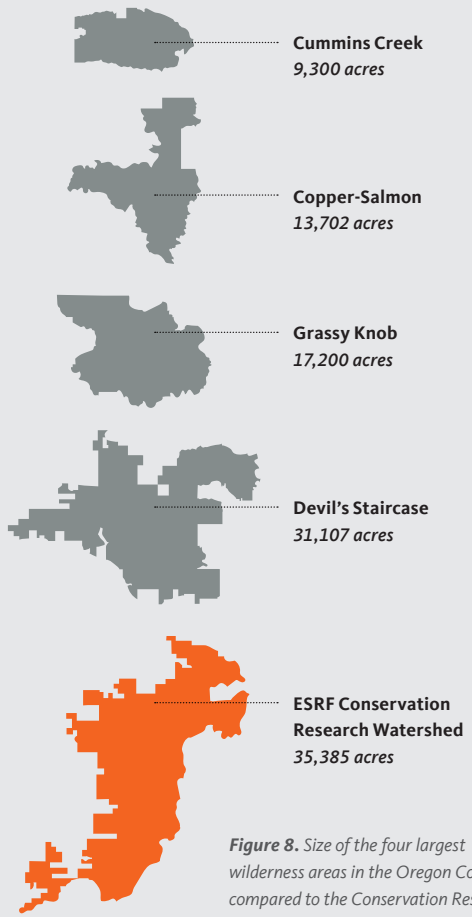

Figure 8. *Size of the four largest wilderness areas in the Oregon Coast as compared to the Conservation Research Watershed. The CRW and Devil's Staircase Wilderness Area are adjacent and represent a 66,492 acre reserve, the largest in the Oregon Coast Range.*

Figure 9. Forest Reserves in the Oregon Coast Range

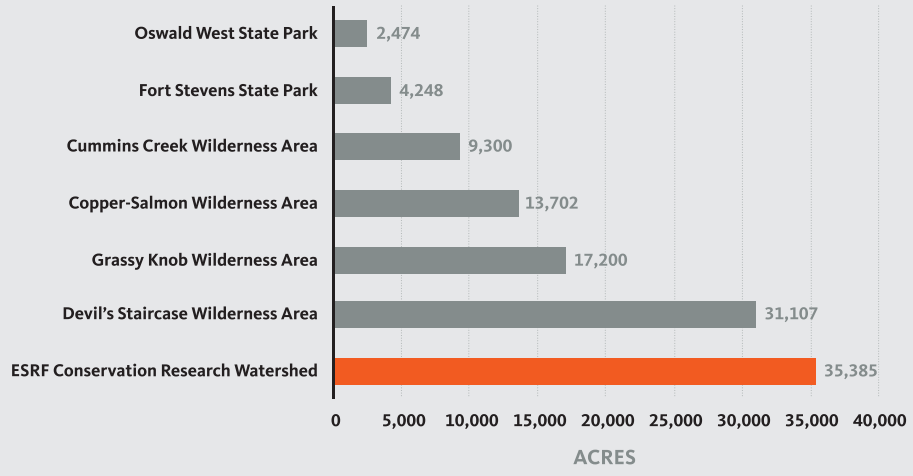

Figure 9. *Number of acres of the largest state parks and wilderness areas in the Oregon Coast Range as compared to the proposed Conservation Research Watershed in an Elliott State Research Forest.*

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.

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

5 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.

6 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.

7 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 50ft on non-fish bearing streams. These values could be increased based on identifying key debris flow torrents and the large wood delivery target to fish-bearing streams.

8 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

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.

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 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.

3 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.

4 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.

5 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.

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6 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.

7 Limit and selectively use herbicides only where necessary to manage invasive species or as a last resort to promote tree regeneration.

8 Plant only where regeneration goals cannot be met otherwise.

9 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.

10 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.

11 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 (Figure 1); therefore, the experimental treatments will require flexibility to maintain relevance.

Examples of research concepts 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 <u>not</u> 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

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ATTACHMENT C

Attachment C describes the steps we are taking to conduct a landscape analysis to allocate and integrate the riparian areas with adjacent research treatments and for determining RCA width requirements in intensive and extensive research treatments.

Figure 10. Example of the first step in integrating treatments along the West Fork of the Millicoma River

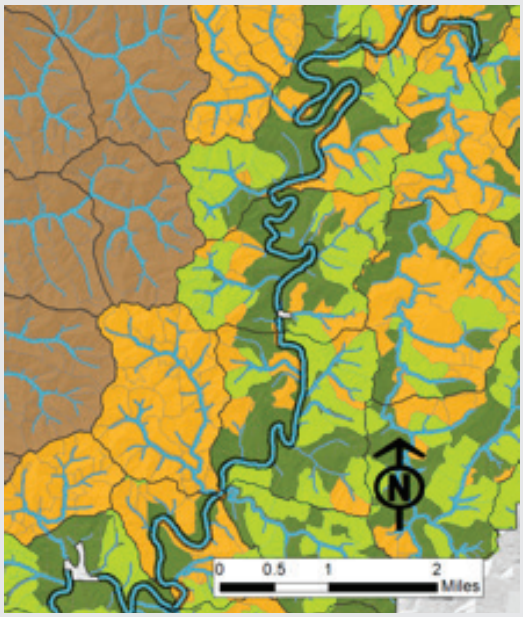

Figure 10. *Example of the first step in integrating riparian and upslope treatments along the West Fork of the Millicoma River on the ESRF. The goal is to ensure the presence of large trees where wood recruitment is most likely to occur from riverside to headwall. The current percentage of each riverside riparian treatment is listed in table 2.*

Table 2. Percent of river miles along the West Fork of the Millicoma River

Treatment	Percent bordering river	Proposed riparian conservation area width (ft)
Extensive	26%	200
Intensive	6%	200
Reserve	68%	NA

Table 2. *Percent of river miles along the West Fork of the Millicoma River that are bordered by the proposed experimental treatments in Figure 10.*

Figure 11. Map showing proposed stand level allocation of Reserve, Extensive, Intensive, and GRCA treatments

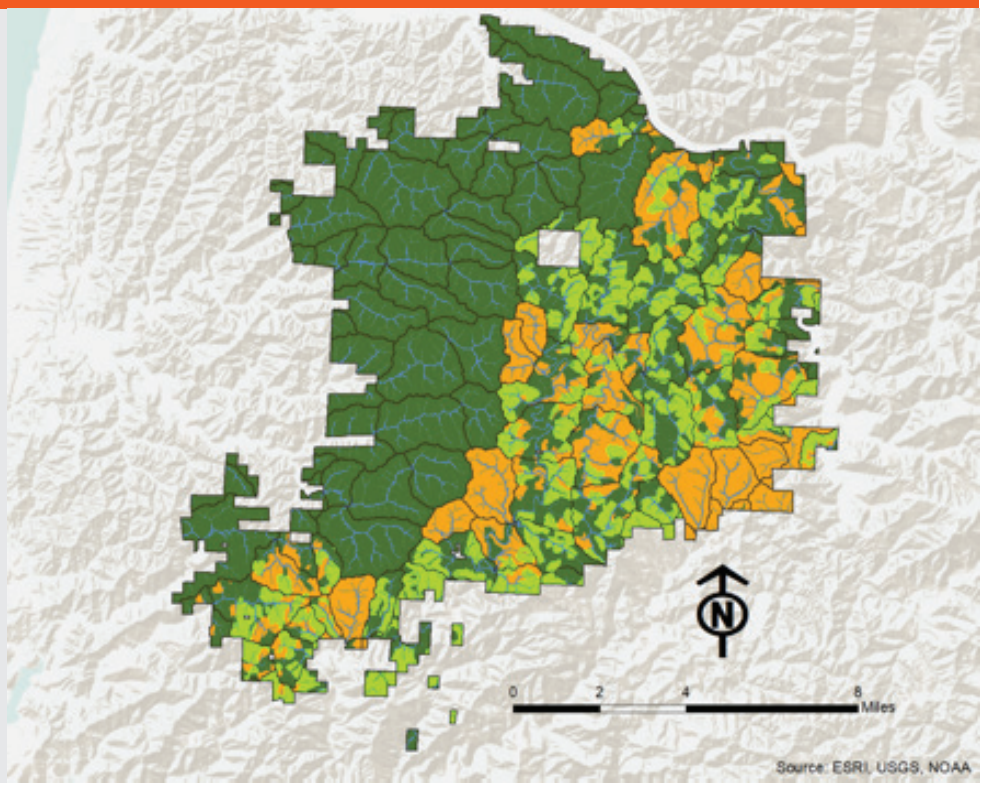

Figure 11. *Map of the proposed stand level allocation of reserve, intensive, and extensive treatments in the June 2020 draft allocation. GRCA is Generic Riparian Conservation Area. Generic Riparian Conservation Areas (GRCA) were estimated by fixed buffers of 100 and 50ft on fish bearing and high priority debris torrent non-fish bearing streams respectively that flow through areas where timber harvests will occur.*

The process for determining where wood delivery will occur and prioritization for RCA width requirements in Extensive and Intensive research treatments.

We propose to use modeled potential large wood recruitment to fish-bearing streams as a criterion for the development and evaluation of stream buffer strategies incorporated into the research designs of MRWs. The aquatic and riparian research strategy envisioned for the ESRF relies on wood recruitment for its specific value as habitat for imperiled species and as a proxy for the attainment of other ecological functions. Typically, most large wood recruited to fish-bearing streams comes from channel-adjacent sources through processes such as chronic and episodic tree mortality, bank erosion, and landslides. These same processes recruit large wood to non-fish-bearing channels. In steep and constrained non-fish-bearing (NFB) channels, episodic debris flows can deliver substantial quantities of accumulated large wood to fish-bearing streams. However, not every NFB tributary has the same potential to deliver wood. Therefore, we want to integrate our treatment of the riparian system with the upslope forests' treatments to ensure water quality and fish habitat as follows.

1. Establish the wood recruitment goal for the MRWs in the ESRF. The CRWs will have a goal of 100% of potential wood recruitment to fish bearing streams since the system is being managed as a reserve.

2. Delineate and classify NFB streams on the ESRF as to their potential for wood recruitment to fish bearing streams. Identify tributaries and headwalls with high potential for wood recruitment and other conservation components.

3. Calculate site potential tree height and riparian buffer needed to ensure wood delivery to the stream.

4. Overlay potential Reserves, Intensive and Extensive treatments, and adjust to better integrate Reserves and Extensive with NFB streams with high potential for wood recruitment. Reserves, Extensive treatments, and RCA's will have the largest trees on the landscape, so they will best emulate historical conditions.

5. Calculate wood recruitment potential and compare against goal. Repeat as needed.

6. Create riparian systems in which different combinations of stream buffers on fish-bearing and non-fish-bearing systems achieve a stated goal for wood recruitment into FB streams.

7. Use riparian systems to test the effectiveness of buffer combinations relative to tradeoffs with other social and ecological attributes, such as habitat, accessibility, and fiber yield. Design several different wood recruitment strategies that meet the goal and develop an experiment to test effectiveness and tradeoffs with other values (see example Figure 12).

Figure 12. Four example riparian buffer configurations with approximately 70% wood yield on the ESRF

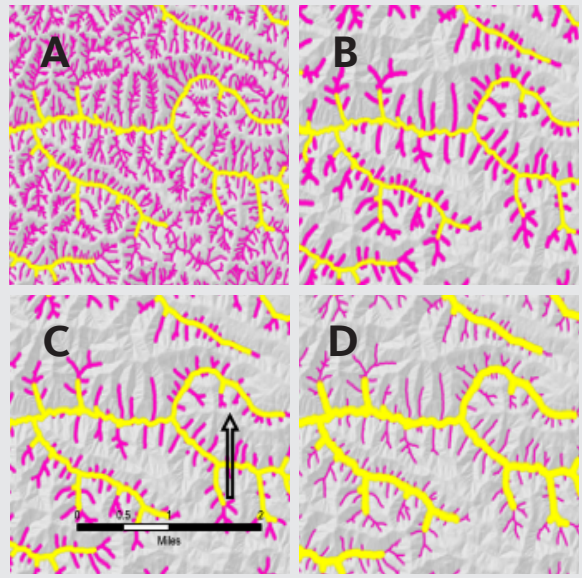

Figure 12. *Buffer width configurations and percent of area allocation to riparian buffers under each configuration to achieve approximately 70% wood yield.*

Table 3. Buffer width scenarios

Scenario	NFB buffer width (ft)	FB buffer width (ft)	Percent of Area
A	50	120	32.5%
B	120	120	25.5%
C	100	150	21.7%
D	50	200	20.9%

Table 3. *Four buffer width scenarios for attaining ~70% wood recruitment*

ATTACHMENT D

Attachment D is intended to provide initial riparian area treatments and details on stream buffers in the CRW, MRW, and the West Fork of the Millicoma River.

Designated Riparian Area Research Treatments

Aquatic and riparian treatments are structured to test the effectiveness and tradeoffs of providing critical ecological processes, such as wood recruitment, cold water, litter fall, and sediment, all of which are important to Coho salmon. Because past management has reduced the supply of wood in streams in the Elliott and other Coast Range forests, particularly of large wood, ensuring high levels of wood recruitment necessitates riparian buffers wide enough to encompass many other riparian functions.

Monitoring and data analysis will test large wood's ability to be a proxy for other ecological functions while ensuring riparian functions are protected to achieve the desired level of effectiveness needed to meet the ecological, social, and regulatory requirements for the RCAs. The research plan objective is to attain nearly 100% of potential wood recruitment in the CRW and reserve watersheds located in the MRW, and a minimum of 70% in the portions of the MRW that are not in reserves.

Research protocols call for RCAs to vary in size and configuration according to stream type and upslope research treatment. Stream types reflect the presence of fish, timing of flow (perennial versus seasonal), and susceptibility to landslide-associated debris flows that deliver wood to fish-bearing streams. Measure RCAs as the slope distance from the outer edge of the channel migration zone and reference to a site potential tree height of 200 feet, per local BLM data. The ESRF research design, in which the RCAs play a critical role, allows for varying, site-specific implementation, with a minimum set of standard prescriptions applied as set forth below.

Stream types:

1. Fish-bearing: Streams connected and accessible to reaches with a gradient of 20% or less.
2. Perennial non-fish bearing: Streams modeled as providing year-round flow but not having game fish.
3. Key Debris Flow Torrent intermittent streams: Streams with a high potential to deliver wood to fish-bearing streams. These streams are typically steep, with few gradient breaks and with approximately 90-degree angle of entry into fish-bearing streams.
4. Other: Streams primarily intermittent streams with low potential for wood delivery to fish-bearing streams.

RCA Buffers in the CRW area and areas designated as Reserves in the MRW:

The Reserve treatments include existing Douglas-fir plantations, in recognition of the need for a focused effort to recruit future old stands and unlogged naturally regenerated older forests. Therefore, Reserves will have two starting points: a) Exploring treatments to restore and enhance conservation value in established plantations transitioning to older, more complex forests; b) Conserving unmanaged mature forests as they move through natural successional processes. Since there is no harvesting in "b", there is no need for designated RCAs. Designated RCAs are only applicable when thinning adjacent to reserve stands to restore dense Douglas-fir plantations. Once these thinning treatments are complete, there will be no more harvesting in the Reserves, thus the designated RA will integrate with the surrounding forest over time. However, during thinning, RCAs at these locations will be 200 feet slope distance on fish-bearing and non-fish-bearing perennial streams, and key debris flow torrents. Thinning to reduce the density of existing plantation stands within RCAs buffers that are less than 65 years of age may be undertaken if determined necessary to support and enhance long-term ecological functions of the RCAs. Thinning would primarily be conducted to promote the more rapid development of large trees that can potentially be recruited to the stream or the establishment of hardwoods to provide higher quality litter resources to the stream, increase habitat diversity and stream productivity. No removal of residual trees (>65-year-old trees as of 2020) will occur from the RCA or upslope areas during thinning operations).

RCA Buffers in the MRW:

The following are standard prescriptions that apply to RCAs adjacent to Intensive and Extensive treatments. No intensive stand replacement management will be conducted within RCAs. Thinning to reduce the density of less than 65-year existing plantation stands within RCA buffers may occur, but only in the context of a study aimed to understand how management can enhance long-term ecological functions of the RCA.

- Fish-bearing: 120 - 200 feet
- Perennial Non-Fish: 100 - 200 feet
- Key Debris Flow Torrent: 50 – 200 feet for high potential

The specific size and configuration of the different RCA components will depend on the level of desired wood delivery potential.

West Fork Millicoma River Proposed RCAs:

The designated RCAs for the West Fork Millicoma River from its entry into the ESRF in the southwest portion of the forest through the confluence with Elk Creek will be established and maintained as follows:

- The RCA will be a distance equal to the site potential tree height, (200 feet measured as the slope distance from each side of the channel migration zone) on either side of the river and 200 feet measured as slope distance along any non-fish bearing stream that has a high potential to deliver wood to the adjacent fish-bearing stream.

- Note that under the current research plan, the river's main channel will be bordered by 68% Reserves, 26% Extensive and 6% Intensive treatments. Since 68% of the river is bordered by Reserves that will not experience timber harvests, the area protected greatly exceeds the 200' designated RA (Table 2.).
- To further minimize the potential for adverse impacts to this ecologically and recreationally valuable region, the approximately 30% of the West Fork Millicoma watershed in Reserves and 30% of the area in Extensive can be integrated with the non-fish bearing streams identified as high potential for debris flow torrents that deliver wood to fish-bearing streams. Doing so would ensure the wood delivered during a debris flow will be large diameter.

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ATTACHMENT E

Attachment E provides additional maps and graphs on the proposed research design of an Elliott State Research Forest.

Figure 13. Potential watershed level allocation of TRIAD treatments

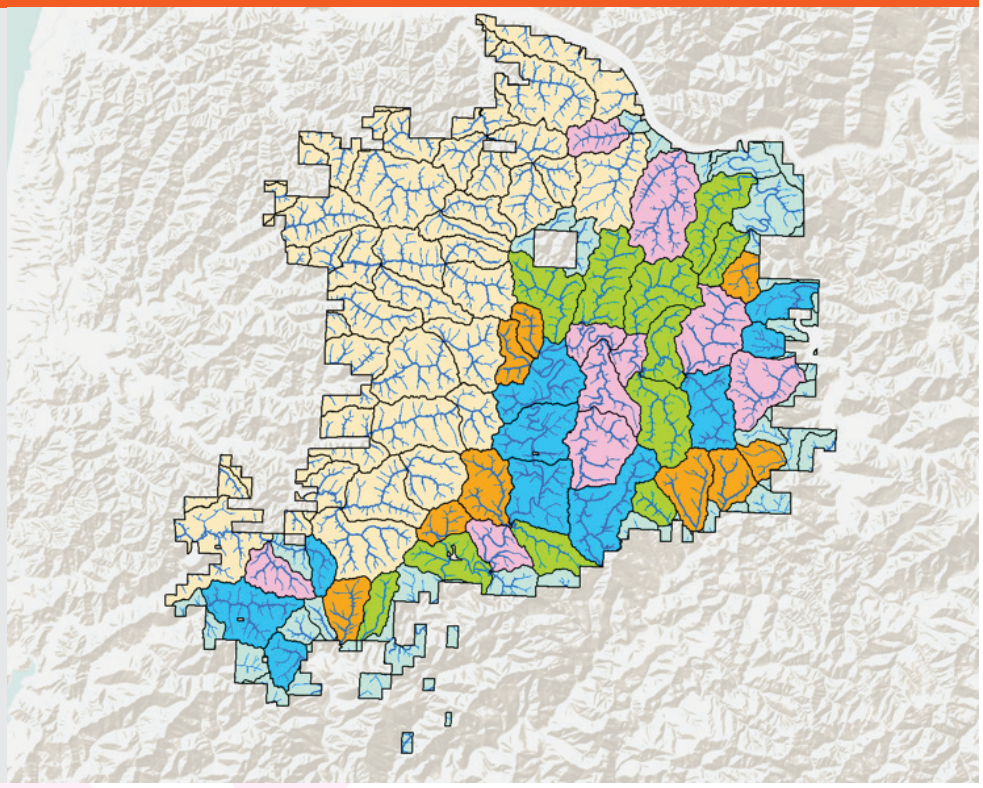

Figure 13. *Draft allocation to illustrate one potential suite of sub watershed treatment allocations on the Elliott State Research Forest. This is primarily to serve as an example of our goal of a landscape approach to integration of multiple values and testing of approaches. "Partial" describes watersheds that are less than 400 acres or are partially located outside of state forest boundary.*

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

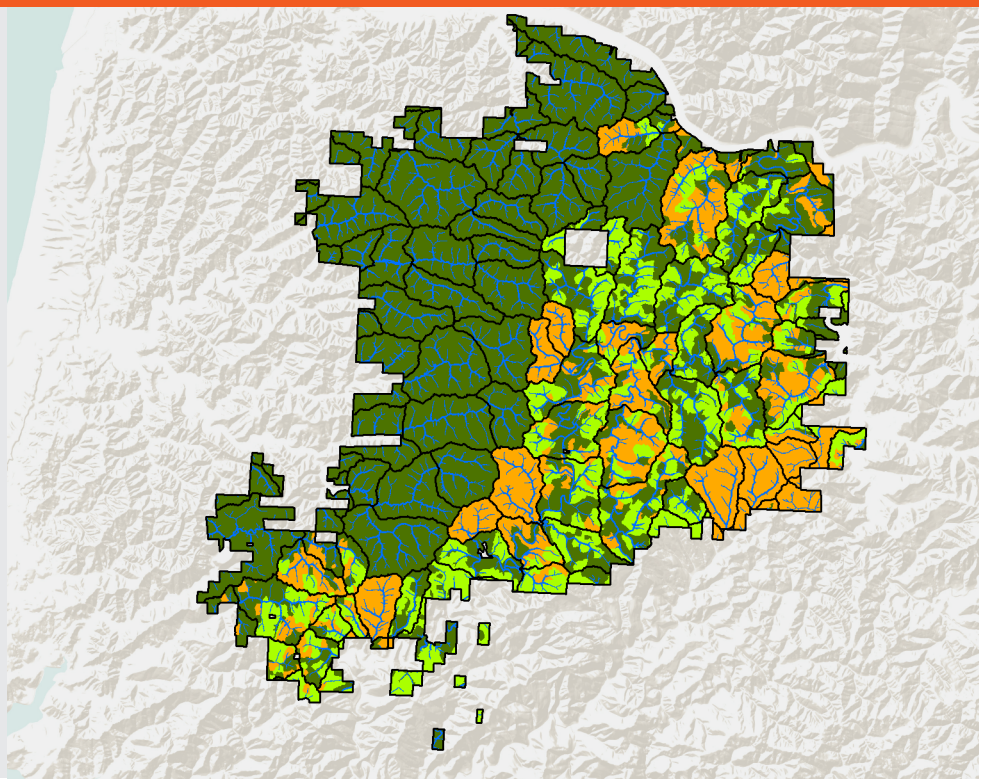

Figure 14. *Draft allocation to illustrate one potential suite of allocations on the Elliott State Research Forest. This is primarily to serve as an example of our goal to find a suite of forest management approaches that integrate fiber production, biodiversity, recreation and aesthetic objectives.*

Table 4. Estimated acres per proposed watershed level treatment assignment on the Elliott State Research Forest using the June 2020 allocation

Watershed Assignment	Total Gross Acres	GRCA Acres (not including stands in reserve)	Acres Net of GRCA
Extensive	5,930	636	5,294
TRIAD-E	10,240	1,006	9,234
TRIAD-I	10,322	737	9,585
Intensive	10,861	629	10,232
Partial	9,784	531	9,253
Sub-Total	47,137	3,539	43,598
CRW	35,386	0	35,386
Grand Total	82,523	3,539	78,984

Table 4. *Estimated acres per proposed watershed level treatment assignment on the Elliott State Research Forest using the June 2020 allocation. Extensive watersheds are 100% Extensive, Triad E is 60% Extensive, 20% Intensive and 20% Reserves. Triad I is 20% Extensive, 40% Reserve and 40% Intensive. Intensive watersheds are 50% intensive and 50% reserves. Partial watersheds are the remaing areas along the boundary of the ESRF that did not make a min 400 acre watershed or had more than 3% other ownership. Generic Riparian Conservation Areas (GRCA) were estimated by fixed buffers of 100 and 50ft on fish bearing and high priority debris torrent non-fish bearing streams respectively that flow through areas where timber harvests will occur.*

Table 5. Estimated acres per stand-level treatment proposed on the Elliott State Research Forest using the June 2020 allocation

Watershed Assignment	Acres Reserve (incl GRCA)	Acres Intensive (net GRCA)	Acres Extensive (net GRCA)	Acres CRW in Reserve (incl GRCA)
Extensive	0	0	5,294	0
TRIAD-E	2,052	1,793	5,389	0
TRIAD-I	4,134	3,638	1,814	0
Intensive	5,435	4,797	0	0
Partial	3,674	3,396	2,183	0
Sub-Total	15,295	13,624	14,679	0
CRW	0	0	0	35,386
Grand Total	15,295	13,624	14,680	35,386

Table 5. *Number of acres estimated per stand-level treatment proposed on the Elliott State Research Forest using the June 2020 allocation. Extensive watersheds are 100% Extensive, Triad-E watersheds 60% Extensive, 20% Intensive and 20% Reserves. Triad-I watersheds are 20% Extensive, 40% Reserve and 40% Intensive. Intensive watersheds are 50% intensive and 50% reserves. Partial watersheds are the remaining areas along the boundary of the ESRF that did not make a min 400 acre watershed or had more than 3% other ownership. Generic Riparian Conservation Areas (GRCA) were estimated by fixed buffers of 100 and 50ft on fish bearing and high priority debris torrent non-fish bearing streams respectively that flow through areas where timber harvests will occur.*

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