Anchor Forests

Sustainable Forest Ecosystems through Cross-Boundary, Landscape-Scale Collaborative Management

Final Report

Prepared for:

The Intertribal Timber Council
1112 NE 21st Avenue, Suite 4
Portland, OR 97232

March, 2016

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The Full Report on the Anchor Forests Pilot Project Assessment consists of eight parts: (1) an Executive Summary that encapsulates key findings and recommendations from the assessment, (2) a Final Report that summarizes the findings and recommendations specific to the six individual tasks, and (3) a Task Analysis Report that contains the detailed results for each of the six individual tasks.

In addition, four (4) short Anchor Forest videos have been produced to facilitate communication of the concepts and exemplify the value of balanced social/cultural, economic and ecologic forest ecosystem management. The Anchor Forest documents can be obtained from the Intertribal Timber Council office listed below. The final reports and videos are also available on-line at: www.ITCnet.org.

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Anchor Forests — People, Place, Community, Environment and Economy

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Acknowledgments

The Anchor Forest Oversight Committee and coordinating team gratefully acknowledges the tribes who participated in this assessment. Special thanks go to the members of the Anchor Forest Oversight Committee who helped guide and direct the team of coordinators and consultants through analysis and final recommendations. We are indebted to the many tribal and agency representatives who generously gave their time and knowledge while participating in surveys, interviews, and site visits. Their contributions are greatly appreciated.

We also want to thank Laura Alvidrez, the Program Manager for the Intertribal Timber Council and Steve Andringa, Anchor Forest Project Manager for the Yakama Nation, for their continual support throughout the project.

A special thanks to the following supporters and contributors

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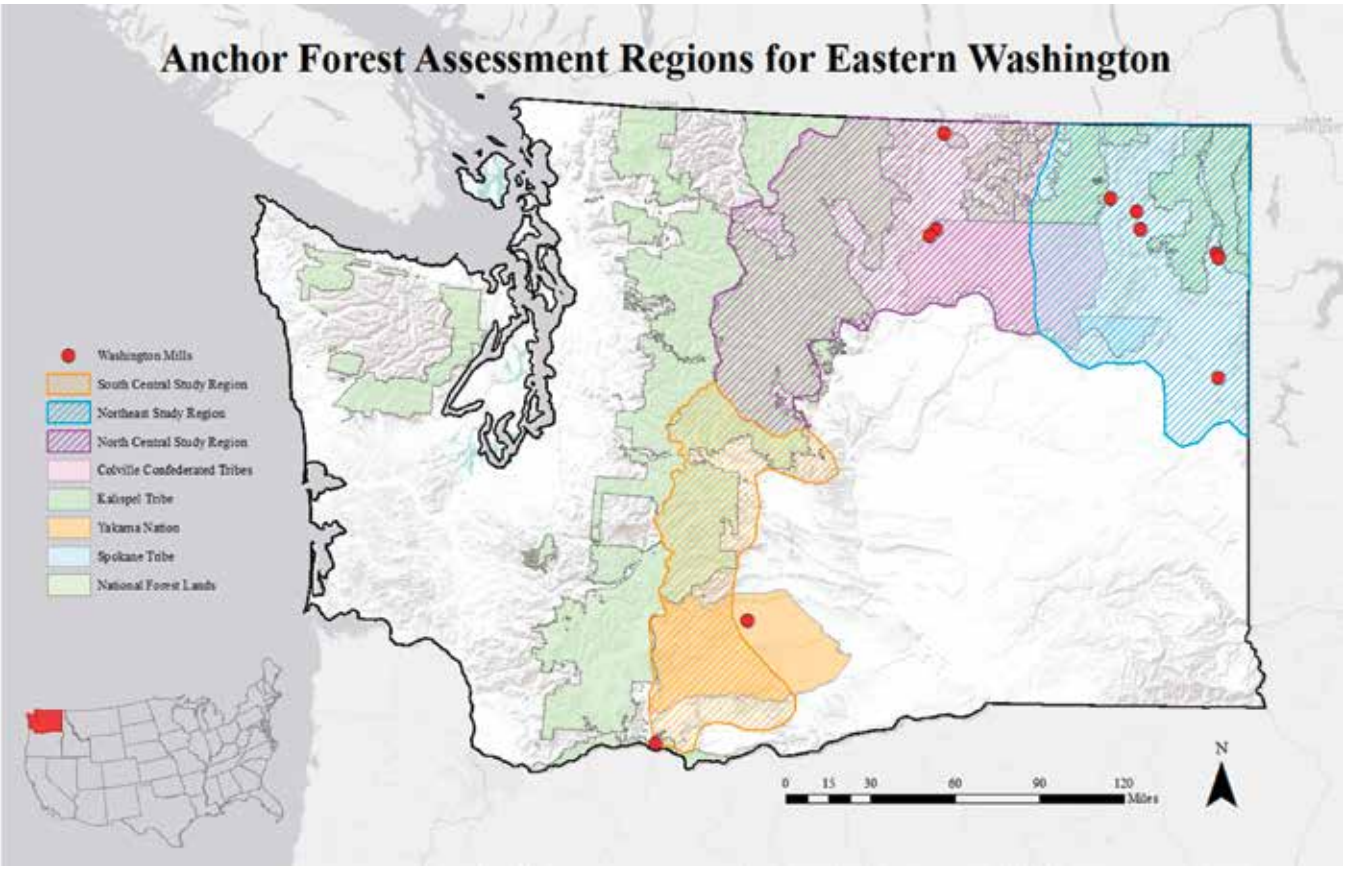
Cover photograph of smoke in the Lochsa Valley by Dana Rand Photography.

Funding support for this study was provided by the Northwest Regional Office of the USDA Forest Service through a Domestic Grant (2011 DG-11062765 026) with the Intertribal Timber Council and the Bureau of Indian Affairs. In accordance with Federal law and U.S. Department of Agriculture (USDA) policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age, disability or retaliation. To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W Whitten Building, 1400 Independence Avenue SW, Washington, DC 20250-9410 or call (202) 720-5964 (Voice and TDD). USDA is an equal opportunity provider and employer.



Forests for Generations

There are more than 740 million acres of forested land (minimum of 10% tree canopy) within the conterminous United States. These forests are essential to sustaining the myriad of social/cultural, economic and ecologic benefits society enjoys from these lands. Healthy forests can provide employment and recreational opportunities as well as forest products such as building materials, food and medicines. They can provide a broad spectrum of ecosystem services such as habitat for flora and fauna, buffering of pollutants, carbon sequestration, places for personal reflection and cultural/spiritual benefits [1]. Healthy forests stabilize stream flow, alleviate flood hazards, and play a critical role in the quantity and quality of water available to society through storage, filtration, and supply. Forests of the western United States provide nearly 65% of the clean public drinking water for nearly 64 million people [2].

The ability of our forests to continue to provide these benefits into the future remains very much at risk [3,4]. Unhealthy forest conditions [5], exacerbated by a changing climate and legacy effects of past management practices,

"The human species, while buffered against environmental immediacies by culture and technology, is ultimately fully dependent on the flow of ecosystem services."

Millennium Ecosystem Assessment. Millennium Ecosystem Assessment: Current State and Trends. 2003. 25-36 p.

lead to catastrophic wildfires that sterilize and erode soils, contaminate water quality, alter habitats for fish, wildlife and plants, destroy homes and, in some cases, permanently alter the very forests we seek to protect and enjoy [6].

Nationwide millions of forested acres, both private and public, are disappearing functionally and physically (Figure 1). This is exemplified by the 193 million acres of forest and grasslands within the National Forest System (NFS), administered by the United States Department of Agriculture Forest Service (USFS) [8]. On these lands, management has centered on wholesale fire suppression for most of the 20th century [9,10] leading to the currently

Figure 1. An unmanaged forest in Washington State with diminished ecosystem function and service (e.g., water quality, wildlife habitat, and recreational use) values due to insect and disease infestations. Historic management and administration, mixed with changing climatic conditions, have led to uncharacteristically high tree densities and fuel loads which now, through severe wildfire, threaten communities, the remaining forestlands, and ecosystems as a whole.

degraded forest conditions and uncharacteristically severe wildfires that have recently burned forests, homes, and communities and led to the destruction of entire ecosystems. Increased fire severity and larger fire size generate greater fire costs and increase the average annual expenditures associated with wildfire (Preparedness, Suppression, FLAME, and related programs). The USFS fire expenses have grown from less than $500 million in the 1980s to $1.4 billion in the 2000s [11] to now more than $3.3 billion, 52% of the total USFS budget in 2015 [12,13] as a result of 53,798 fires consuming more than 9.4 million acres nationwide [14]. Many NFS lands, unstable and faced with a changing climate. are expected to continue this legacy of fire and deteriorate further in as little as 15 years [15].

A paradigm shift is needed to improve and sustain ecosystem function [16,17], as well as reduce the potential for landscape-altering conflagrations that jeopardize societal well-being and human safety at a cost of billions [11,18] for generations to come [19,20]. Land fragmentation [21], administrative inconsistencies [22], agency personnel turnover [8], litigation [23,24], and a weakened "social license" [25,26] create many of the formidable challenges facing maintenance of economically viable and ecologically functional forests. These "working forests" are a crucial part of improving overall forest ecosystem health [27–29]. However, they are reliant on disappearing harvesting, transportation, and processing infrastructure, investment strategies for limited funding resources, and eroding management capacities [30].

Within the past several decades, public and private forest managers have struggled unsuccessfully to integrate stewardship of ecological processes with the ability to achieve sustainable economic returns [18]. This is due in part to inflexible policy and inconsistent regulatory input [17,31], as well as appeals and litigation targeting timber sales, salvage sales, and forest planning, incentivized by "partial fee-shifting" laws [32], agency settlements, positive publicity, and action delays [24,33,34]. Consequently, this has resulted in the loss of forestry infrastructure, further fragmentation of forest ownerships through the economic draw of "higher-and-better-uses", a highly complex regulatory environment, discouraged investments in forest restoration, and ecosystem conditions that encourage wildfire [35–38].

The challenges confronting our forests have reached crisis proportions and become too large and complex to be addressed by

"The threats facing our forest do not recognize property boundaries; we must operate at a landscape scale by taking an 'all lands approach.'"

Western Governors Association, Agriculture Sec. Vilsak 2009

"Debates that once focused on the relatively simple dichotomy between timber harvest and forest preservation are evolving into more complex considerations of competing management priorities, including real estate development, expanded recreational use, and the mitigation of fire risk, all in a landscape where traditional forest management activity is disappearing…" [4]

USDA Forest Service. National report on sustainable forests-2010. 2011. 214 p.

"[Describing a massive beetle killed forest in Canada], You can't negotiate with a beetle. You are now dealing with natural law. And if you don't understand natural law, you will soon. [If] you don't abide by that law, you will suffer the consequences. Whether you agree with it, understand it, comprehend it, it doesn't make any difference. You're going to suffer the consequences, and that's right where we're headed right now."

Oren Lyons, Onondaga Faithkeeper as cited by Wood, (2014)

any single forest ownership [40]. Proactive, collaborative, cross-boundary landscape-scale management is essential to improve and maintain healthy forest ecosystems [31,41]. Recent wildfire seasons have demonstrated the risks and consequences of failing to address forest health issues on a landscape scale. In the wake of the 2015 fire season, more than 1 million acres burned in Washington alone [14] and a changing climate threatens to further alter the distribution of forest cover types, species, and natural disturbance patterns across the entire forested landscape [42,43]. Elevated tree mortality from insects and disease in recent decades has amplified wildfire severity, and conditions are predicted to worsen on more than 20% (2.7 million acres) of these forestlands within the next 15 years [5]. The need for creative actionable solutions has fueled the development of the Anchor Forest concept, and this assessment, to explore landscape-scale forest management that exhibits a sustainable social/cultural, economic, and ecologic balance [8].

The Anchor Forest Concept

The Anchor Forest concept is founded on the premise that large tracts of forestland under long-term stewardship inclusive of commitments for commodity production can economically incentivize cross-boundary, collaborative management [8]. These "Anchor Forests" would provide a pivotal setting for investments in ecological services and the infrastructure needed to address forest health conditions and sustain working forests, thereby improving ecosystem resiliency [5,44].

Coordination of management efforts will require leadership, founded by tenure in sustainable forest stewardship and a dogmatic permanence focused on the future such as that exemplified through Indian lifeways[46] and the traditional ecologic knowledge [9] of tribes. Anchor Forests, through sustainability and stewardship, can encourage cross-boundary multi-jurisdictional management of degraded forest landscapes which will in turn engage communities and direct investment of limited resources more effectively to achieve ecological resilience and economic sustainability. The Anchor Forest concept draws

"Anchor Forests are a multi-ownership land based area which will support sustainable long-term wood and biomass production levels backed by local infrastructure and technical expertise, endorsed politically and publicly to achieve desired land management objectives."

Morishima G. National Conference of State Legislatures Environmental Forum. In: Indian Tribes and Forests – Anchor Forest. Denver, Colorado: Intertribal Timber Council; 2013. p. 70.

The Anchor Forest concept represents an effort to provide forest land stewardship across ownership boundaries and among disparate interests to address deteriorating forest health conditions by:

- Promoting forest ecosystem function through maintaining and improving the infrastructure needed to increase the ecosystem services and benefits gained from healthy forests;
- Reducing the impacts of insects, disease and wildfire in the face of a changing climate through active forest management; and
- Providing a framework for cross-boundary land management that achieves the social/cultural, economic, and ecologic values and benefits realized through long-term stewardship.

upon three attributes exemplified by tribal forests that foster stewardship (e.g., capability, commitment, and vision) to embody ecologic and economic sustainability (Figure 2) [44].

When established, an Anchor Forest system would result in the social license and ability needed to implement the "all hands, all lands" management of the forested landscape [28] through collaboration forged in the collective ability of many working toward a unified goal of maintaining working forests and improving forest ecosystem resilience.

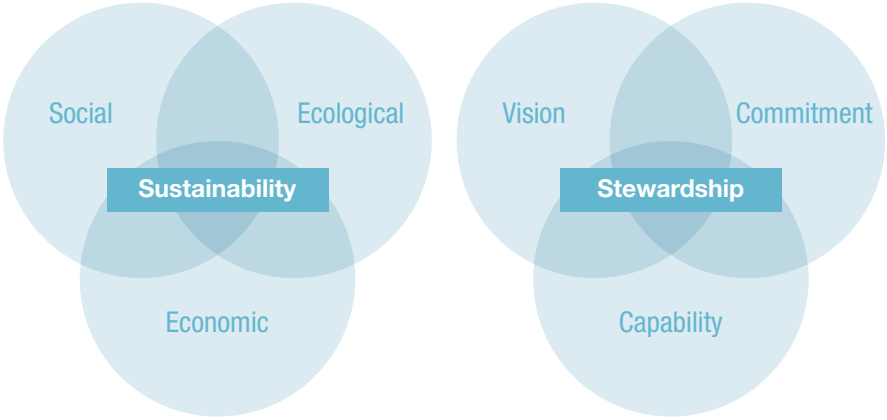


Figure 2. The "triple bottom line" of sustainability combining social, economic, and ecologic dimensions inextricably coincides with the foundation of stewardship. Stewardship for sustainability has been described as the intersection between vision, commitment, and capability. *Vision* represents the ability to establish and convey a shared sense of "what can be," *commitment* represents relationships that maintain respect, trust, and collaboration over the long-term, and *capability* represents the availability of competent interdisciplinary staff with the information and resources to implement multiple-use multiple-resource management plans [28].

"Ultimately, the people who are best able to take care of the land are those who live on the land, work on the land, and love the land. They have the knowledge, skills and motivation to care for the land. We need to empower them."

Gale Norton, Former U.S. Secretary of the Interior, on August 31, 2005 when announcing the Department of Interior's participation in the National Conference on Cooperative Conservation

The Anchor Forest Assessment

The purpose of the Anchor Forest assessment was to determine if the Anchor Forest concept is a viable framework for institutionalizing collaborative cross-boundary forest ecosystem management, and to assess the potential of Anchor Forests to form the cornerstones needed to overcome forestland fragmentation and sustain ecosystem services at a landscape scale.

The need for actionable goals and a balance of landscape-scale social/cultural, economic, and ecologic management to maintain ecosystem function and working forests was the motivation behind the launch of the Anchor Forest assessment by the Intertribal Timber Council (ITC) in October, 2012. Through development of a proposed study design, secured funding, and the selection of the Yakama Nation as project lead, the ITC sought interactive, consensus-based solutions for managing forest health, avoiding forest land conversion, and improving ecosystem function within the east Cascades. Through the objectives and questions proposed in Table 1 the feasibility of implementing

Table 1. Objectives and questions that guided the exploration of Anchor Forest implementation and the viability of an Anchor Forest to accomplish needed forest management actions.

What	Would Anchor Forests form a useful framework for coordinating investment and management across fragmented forest ownerships and jurisdictional boundaries?
Where	Does the Anchor Forest concept represent a viable model to address the array of ownership patterns and differing infrastructure capacities encountered within the three study areas of eastern Washington?
How	What would provide the desired social/cultural, economic, and ecologic benefits and incentives needed to gain stakeholder and community participation in an Anchor Forest?
▶	Do long term management plans, supported by inventory and monitoring systems, professional staff, up-to-date technical capabilities, and integrated research, i.e. capable of working with adaptive management strategies, exist? Are projected harvest volumes sufficient to support economically viable manufacturing and processing, as well as keep pace with or exceed currently deteriorating forestland conditions? What are reasonable expectations for sustainable wood commodity production for the three study areas?
▶	Is local interest in the Anchor Forest concept sufficient to sustain the institutional and operational commitment and capacity needed for implementation? What resource investments and commitments might be required to support an Anchor Forest?
▶	What are the barriers and opportunities for utilizing the Anchor Forest concept in the three study areas? Are there candidate areas within eastern Washington suitable for an Anchor Forest?
▶	What are the requirements for a successful application of the Anchor Forest concept? What are the recommendations for overcoming barriers and taking advantage of opportunities?

the Anchor Forest concept in eastern Washington was assessed (Figure 3) with guidance from an ITC oversight committee and support from selected contractors.

Six task assessments were identified to address the study objectives. These assessments are shown in Table 2 and include: The state of the forest industry in eastern Washington (Task 1), existing collaborative frameworks (Task 2), institutional capacity and barriers to collaboration (Tasks 3 and 4), a database of funding sources (Task 5), and an assessment of ecosystem resilience, processes, and services (Task 6). All task findings were used to evaluate the potential of existing processes and authorities to maintain working forests, improve ecosystem function, and achieve economic and ecologic gains across multi-jurisdictional ownerships at a landscape scale.

The goals and objectives of this Anchor Forest pilot project study identify opportunities and barriers for both individuals and organizations seeking to

Figure 3. The Anchor Forest study assessments evaluated the feasibility of establishing Anchor Forest systems in the South Central (SC), North Central (NC), and Northeast (NE) portions of eastern Washington State. These regions were selected on proximity of tribal, NFS, and state lands, their inclusion of the Yakama Nation, the Confederated Tribes and Bands of the Colville Reservation, the Spokane Tribe, and the Kalispell Tribe, the occurrence of struggling forest infrastructure, and differences in capacity, capability, and markets. Additional selection criteria focused on the imminent danger of forests in these regions to catastrophic losses from wildfire, insects, and disease.

coordinate investment and management across fragmented forest ownerships through cooperatively developing a shared vision for future forests and the requisite actions to maintain the health and function of these lands. The findings and recommendations from each task assessment are presented to facilitate management decisions that address forest ecosystem health. Assessment results focus on opportunities provided by existing personnel, expertise, and forestry infrastructure given the implementation of an Anchor Forest and the social license provided by inclusion of diverse landowner interests. As a collaborative framework, Anchor Forests have the potential to assist land managers in sustainably accomplishing cross-boundary ecosystem management while maintaining a collaborative balance of social/cultural, economic and ecologic practices at a landscape-scale.

Table 2. The Anchor Forest study consisted of six "Tasks" aimed at defining the current conditions, opportunities, and barriers to implementation of multi-jurisdictional landscape-scale Anchor Forests in eastern Washington using the best science, knowledge, funding, and organizational resources available.

Task description	Assessment action
Forest industry infrastructure	Study region assessments of: forest condition, forest planning, timber harvest, processing, infrastructure, capacity, and projected treatments needed.
Collaborative forest restoration frameworks	Assessment of existing collaborative forest restoration frameworks and insights applicable to the Anchor Forest concept.
Forestry institutional capacity	Evaluation of current forest management planning, actions, infrastructure, organizational commitment, and resources.
Collaboration opportunities and barriers	Assessment of local interest, capabilities, staffing capacities, available resources, opportunities and barriers. Focus-group discussions with potential stakeholder groups.
Resource database	Identification of technical and financial opportunities available to Anchor Forests.
Non-market forest ecosystem services	Identification of ecosystem service benefits from Anchor Forests, methods of quantifying non-market values, and incentives that increase stakeholder awareness and participation.

"Healthy working forests are essential to enable society to maintain clean air and water, and to protect our soils, fish, and wildlife. Economically viable infrastructure must be in place to reduce costs of forest management and minimize potential risks of loss to life and property from growing threats of wildfire, insect and disease. The integrated approach envisioned under the Anchor Forests concept holds great promise as a means to focus scarce investments in infrastructure and environmental services, and as important, for helping diverse interests find a common path to the future."

Gary Morishima, National BIA Conference on Forestry and Wildland Fire, San Diego, 2012.

Dana Rand Photography

Anchor Forest Task Assessment Results

Eastern Washington Forestry Infrastructure, Commodity Production and Biomass [30]

The east Cascades region of Washington State has experienced a reduction in sawmilling capacity over the past few decades and has a shortage of biomass facilities. These conditions represent a loss of forest management infrastructure and capacity available to support cross-boundary forest ecosystem management. When milling facilities and infrastructure are sparsely distributed within an area in need of forest management, there can be substantial increases in product transportation and harvesting costs as well as decreased competitive bidding for timber resources and low market values for many products.

These conditions lead to lost job opportunities and the reduction of an already limited workforce.

Across the State of Washington more than 1 million acres of forest land are being impacted annually by insects and disease leading to an increase in the size and frequency of wildfire (>9.4 million acres burned nationwide in 2015). Currently, within the three study regions there are 11 sawmills (Figure 4), many of which are operating at 10% to 30% below capacity. This, coupled with an aging workforce, a weakened social license in support of silvicultural management, and an expanding urban population culturally removed from forestry, has created a challenging and dynamic environment for forestland managers to address diminished forest ecosystem conditions. Successes in achieving forest health objectives within this dynamic environment will require increases in the annual management of forested acres across ownerships in order to keep pace with deteriorating forest conditions, reduce wildfire threats, conserve water quality and wildlife habitat, increase public safety, and improve overall ecosystem function as well as provide the jobs, wages, and taxes needed to support local communities and maintain working forests.

The South Central Study Region

Within the SC study region there are 2,356,000 forested acres with an estimated 450,000 operable acres (Table 3) at an increased risk of additional tree mortality and damage by insects, disease and wildfire within the next 15 years. There are currently three sawmills in this region processing an average of 203 MMBF annually (Figure 5), thereby providing 4,782 jobs and approximately $107.2 million in wages, $649.6 million in the sales of goods and services, and 233,280 bone-dry tons of biomass. An annual increase of 2,257[1] treatment acres (Table 3) recommended for Anchor Forests would generate approximately 11 MMBF in forest products, 198 new jobs, $5.8 million in wages, and $35.2 million in produced goods and services (Table 4). If current forest management within the region (43,743 acres per year) is increased by 2,257[1] acres annually, it would require approximately 10 years to treat the currently

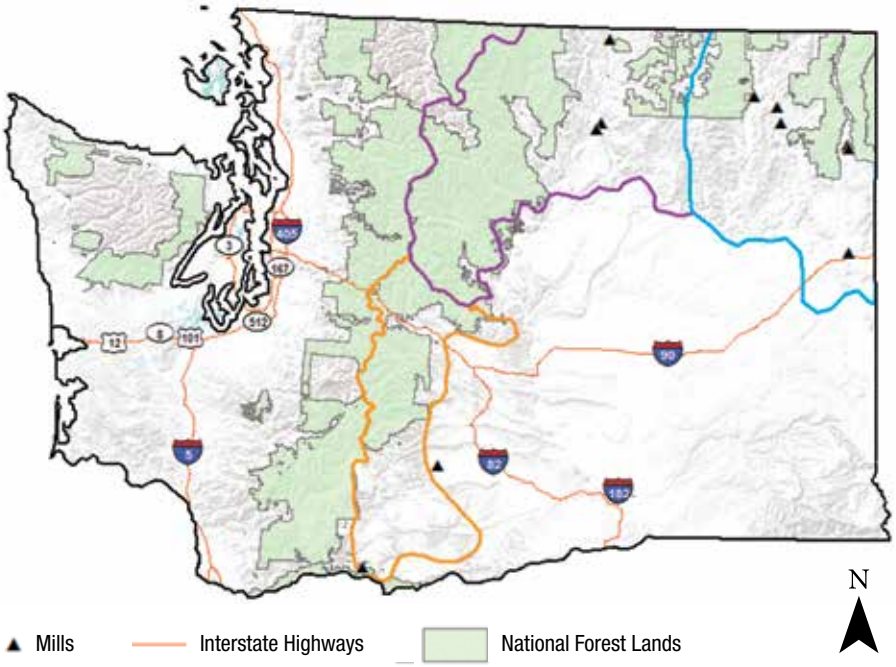


Figure 4. Timber processing locations within the three study areas (South Central, North Central, Northeast) of eastern Washington State.

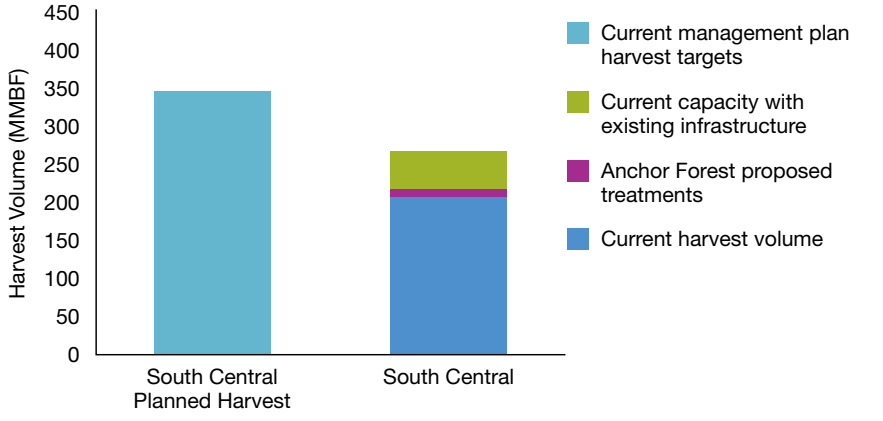


Figure 5. The current volume planned and approved for harvest in the South Central region is shown in comparison to the current "actual" annual timber harvest, the projected harvest from proposed treatment areas within the Anchor Forest framework, and the estimated capacity usable by existing infrastructure if processing is increased to near full capacity.

identified 450,000 operable acres across all ownerships.

With more than 1 million acres of forest land being impacted annually by insects and disease within the State of Washington [15,52], annual increases in the size and frequency of wildfire [14], and federal land treatment recommendations from the USFS (711,457 acres) [52] and governor Inslee (~720,000 acres) [53], an increase in annual forest management beyond the recommended 2,257 for the SC study region will be required to keep pace with deteriorating forestland conditions. Currently, most mills within the SC region are operating at a reduced capacity of between -10% and -30%. This reduced capacity offers the potential to process an estimated additional 20 to 61 MMBF (203MMBF * 10% and 30%) annually using currently established infrastructure.

Table 3. Summary information for the three study regions within eastern Washington are presented to shown total forested lands, current annual treatments by landownership, and the estimated biomass produced and used for each region[30]. Analysis of harvesting, processing, transportation and utilization, costs and infrastructure needed, for biomass and sawlog production are presented in Task 1[30]. The proposed increase in treatment acres for implementation of an Anchor Forest represents a cumulative total spanning all ownerships within each region and would be in addition to the shown "Current Acres Treated Annually." Operable acres are those available to forest management exclusive of wilderness, inventoried roadless and other federally protected lands[48].

Regional conditions and target treatments	South Central	North Central	Northeast
Forested acres	2,356,000	3,276,000	1,808,000
Operable acres needing treatment[1]	450,000	468,000	973,000
Operable acres by ownership			
Federal	53,000	232,000	261,000
Tribal	114,000	70,000	168,000
State	101,000	72,000	78,000
Industrial private	107,000	17,000	166,000
Non-industrial private	75,000	77,000	300,000
Current acres treated annually	43,743	28,992	70,465
Current annual timber harvest (MMBF)	288	77	298
Estimated annual biomass from harvest (BDT)[2]	233,280	62,370	241,380
Estimated utilized biomass (BDT)[3]	39,411	10,537	40,779
Eastern Washington forest products produced by region	43%	12%	45%
Proposed total increase in treatment acres[4]	**+2,257**	**+7,008**	**+14,035**

1 Haugo et al. 2015

2 Estimated annual biomass production was calculated using a conversion factor of 0.81 bone-dry tons of biomass per thousand board feet of timber harvest (Perez-Garcia et al. 2012).

3 Current statewide biomass utilization is 498,500 BDT (Perez-Garcia et al. 2012), with 18.2% (approximately 90,727 BDT) being attributed to eastern Washington. It was assumed biomass production for each study region was the same as percent-harvested timber volume, 43%, 12%, and 45% of the 90,000 BDT for the South Central, North Central, and Northeast study regions respectively.

4 Approximate acres treated were calculated based on an assumption of 5,000 board feet of harvest per acre. The number of acres needing treatment and the timeline to address those acres will likely vary depending on actual on-ground timber volume per acre, local forest management capacities, and the spread of insect and disease tree mortality in future years.

If the milling capacity within the SC study region was increased by 30% this would equate to the production of an estimated 61 MMBF and the treatment of approximately 12,000[1] acres annually. This would represent an additional 9,943[1] acres beyond the Anchor Forest-proposed increase of target acres (2,257 acres), thereby increasing the total annual treatment acres to 55,943 and requiring only 8 years to treat the total operable acres within the SC study region. To accomplish additional management on 9,943 acres, increases in silvicultural and timber-sale layout personnel will be required with minimal investments in processing infrastructure. Furthermore, processing any volume in addition to the Anchor Forest target of 2,257 acres (11 MMBF) would likely require some investments in harvesting, trucking, transportation system, and training/educational infrastructure as well as additional biomass utilization opportunities.

Table 4. A summary of potential benefits and avoided costs following implementation of the Anchor Forest concept in each of the three study regions is presented following the results of the Task 1 analysis[30]. Avoided cost estimates were calculated based on implementing fuels treatments to reduce associated wildfire expenses as provided within the literature.

Estimated benefits from proposed treatment	South Central	North Central	Northeast
Additional forest products generated (MMBF)*	11	35	70
New jobs[1]	198	630	1,260
Wages[1]	$5,808,000	$18,480,000	$36,960,000
Product sales[1]	$35,200,000	$112,000,000	$224,000,000
Avoided cost per acre for high-risk conditions[2]	$1,402	$1,402	$1,402
Estimated total avoided costs	$3,164,314	$9,825,216	$19,677,070

1 Research has shown an average of 18 jobs, $528,000 in wages, and $3.2 million in sales are generated per million board feet of harvest within the Pacific Northwest (Cook et. al, 2015)

2 An assessment of avoided costs using management costs, and benefits derived from, and associated with, investments in forest fuel removals and fire risk reduction (Mason et al. 2006).

* Calculated based on an assumed harvest of 5,000 board feet per acre.

The North Central Study Region

Within the NC study region there are 3,276,000 forested acres with an estimated 468,000 operable acres (Table 3) at an increased risk of additional tree mortality and damage by insects, disease and wildfire within the next 15 years. There are currently two sawmills in this region processing an average of 61 MMBF annually (Figure 6), thereby providing 1,015 jobs and approximately $32.2 million in wages and $195.2 million in the sales of goods and services. An annual increase of 7,008[1] treatment acres would generate approximately 35 MMBF in forest products, 630 new jobs, $18.5 million in wages, and $112 million in produced goods and services (Table 4). If current forest management within the region (28,992 acres per year) is increased by 7,008 acres annually it will require approximately 13 years to treat the currently identified 468,000 operable acres across all ownerships.

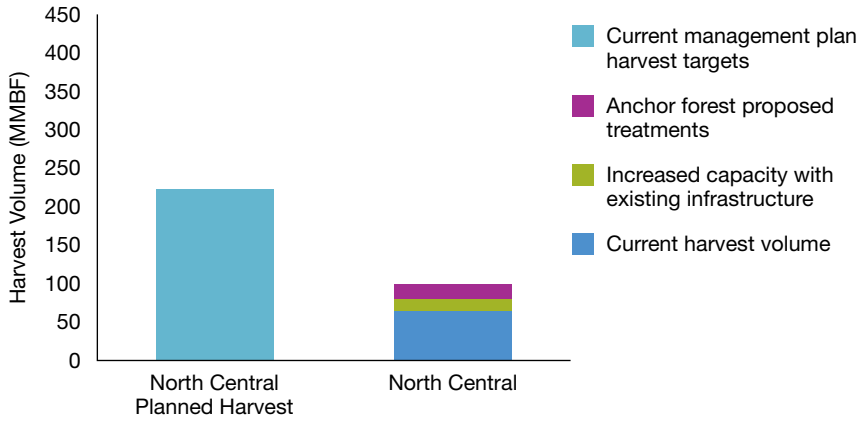


Figure 6. The current volume planned and approved for harvest in the North Central region is shown in comparison to the current "actual" annual timber harvest, the projected harvest from proposed treatment areas within the Anchor Forest framework, and the estimated capacity usable by existing infrastructure if processing is increased to near full capacity. Established infrastructure within the North Central study region is only capable of processing 51% (18 MMBF) of the estimated volume produced by Anchor Forest treatments.

The urgency of increased proactive forest management within eastern Washington is undeniable and faces a myriad of challenges. The greatest challenge may be the protection of forest ecosystems on federal lands in the NC study region, given nearly 50% (232,000 acres) of the identified at-risk forestlands are under USFS management[30]. An increase in regional capacity and multi-jurisdictional ownership collaboration will be a critical part in keeping these forested lands green and resilient to wildfire in the face of increasing insect, disease, and climate constraints over the next 15 years.

With increases in forest mortality reaching new heights every year [15,52], annual increases in wildfire such as that during 2014 and 2015 [14], and federal land treatment recommendations from the USFS (711,457 acres) [52] and governor Inslee (~720,000 acres) [53] within Washington, an increase in annually treated acres beyond 7,008 for the NC study region will likely be required to keep pace with deteriorating forest conditions. Currently, mills within the region are capable of processing an estimated additional 18 MMBF annually without significant increases in infrastructure due to operations at a reduced capacity of between -10% and -30%.

If milling within the NC study region was increased by 30%, an additional 18 MMBF annually would equate to the treatment of only approximately 3,600[1] acres. Based on current forest health conditions, the Anchor Forest target for the NC study region is 7,008 acres (35 MMBF), therefore an additional 17 MMBF of volume beyond the projected processing capacity of current infrastructure would be generated. Successful treatment of the Anchor Forest target acres annually could subsequently present a consistent 13-year supply of timber to support investment in new infrastructure such as a small sawmill (15 to 20 MMBF) or biomass facility. Achieving treatment of the Anchor Forest target (7,008 acres) for this study region would likely require investments in harvesting, trucking, and training; and has the potential to incentivize investments in new processing/ milling infrastructure.

The Northeast Study Region

Within the Northeast study region there are 1,808,000 forested acres with an estimated 973,000 operable acres (Table 3) at an increased risk of additional tree mortality and damage by insects, disease and wildfire within the next 15 years. There are currently five sawmills in this region processing an average of 267 MMBF annually (Figure 7), thereby providing 6,849 jobs and approximately $140.9 million in wages and $854.4 million in the sales of goods and services. An annual increase of 14,035[1] treatment acres would generate approximately 70 MMBF in forest products, 1,260 new jobs, $37 million in wages, and $224 million in produced goods and services (Table 4). If current forest management within the region (70,465 acres per year) is increased by 14,035 acres annually, it will require approximately 12 years to treat the currently identified 973,000 operable acres. The need for increased proactive forest management within the NE study region will face many of the same challenges as the other study regions, the most crucial being that nearly 27% (261,000 acres) of the at-risk forestlands are under federal and/or tribal ownership where management has fallen short of planned and approved objectives, on average, every year for the past decade[30].

There is an urgency to "act" among those who live, work, and enjoy the forests of eastern Washington. This urgency is based on increasing losses of forest sector jobs, renewable forest products, spiritually significant areas, recreational opportunities, and water quality as a result of conditions that promote insects, disease and ecosystem-replacing

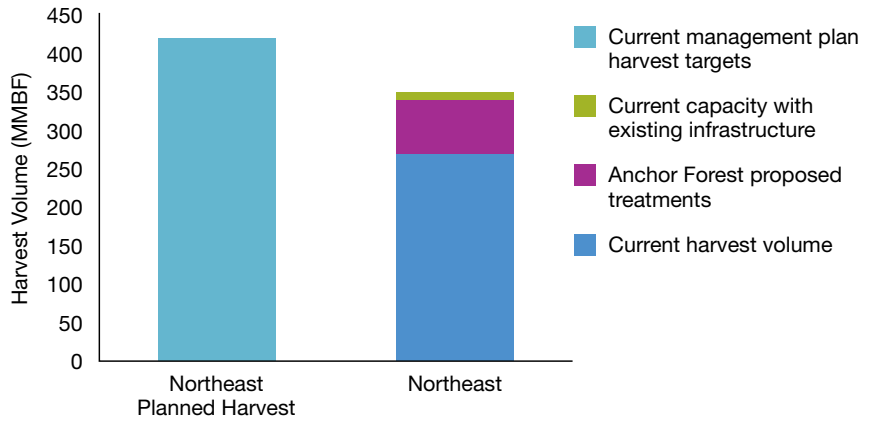


Figure 7. The current volume planned and approved for harvest in the Northeast region is shown in comparison to the current "actual" annual timber harvest, the projected harvest from proposed treatment areas within the Anchor Forest framework, and the estimated capacity usable by existing infrastructure if processing is increased to near full capacity.

wildfire. Similar to the other study regions, as increases in forest mortality and wildfire reach new levels every year [14,15,52], an increase in annually treated acres beyond the Anchor Forest target of 14,035 for the NE study region will likely be required to keep pace with deteriorating forest conditions. However, with many mills throughout this study region operating at an estimated reduced capacity of between -10% and -30%, there is an opportunity to process an additional potential 27 to 80 MMBF annually with increased use of currently established infrastructure.

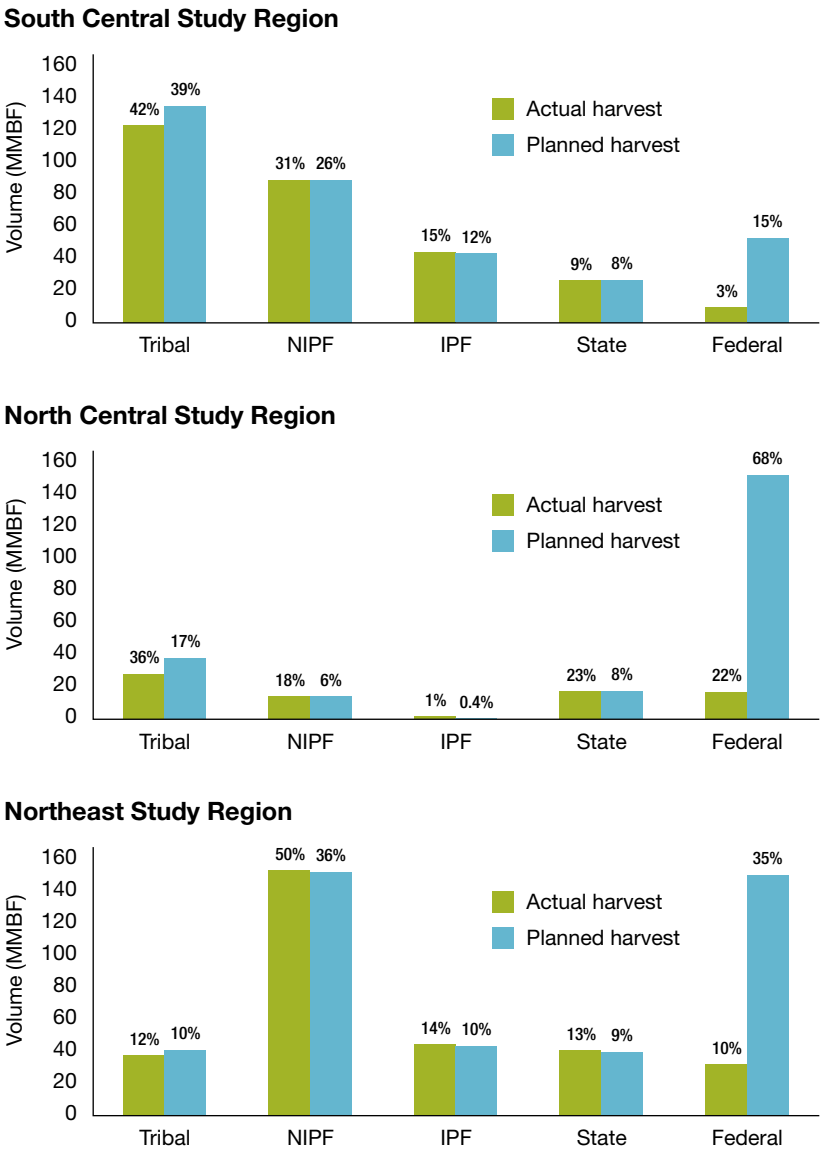


Figure 8. Total annual average and planned (as approved in currently available forest management plans) production of forest products for each landownership classification within the three study regions of the Anchor Forest study assessment. Percentages represent the portion of allowable or actual harvest contributed by each business sector when compared to the others.

1 Many of the current management plans are dated and most are in revision, consequently, "planned harvest" volume is likely to change in order to more appropriately match the present management needs of these landscapes.

If the milling capacity within the NE study region was increased by 30% this would equate to production of approximately 80 MMBF and the treatment of approximately 16,000[1] acres annually. This would represent an additional 1,965[1] acres beyond the target acres identified for an Anchor Forest (14,035 acres), thereby increasing the total annual treatment acres to 86,465 and requiring only 11 years to treat the total operable acres within the NE study region. To accomplish management on 1,965 acres that yields 10 MMBF in addition to the identified Anchor Forest target and estimated volume, the NE study region would not likely require significant increases in investments of personnel, harvesting, trucking, transportation system, or training/ educational infrastructure.

The urgency of increased land stewardship within eastern Washington is undeniable and faces a myriad of challenges, the greatest potentially being management of identified at-risk forest ecosystems on federal lands under U.S. Forest Service management ((SC – 11.7% (53,000), NC – 66% (549,000 acres), NE – 50% (595,000 acres)). For example, within the three study regions, management on these lands has fallen short of planned and approved objectives, on average, every year since 2000 (Figure 8). An increase in regional capacity and multi-jurisdictional ownership collaboration, such as that provided in the Anchor Forest framework, will be critical in keeping these forested lands green and resilient to wildfire in the face of increasing insect, disease, and climate constraints over the next 15 years.

Collaborative Forest Restoration Frameworks and the Anchor Forests Concept [54]

Degraded forestland conditions, multi-faceted and only treatable through proactive innovation and collaboration involving multiple ownerships, exist throughout the nation as evidenced by the growing volume of legislation requiring collaboration. Throughout the west, divergent interests are negotiating how they would like particular national forestlands to be managed. Many proposals include provisions for protection of lands, economic development, timber harvesting, forest restoration, and funding mechanisms. Challenges facing collaborative progress often result from stakeholder adversity to the rigidity of mandates, a lack of collaborative inclusion, or a lack of communication and transparency. These challenges can generate mistrust that lead to appeals or litigation that further delay actions and may discourage future collaborative participation. Collaboration in general is a slow process requiring patience, communication, relationship building, conflict resolution, leadership and commitment to realize the objectives and actions needed to improve ecosystem health and the services provided by forests.

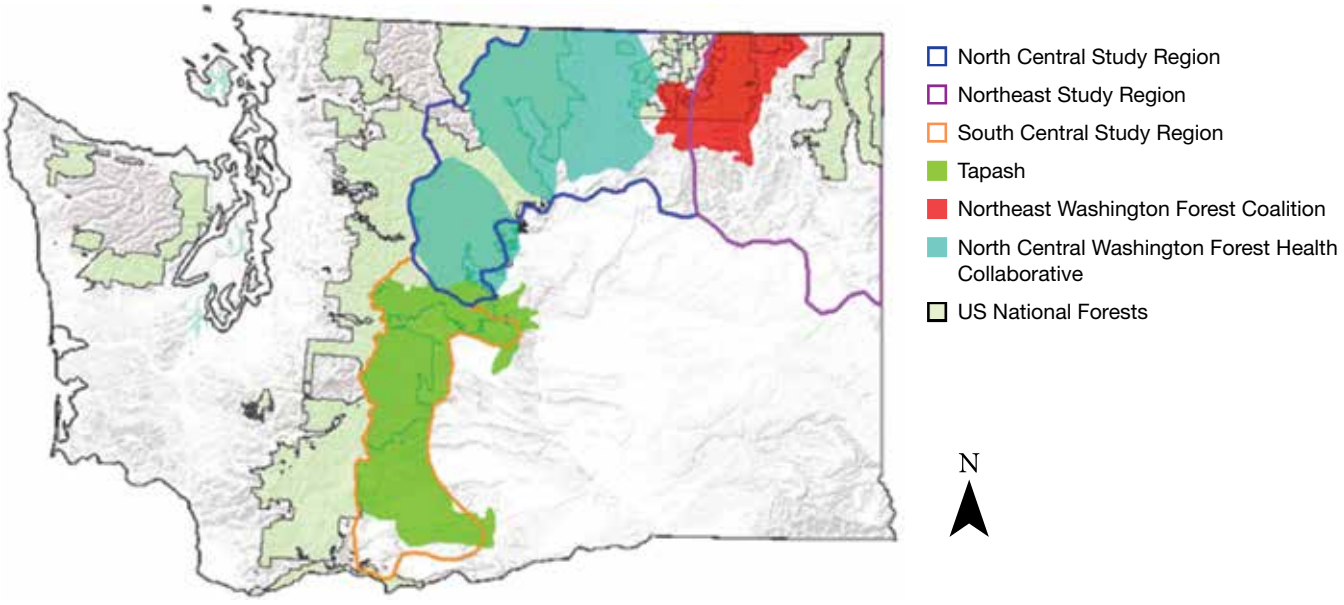


Figure 9. Current collaborative entities targeting forestlands within eastern Washington that include national forestlands and tribal stakeholders.

Within eastern Washington there are three organizations operating under a collaborative structure targeting forestland management. These are the Tapash Sustainable Forest Collaborative (Tapash) within the SC study region, the North Central Washington Forest Health Collaborative (NCWFHC) within the NC study region, and the Northeast Washington Forestry Collation (Coalition) which developed the Colville National Forest "Blueprint" in the NE study region (Figure 9).

Assessment of collaborative governance and project success were completed for these entities given their longevity and operation within the dry-land forest conditions of eastern Washington. These collaborative frameworks provide models of forest ecosystem management founded on stable partnerships, a strong willingness to push forward from all stakeholders, and thoughtful leadership with a clear understanding of anticipated outcomes. For example, collaboration within the NE study region's Blueprint has resulted in designated acres for active forest management, forest restoration, new wilderness, a new Kettle Range National Conservation Area, and three new National Recreation Areas [55]. The Coalition has also successfully collaborated on the implementation of 36 forest restoration projects in the Colville National Forest with limited objections or appeals.

Despite the successes of previous collaboratives, none have completed projects that include multiple-sector landowners where actions were applied across jurisdictional boundaries or at landscape-scales similar to those proposed for Anchor Forests. Additionally, the triple-bottom-line approach and objectives that include ecosystem health, working forests, tribal lifeways, treaties and sovereign rights makes Anchor Forests a unique and innovative framework. This framework, therefore, presents opportunities to build cross-boundary landscape-scale collaborative projects that include ecosystem-specific treatments, a diversity of land ownerships, and the goals to ensure social/cultural, economic, and ecologically balanced forestland management.

Figure 10. This flow chart provides one example for a modified governance structure of the Tapash Collaborative inclusive of tribal leadership and the balanced social/cultural, economic, and ecologic principals of the Anchor Forest concept aimed at managing deteriorating forest ecosystem conditions in eastern Washington.

Due to a necessary degree of direct decision-making from land management agencies and tribes, given legislative mandates and sovereign rights, a structure such as the Tapash or the NE Washington Coalition may provide the necessary opportunities for forest management through existing established legislation. The difference between the governance of these two collaboratives is predominately in the participant structure; where the Tapash is led by a board of landowners from the area of interest, and the Coalition is led by a board of stakeholders that may or may not be landowners within the area of interest.

In assessing feasibility of Anchor Forests it was important to link collaborative efforts to cross-boundary actions. Therefore, while a top-down governance structure may not be the desired model for all collaborative groups, the "Executive Team" and "Working Group" structure of the Tapash provides one potential illustration for successful implementation of the Anchor Forest concept. For example, collaborative input from multi-sector landowners coupled with tribal leadership and a top-down type of governance structure (Figure 10) has the potential to sustainably manage forest ecosystem function at a landscape-scale.

Evaluation of Institutional Capacity [56]

Survey responses varied from highly supportive to mild opposition regarding the overall institutional capacity available to support an Anchor Forest (Figure 11 and Figure 12). Capacity to contribute was primarily driven by budget constraints, staffing requirements, and collaborative trust in the sharing of responsibility. However, respondents at the state and federal levels were most concerned with funding while all others focused on action, deliverables, and accountability. Willingness and capacity to participate was greatest within the tribal and private sector respondents. State sector respondents indicated a similar willingness but limited capacity given time and staffing resource needs. Federal respondents were on average less willing to participate and similarly constrained in capacity by staffing and financial resources. The overall readiness to collaboratively participate in an Anchor Forest varied by

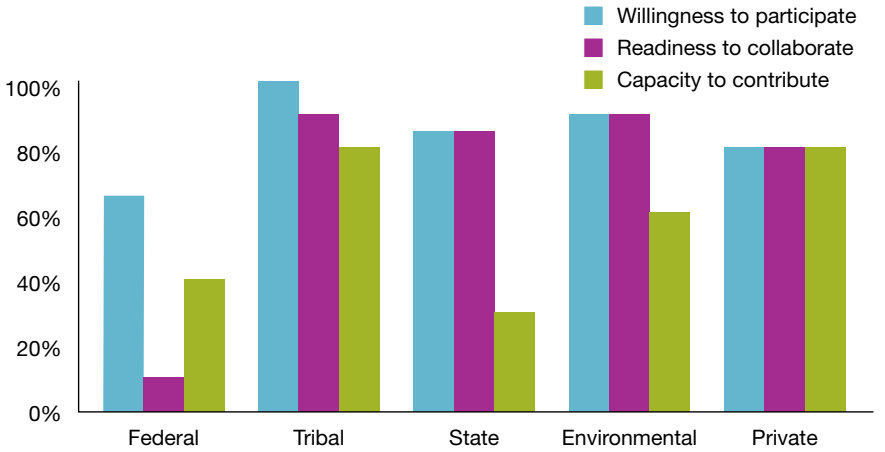


Figure 11. Respondents from interviews in the South Central region indicated a general willingness, readiness, and capacity to participate in an Anchor Forest collaborative, with the exception of federal participant responses indicating a less-than-likely readiness, and both federal and state respondents indicating a similarly limited capacity to contribute staff and timing resources.

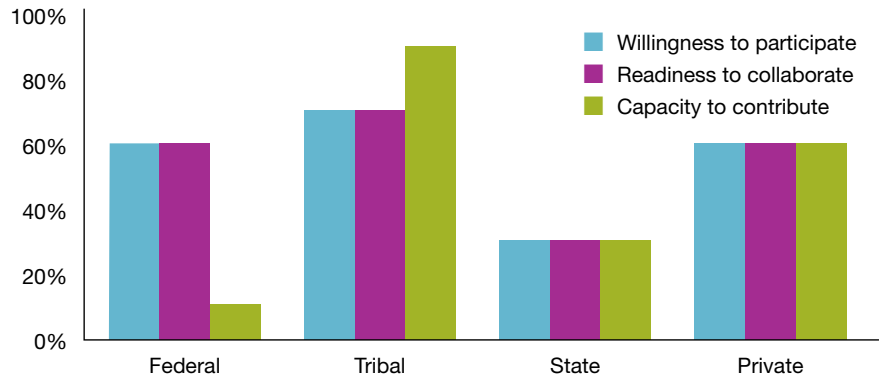


Figure 12. Responses for the North Central and Northeast regions are presented together due to an overlap of interview participants between these two regions. Respondents in both regions indicated a lower overall willingness, readiness, and capacity to participate in an Anchor Forest collaborative, with the federal participants indicating very limited capacity and state respondents indicating an overall uncertainty in their readiness or capacity which affected willingness.

participants indicating sharing of resources, staff, expertise, and equipment would be based upon leadership support as well as the availability and timing of resources. Readiness across all participants was constrained by an unclear understanding of the actionable goals and objectives of an Anchor Forest, concerns regarding a downsized workforce, reduced milling infrastructure, and limited time, staffing, and financial resources.

The majority of respondents believed the Anchor Forest concept merits investment and implementation due to the unique attributes of the framework and current forest land conditions throughout eastern Washington. The majority of participants from all interviewed sectors were committed to dedicating staff time to a collaborative project.

Comments in support of Anchor Forest implementation focused on topics such as:

- Specific funding and staffing in the areas of forest management, forest development, and forest product sales is needed.
- A public communication and education process to increase public awareness of the Anchor Forest concept is necessary.
- Examples are needed that support the ability of Anchor Forests to restore forest ecosystem functions and provide long-term economic sustainability to local communities, thereby gaining the necessary social license to achieve forest management.
- Leadership to guide, moderate, and organize collaborative actions is critical.

Identification of Barriers to Cooperative, Collaborative Cross-Boundary Forest Management [57]

Focus group discussions within each of the three study regions revealed many insights into the opportunities and potential barriers facing implementation of the Anchor Forest concept (Table 5, Table 6, and Table 7). Discussions covered many facets vital to successful collaborative ecosystem management. These included topics such as the belief that currently deteriorated forest conditions should be the greatest priority and that particular legislation, local laws, and policies are often unreasonably time consuming and too slow to effectively achieve the actions needed on these forestlands.

Table 5. Feedback for the South Central region provided through survey responses and focus groups.

SOUTH CENTRAL REGION Predominantly tribal and federal sector presence with active forest management on tribal lands	
+	A collaborative process led by tribes and the U.S. Forest Service is preferred.
+	There is a desire to include more stakeholders from a broader audience in the already formed collaborative processes.
+	There is a focus on forest health, sustainable ecosystem function, and ecosystem services in this region that may outweigh timber production.
+	There is a significant active tribal presence with a background in active forest management and a large contiguous land base.
+/-	Forest treatment capacity is more limited than funding for some ecosystem restoration activities. There is a need for additional personnel training.
+/-	There is a need for more participation and cooperation from the U.S. Forest Service in active land management or adjacent forest lands to minimize threats to management tribal lands.
+/-	U.S. Forest Service funding and resources are tied up in planning, and not in action.
-	Tribes identified mismanagement as the largest threat to forest health. The occurrence of uncontrollable wildfire, due in part to conditions on adjacent lands, has impacted water quality, fishery resources, cultural sites, and the function of entire ecosystems.

\+ Generally represents an opportunity for an Anchor Forest Project.
+/- Represents an opportunity as well as a challenge for an Anchor Forest Project.
\- Represents a challenge or a barrier for an Anchor Forest Project.

Table 6. Feedback for the North Central region provided through survey responses and focus groups.

NORTH CENTRAL REGION Predominantly industry and private sector presence with active forest management	
+	There is support for a collaborative process from the U.S. Forest Service in support of an Anchor Forest.
+	Collaboration and communication are needed and generally supported by all participants within the study region.
+/-	There is limited milling capacity for forest products and substantial investment would be required to increase capacity.
+/-	There is limited timber supply due to restricted forest management and agency resources.
+/-	Tribal participants have limited resources within this area.
+/-	Private landowners within this region are concerned that Anchor Forests would "add another layer of regulation to forest activities."
+/-	In general, infrastructure and markets are lacking for wood products, especially "large wood."
+/-	There is a lack of logging personnel across all business sectors.
+/-	This region has the greatest number of acres designated as unhealthy forest conditions. The majority of acres are on federal lands and many are not restricted from treatment by wilderness or roadless designations.

\+ Generally represents an opportunity for an Anchor Forest Project.
+/- Represents an opportunity as well as a challenge for an Anchor Forest Project.
\- Represents a challenge or a barrier for an Anchor Forest Project.

Table 7. Feedback for the Northeast region provided through survey responses and focus groups.

NORTHEAST REGION Predominantly industry and private sector presence with active forest management	
+	Collaboration was preferred for forest management based on experience.
+	There is a focus on timber supply and forest product utilization through active management.
+	Goals are support for local communities through jobs and use of a diversity of forest products.
+	There is well established private sector milling capacity and marketing.
+/-	The majority of unhealthy forest conditions are on federal lands and many are not restricted from treatment by wilderness or roadless designations.
+/-	There is a need to define "sustainability" in support of active forest management for communication purposes.
+/-	The public perception of forest health needs modification and attention needs to be drawn toward the implications for non-management.
+/-	There is a lack of infrastructure and markets for "large wood."
+/-	There is a lack of Tribal milling capacity and a general lack of logging personnel across all business sectors.
+/-	There is a lack of U.S. Forest Service support and leadership regarding active forest management.
+/-	U.S. Forest Service funding and resources are tied up in planning, and not in action.
-	Tribes identified mismanagement as the largest threat to forests, noting management for "desired future conditions" can be an obstacle for adaptive management.

\+ Generally represents an opportunity for an Anchor Forest Project.
+/- Represents an opportunity as well as a challenge for an Anchor Forest Project.
\- Represents a challenge or a barrier for an Anchor Forest Project.

Participants also acknowledged the value of partnerships between stakeholders with differing opinions and the importance of leadership from agency personnel or tribes to unite stakeholders and move actions forward through well-defined objectives. Discussions further presented concerns regarding the need for a measure of "protection" for the collaborative process to discourage non-participant appeals, litigation, and delay to more effectively move collaborative projects forward when parties, unwilling to participate, challenge the decisions of collaboratives.

Anchor Forest Information, Programs, and Financial Assistance Database [58]

Cooperatives are employed throughout the United States and worldwide, with forestry cooperatives operating in 17 countries, involving over 3.6 million landowners, and managing more than 60 million acres of forest lands. There is currently a highly diverse array of existing programs designed to help maintain working forests on the landscape, however many of these opportunities are not being maximized.

Greater solicitation and utilization of funding can be improved through coordinated efforts such as those within the framework of the Anchor Forest concept given the new opportunities to match available funding with ecosystem needs and a greater diversity of stakeholders. For the purposes of this assessment, analysis of the forest industry and ecosystem conditions were used to develop a searchable database of programs, authorities, funding sources and technical assistance available to support the infrastructure, personnel and collaborative needs for implementation of an Anchor Forest. Through this analysis 90 funding sources within 24 different organizations were identified that could be applied to a wide variety of activities in support of an Anchor Forest (Figure 13). This diversity of funding sources supports a comprehensive range of ecosystem management activities that can address restoration, research, biodiversity enhancement, community assistance, and regional climate challenges, among others.

Continuously changing legislation and funding programs such as the 2014 Agriculture Act (Farm Bill) include permanent authorities for stewardship contracting as well as incentives for use of the Good Neighbor Authority and categorical exclusions. Implementation of the Anchor Forest concept can be supported by many of the opportunities offering resources

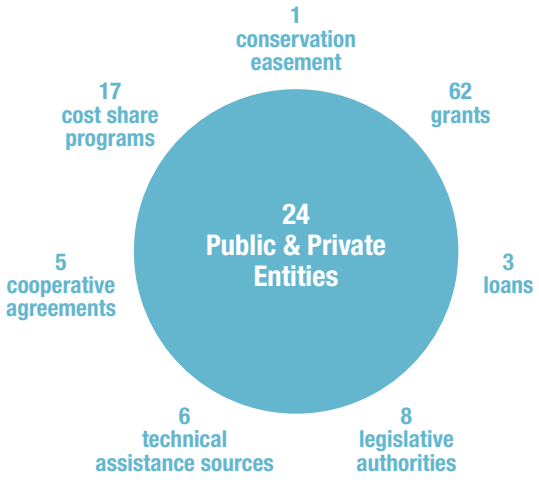


Figure 13. Twenty-four organizations and entities were identified as offering a variety of funding opportunities, many of which are applicable to the infrastructure and organizational needs of an Anchor Forest.

to treat forests at risk of wildfire as a result of insect and disease infestations, or overstocking. Through shared leadership and a well-structured collaborative framework such as the example provided in Figure 10, Anchor Forests can provide opportunities to adapt management decisions and maximize the use and effectiveness of available funding.

Socio-Economic Forestland Values and Non-market Benefits of Ecosystem Services [59]

Eastern Washington is experiencing severe forest-health issues and without strategically planned ecological management throughout the region these issues will continue to persist, further impacting communities and forests through landscape-scale tree mortality and catastrophic wildfire. The need to address forest health involves many considerations such as: ecosystem services, public expenditures for wildfire suppression, water quality and quantity, soil erosion, fish, wildlife, economic vitality, carbon sequestration,

Table 8. These ecosystem service categories are available in properly functioning forested ecosystems. Some of the appropriate methods for estimating their value to society are provided for reference. *(Table adapted from Farber et al. (2006), reproduced with permission from Turner et al. (2015)).*

Ecosystem services	Amenability to economic valuation	Most appropriate method for valuation	Transferability across sites
Provisioning services			
Water supply	+++	AC, RC, M, TC	++
Food	+++	M, P	+++
Raw materials	+++	M, P	+++
Genetic resources	+	M, AC	+
Medicinal resources	+++	AC, RC, P	+++
Ornamental resources	+++	AC, RC, H	++
Regulating services			
Gas regulation	++	CV, AC, RC	+++
Climate regulation	+	CV, AC, RC	+++
Disturbance regulation	+++	AC	++
Biological regulation	++	AC, P	+++
Water regulation	+++	M, AC, RC, H, P, CV	++
Soil retention	++	AC, RC, H	++
Waste regulation	+++	RC, AC, CV	++/+++
Nutrient regulation	++	AC, CV	++
Cultural services			
Recreation	+++	TC, CV, Ranking	+
Aesthetics	+++	H, CV, TC, Ranking	+
Science and education	+	Ranking	+++
Spiritual and historic	+	CV, Ranking	+

AC=avoided cost, CV=contingent valuation, H=hedonic pricing, M=market pricing, P=production approach, RC=replacement cost, TC=travel cost; High: +++; Medium: ++; Low: +.

and climate change mitigation. When forest management is practiced within the confines of property boundaries, isolation, fragmentation, and a lack of collaboration have resulted in exploitation and depletion of natural capitals, and often accompany transfer of costs to others. Consequently, there is a need to quantify and value the capacity of an ecosystem to provide public services (Table 8). For example, as land conversion occurs to support a growing population culturally removed from natural resource management, amenities on private lands are lost and public lands are expected to replace them or at least minimize the need for private land management.

Anchor Forests are intended to provide the framework needed to maintain and expand working forests on the landscape that perpetuate sustainable ecosystem processes and increase the value and extent of available ecosystem services through a balance of social/cultural, economic and ecologic actions. For clarification; ecosystem *processes* are the naturally occurring functions describing biophysical relationships that exist whether humans benefit from them or not, whereas ecosystem *services* are "what" the goods or processes of an ecosystem contribute to human well-being, and as such, would not exist without the existence of people and societies (Figure 14).

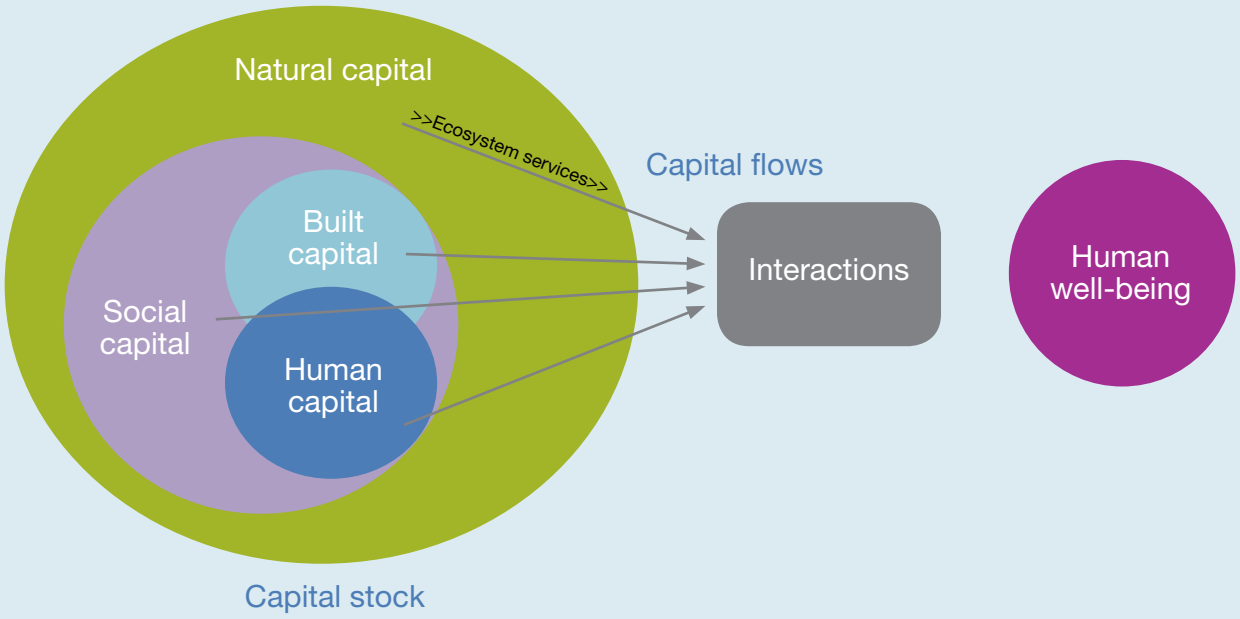


Figure 14. Human-environment interactions are formed between built, social, human and natural capital and collectively contribute to human well-being. Built (including economy) and human capital are embedded in society which is enveloped within the rest of nature. Ecosystem services are the relative contribution of natural capital to human well-being; they do not flow directly to create well-being and need the other sources of capital to exist. It is therefore imperative to incorporate all facets of capital within collaborative landscape-scale management actions such as those of an Anchor Forest. *(Figure reproduced with permission from Turner et al. (2015)).*

Anchor Forest Opportunities and Barriers

Millions of forested acres are in decline as a result of overstocking, pathogen epidemics, and climate change impacts, further increasing the threat of uncharacteristically severe wildfires. Currently, the inability to treat deteriorated forest conditions, specifically on NFS lands, is increasing the threat of wildfire on neighboring tribal, state, and private lands. As these threats increase, our ability to effectively respond diminishes, further amplifying wildfire costs that continue to consume agency budgets, reduce resources, and conservation efforts needed to address declining forest ecosystem resilience. Low timber prices as well as atrophying harvest, transportation, processing, and work force infrastructure have left many private landowners with little financial incentive to maintain productive forests, thereby increasing opportunistic land sales that lead to fragmentation and conversion to non-forest uses.

The difficulty associated with addressing deteriorating ecosystem conditions at the landscape-scale has led agencies and the public to regulation, litigation and now, collaboration. Disagreements over forest management have resulted in increased planning, assessment, and operating costs, decreased forest treatment incentives, and

"When the Forest Service's general budget is reduced either by fighting wildfires or inflationary costs, other vital projects such as restoring watersheds, investing in infrastructure, and managing for ecosystem health are put on an indefinite hold. These programs are critical to protecting our communities, adapting to climate change, maintaining our forest products infrastructure and improving ecosystem health."

Letter from U.S. Senators Tester and Wyden et al. 2009, to President Barack Obama[36]

discouragement of many forestland owners from collaboration and management. This has resulted in decreased ecosystem function and a loss of ecosystem services throughout many forestlands in eastern Washington and the western United States.

The assessments presented focus on an Anchor Forest concept that recognizes and respects the prerogatives and obligations of individual landowners. This focus offers a foundation to develop actionable strategies of collaborative landscape management that will accrue shared benefits for all willing to work together in a respectful, trust-based atmosphere. The opportunities for landscape-scale forest ecosystem management provided by Anchor Forests are further intended to help:

- Restore the ability of the USFS to manage lands within its jurisdiction to maintain forest health and resilience alongside other landowners on a landscape scale.
- Coordinate management across ownership boundaries in order to enhance ecosystem functions, address forest vulnerabilities to severe wildfire, and provide management adaptation strategies that address the effects of a changing climate.
- Provide sufficient economic benefits to retain viable processing infrastructure, working forests, and rural communities across the landscape in support of forest ecosystem health.

Opportunities within Anchor Forests

An increase in forest ecosystem health will provide additional jobs, wages, and taxes to local communities while reducing wildfire threats, increasing public safety, and improving overall ecosystem function. The greatest potential for jobs and economic growth exists within the NE study region due to the presence of existing infrastructure (six facilities) and the support it could provide to treatment of operable acres as identified by the Anchor Forests assessment. The NE region however, has an overall lower willingness to participate in the Anchor Forest concept than the other regions (Figure 12). The greatest willingness to collaboratively participate in the treatment of proposed operable acres exists within the SC study region. Stakeholder support within the SC region combined with existing infrastructure (two facilities) offers one of the greatest opportunities to immediately implement actionable management on operable acres that addresses the triple bottom line of the Anchor Forest concept. Both the NE and SC regions provide opportunities for implementation of the Anchor Forest concept given existing processing facilities, harvesting infrastructure, knowledgeable silvicultural personnel and availability of contractors.

The proposed "target" treatment acres with the Anchor Forest assessment provide an opportunity to begin addressing the current and increasing insect, disease,

1 Readers should note the proposed target treatment acres within Anchor Forests are in all cases smaller in area (-20% to -80% less) than the currently "planned and approved" acres for agencies and some tribes. Additionally, these target treatment acres have all been previously recognized by the Forest Service, The Nature Conservancy and the Governor of Washington as lands requiring treatment. The reduced acreages presented by the Anchor Forests assessment are intended to be more attainable given current infrastructure, management capacity, funding, and overall study region "willingness" to actively manage forest ecosystem conditions.

and wildfire conditions across ownership boundaries. These target treatment levels can provide an example of landscape-scale management founded on ecological function, forest resilience, recreation, and economic support for working forests and local communities. The Anchor Forest assessment has identified landowner management and treatment activities that could be combined into a cross-boundary action plan that addresses forest health, maintenance of working forests, forest product markets and local communities.

Acres in need of treatment to improve forest ecosystem function are presented for all study regions with the largest acreages occurring in the NC and NE study regions, primarily due to extent of federal land ownership. Achieving the proposed treatment acres[1] in the SC or NE study regions may initially offer the greatest opportunity for implementation of an Anchor Forest given already established partnerships between tribal and federal land managers, past successes in collaborative land management, currently existing infrastructure, and a diverse mosaic of land ownership.

Across all three study regions current perceptions and an understanding of forest conditions, wildfire, and natural resource policy, are extensive within current leadership. This was demonstrated through the identification of all Anchor Forest goals and objectives in responses from focus groups and interviewed participants. This is further supported by the successes of current collaborative programs offering examples of effective forest ecosystem management founded on stable partnerships, a strong willingness of stakeholders to move forward and solid leadership focused on clear objectives. Anchor Forests would span multiple land ownerships at a regional (≥1,000,000 acres) scale. Leadership by tribes through collaboration with the USFS and other federal agencies would then set a new precedent with the potential to address landscape-scale ecosystem functions at a timescale sufficient to curtail increasingly frequent catastrophic wildfire, and improve ecosystem resilience in the face of a changing climate.

The inclusion of tribal lands in Anchor Forests provides an opportunity to improve the coordination of landscape-level restoration projects, support the socio-economic needs of communities, maintain forest management infrastructure, monitor the effects of restoration projects, and gain more diverse stakeholder inclusion and leadership. Tribes provide a depth of holistic forest management no other participant has. Through leadership and cooperation with stakeholders, tribes can help utilize state and federal resources to accomplish balanced forest-health objectives. Additionally, tribes, as sovereign nations, have an opportunity to co-manage many of the federal lands in need through trust obligations and federal fiduciary responsibilities. Moreover, tribes offer experience through "Traditional Ecological Knowledge" that can provide

"Community-based landscape conservation is practiced when partners working in the right places on the right projects follow what has come to be known as the 80/20 rule—committing to work on the 80% in common, not the 20% that divides. Once partners build trust and credibility by working on the 80%, they are able to tackle the remaining 20%."

In reference to the Blackfoot Challenge Collaborative Partnership by Burnett (2013)

a foundation for sustainable ecosystem stewardship. Traditional knowledge, gained through a legacy of living within forest ecosystems, supports tribal successes and economic objectives that provide employment stability, processing infrastructure, an overall protection and enhancement of social/cultural values as well as increases in ecologic resilience at a landscape scale.

The success of a landscape-scale collaborative framework such as an Anchor Forest requires a diverse array of stakeholders and considerable investments in time and relationship building to accomplish win-win results. The need to bridge public agency strengths and public/private efforts can be provided within Anchor Forests through objectives that focus on a common desire to improve and conserve forest health and function.

Moreover, a unique opportunity for Anchor Forests resides in the ability for sustainable forest management to be funded through revenue generated by management prescriptions, recreational fees, and/or institutional resources in support of improving whole forest ecosystems. However, this will require a social and political network focused on ecosystem service values that can only be gained by including diverse cross-boundary stakeholders encompassing tribes, government agencies, local business and industry, recreationalists, food producers and sellers, hydroelectric energy producers, and the general public at large.

Barriers to Anchor Forest Landscape-scale Forestry

Forest management planning that assesses the impacts of historical management on ecosystems and addresses the effects of fire exclusion on dry fire-prone landscapes is needed. This is critical in motivating restoration efforts because insect, disease, and wildfire impacts have increased significantly throughout the past two decades, impacting a substantially greater area than current management efforts are addressing. Within the three study regions of this assessment nearly all landowners with the exception of the USFS, and to a lesser degree some tribes, have been successful in achieving their forest planning objectives. The USFS inherently has challenges unique to their role as a federal land management agency that impact forest planning and management activities. Recent research has identified some of these challenges to be: frequent leadership turnover, a lack of leadership direction, conflicting rules and regulations, inconsistent support for activities within the agency, excessive financial resource allocations to wildland fire, and influence of individual personnel attitudes, values, and beliefs in management decisions.

A lack of large scale "positive" experiences and successful examples that substantially improve deteriorating forest ecosystem conditions at a landscape-scale are not available to the general public and has therefore weakened the social license critical to generating support for forest stewardship and silvicultural expertise. Furthermore, mistrust, inconsistent federal agency guidance, and non-participant litigation represent some of the greatest barriers to

"In the U.S. Forest Service, research shows that the attitudes, values, and beliefs of agency personnel influence project-level decision-making, the goals and strategies pursued in NEPA processes, and the ways public involvement processes are conducted [62–64]" [22]

actions that will mitigate or address insect and disease infestations in currently overstocked forests. These conditions lead to reduced ecosystem resilience that promotes more severe wildfire which damages ecosystem function and eliminates many opportunities to maintain functional forest structures. Wildfire and the subsequent loss of forest management opportunities in turn discourages stakeholder participation, consumes already limited resources, and leads to a further weakening of the social license needed to address currently degraded forestland conditions.

The public perception of forest management and the social license needed to plan and implement actionable restoration activities alone presents one of the greatest barriers to addressing the landscape-scale ecosystem degradation resulting from unnatural tree densities, the exclusion of fire, and increasing tree mortality. This barrier is further amplified by a general lack of public understand regarding the practices and tools available through professional forestry and the science of silviculture. Degraded forestland conditions, if not corrected, will continue to fuel the already increasing frequency and severity of catastrophic wildfires that have destroyed homes and wildlife habitat, impacted water resources, and altered entire ecosystems for decades into the future.

The annual nature of the Forest Service funding cycle increases the difficulty in planning long-term projects and in keeping projects on schedule as funding is often allocated late, leading personnel to present agreements with reduced timeframes. This can be further complicated by declining operational experience and frequent turnover of agency leadership, thereby weakening agency ability to achieve management goals and targets. What this means for collaboratives is additional time spent planning and re-planning which encourages inefficient or inadequate decision-making that can discourage collaborative efforts and participation from some stakeholders.

Limited capital for investments in harvesting equipment and trucking is anticipated to be available for the projected needs to accomplish restoration on the identified acres within each of the three study regions. These investments would be prior to, and not include, future maintenance costs associated with the use of existing facilities and infrastructure to accommodate increased annual harvest volume. Assessments of forest planning and treatment implementation noted the cost of management to prepare timber harvest operations is significant ranging from $66 to $71 per thousand board feet (MBF) on state-managed lands and from $150 to $220 per MBF on USFS Region 1 and Region 6 lands, respectively.

Although there is a significant volume of biomass available within eastern Washington, the infrastructure and capacity increases needed to address transportation and use of the estimated annual increase in biomass produced from proposed treatment acres would be substantial. Moreover, existing biomass facilities will not likely be able to accommodate all the additional volume. This is in part due to market value and costs associated with timber harvest and transportation. It is therefore unlikely that additional biomass within eastern Washington could be utilized in the near future without increases in production and supply incentives/subsidies as well as market price for generated products.

The workforce demographic of the forestry sector is aging, and training and education for new and existing opportunities are needed. Programs addressing this are limited throughout the State of Washington as a whole,

regardless of study region. Survey respondents supported this finding and additionally noted reduced availability of contractors, diminished capacity of forestry workers, litigation, and an ability to maintain competitive prices for forestry services and products were also barriers. Additional barriers were also attributed to a lack of available professional staff for inventory, forest analysis, and planning, as well as expertise to collaboratively conduct operations across boundaries.

Forestland fragmentation and conversion to other uses increase wildfire risk and the cost of wildfire suppression through amplifying the complexity of the landscape in semiarid and dry forest-type ecosystems. Permanent forestland conversion away from working forests often leads to increased runoff and sedimentation, higher peak streamflow, and loss of riparian vegetation, as well as an increased need for channel stabilization infrastructure. Additionally, forestland fragmentation, as a result of conversion, often decreases outdoor recreation opportunities increasingly important to the growing urbanized population. Fragmented forests, often being more prevalent within areas of greater population density, generally have parcels too small to support investments in forest management or ecosystem processes and therefore represent a barrier to landscape-scale goals.

Federal legislation such as the Equal Access to Justice Act (EAJA), National Forest Management Act (NFMA), Endangered Species Act (ESA), and the National Environmental Protection Act (NEPA) process in particular, reduce the efficiency and effectiveness of the USFS to complete planning and apply actionable treatments to forestlands with diminished ecosystem function vulnerable to severe wildfire. Research has predominantly attributed this to numerous lawsuits and appeals from parties not participating in the collaborative process. As a result, agency caution regarding administrative appeals and litigation as well as the perception of risk has led to smaller and more narrowly scoped projects further increasing per unit costs.

The quantification of ecosystem services, protected or enhanced, is challenging without assessment data and long-term monitoring that detects changes using quantifiable metrics. To date, timber and fiber as well as forestland itself have generally-accepted monetized market values, but there is no succinct method for assessing the value of non-timber services, avoided or preserved. The difficulty in assessing the monetized value of non-timber forest resources has led to a lack of consensus or acceptance of their inclusion in forest planning in the past. This is beginning to change however, with the requirements of federal agencies to include ecosystem services in planning activities as of 2016.

"The absence of clear and cohesive federal policies and leadership on climate change adaptation, the use of biomass for energy production, and the sustainability of forests perpetuates the declining condition of Western forests. The need for forest restoration is larger than can be effectively addressed given current treatment sizes, rates of restoration treatments, and typical planning and implementation processes."

Western Governors Association, Forest Health Advisory Committee (2010) [27]

Implementing Anchor Forests

There is a need to demonstrate the value of effective cross-boundary planning and partnerships to enhance forestland stewardship, coordinate and leverage resources, evaluate investments in working forests, and improve the quality of life and societal well-being that forestlands provide.

What

The framework of Anchor Forests offers a strategy and incentives for collaboration as well as the necessary economic viability essential to maintain healthy forests on the landscape, whether those forests are tribal, state, federal, industrial or private. Operated under collaborative frameworks founded in trust and responsibility, Anchor Forests will support a myriad of public values and help stem the tide of resource loss. Analysis of the forest industry within eastern Washington yielded proposed treatment levels by ownership where the greatest need for action exists on the landscape. The framework of Anchor Forests, with leadership from tribes, has the ability to treat these acres and support the triple bottom line of social/cultural, economic, and ecologic benefits to all. Treating these acres will equate to an overall increase in management activity of more than 50% on NFS lands from the current annual average across each of the study regions. Although this would represent a significant gain, treatment of additional acres must be encouraged to keep pace with increasing tree mortality, insect and disease infestations, and wildfire occurrence in the face of a changing climate.

When established, Anchor Forests have the potential to improve the social license needed to implement the "all hands, all lands" forest management concept through collaboration of many working toward a singular goal of forest ecosystem health and resilience. The successes of forest stewardship require coordination of management efforts, leadership founded by tenure in sustainable forest stewardship, and a dogmatic

permanence focused on the future, such as that exemplified through tribal lifeways and the traditional ecologic knowledge of tribes. With leadership founded on these principals Anchor Forests will help attain additional ecosystem services and benefits from avoided costs. The avoided costs resulting from forest health improvements and fuels treatments needed to reduce expenses associated with fire suppression and capture per-acre savings can range from $606 for moderate, to $1402 for high-risk, forest lands[49,50].

The integration of programs like the Collaborative Forest Landscape Restoration Program (CFLRP), the Tribal Forest Protection Act (TFPA), or stewardship contracting with tribal leadership in a collaborative process focused on landscape level cross-boundary integrated resource projects has the potential to streamline processes within the NEPA, NFMA and ESA while encouraging stakeholder participation. The landscape-scale concept of the Anchor Forest framework encourages multi-ownership coordination and management that affords opportunities not previously realized by collaborative efforts at smaller spatial scales. Additionally, the unique relationship of tribes as sovereigns and the U.S. government, coupled with tools such as the Tribal Trust Doctrine, provide opportunities for greater consultation and collaborative forest management for acres crossing jurisdictional boundaries and those federal lands bordering tribal reservations.

Collaborative forest management within Anchor Forests can exemplify how forest stewardship, founded by balanced social/cultural, economic, and ecologic values, can enhance forest resilience through responsible forest management, and demonstrate the advantages of biomass use related to climate change, energy security, and economic development (e.g., homes, jobs, biodiversity, carbon sequestration, and more).

Where

The NC region has the least forestry infrastructure (e.g., sawmills and biomass facilities), and an overall low willingness to participate in a collaborative project. Substantial investments in infrastructure, personnel and collaborative relationships would be needed to support the development of small log or biomass processing facilities required to address the forested acres in need of treatment. Motivation to invest in the necessary infrastructure and personnel would likely require examples of successful collaborative projects with federal agency participation and demonstrated long-term contracting which are not currently available within this region. Assessment results suggest forest resources could be available in the quantities required to maintain sufficient infrastructure and contribute significantly to improvements in forest ecosystem function if collaborative long-term projects involving treatments on NFS and neighboring lands become established.

The NE region has the greatest forestry infrastructure and employment opportunities compared to the other study regions. This existing infrastructure coupled with the magnitude of acreage in need of management within the NE study region provides a variety of opportunities to implement the Anchor Forests concept. Additionally, the NE region has a prior history of applying policy that supports collaborative tools such as stewardship contracting, and has previous examples of successful

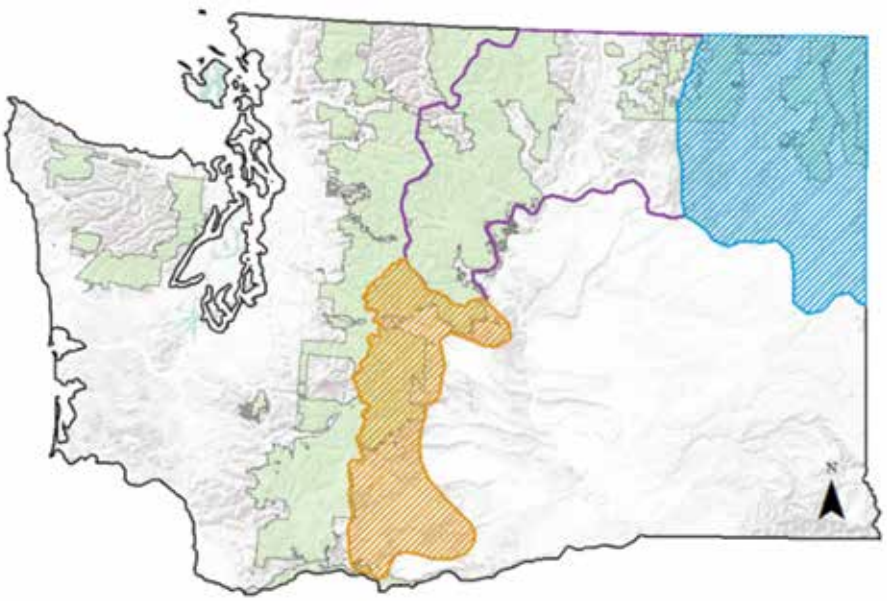


Figure 15. The Northeast and South Central study regions have been identified as areas with established infrastructure, personnel, and resources currently available to facilitate implementation of the Anchor Forest concept. The South Central study region differed from the Northeast in tribal participation for on-going collaborative actions and a greater willingness to participate in an Anchor Forest collaborative from survey participants and focus group discussions.

collaborative forest management projects. Within the NE study region however, assessment results showed an overall low willingness to participate from all potential stakeholders, with the exception of tribal respondents.

Within the SC region there are substantial holdings of forest lands managed by the Yakama Nation exhibiting active management, sustainable forest stewardship, available forest milling and processing infrastructure, and locations where tribal lands are adjacent to federal and state forest lands in need of treatment. Involvement of the SC region in the Tapash collaborative specifically, has provided an example of how an Anchor Forest may function. The Tapash offers a structure to advance communication, and the significant investments of time and resources often required to participate in a large-scale collaboratives. Additionally, the SC region, to date, has not experienced the appeals and litigation many other collaboratives have with regard to forest land management.

These conditions supported by a well-developed governance structure will provide opportunities to improve forest health and ecosystem function at a landscape-scale while simultaneously maintaining working forests and supporting local communities. As a result the SC study region appears to provide the greatest opportunity to implement the Anchor Forest concept given currently available forestry infrastructure, adjacent land ownership diversity, survey responses regarding willingness and capacity to collaborate, and currently existing forest management infrastructure.

This assessment is founded on the expectation of respectful partnerships and actionable decisions that can address current forest health conditions through sustainable management using the current infrastructure, previous collaborative experiences, and expressed stakeholder willingness to participate. Therefore, both the NE and SC study regions, separate in markets and labor force issues, hold promise for implementation of the Anchor Forest concept to provide eastern Washington with sustainable economic incentives while simultaneously treating forest ecosystem health conditions (Figure 15).

How

Assessment results indicate the value of relationships founded in trust and respect within a collaborative group can be more critical to the success of an organization than any one particular governance structure. However, the function of a well-defined structure is undeniably advantageous in organizing efforts and leveraging resources within management decisions. For this reason the "Executive Team" and "Working Group" framework of the Tapash Collaborative may be appropriate for implementation of the Anchor Forest concept in either the SC or NE study regions due to a necessary degree of direct decision-making from land management agencies and tribes, given legislative mandates and tribal sovereign rights. Additionally, a governance structure similar to the Tapash and further supported by management tools that complement a collaborative governance structure with tribal leadership, as illustrated by the

flow chart in Figure 16, is likely to provide increased opportunities for sustainably improving forest ecosystem health in eastern Washington.

In order to address the challenges of an aging demographic in the forestry sector, programs are needed that encourage and educate students on the importance of forestry and silvicultural timescales, and that teach the value of communication, understanding of the social license, and responsibility required for forestry activities. This can be incorporated into the implementation of Anchor Forests at the state and local community levels to match employment opportunities with local residents.

Long-term contract commitments to active management and timber supply are necessary to encourage capital investments needed to outpace deteriorating forest ecosystem conditions across the State of Washington, regardless of study region. A minimum of 15-year supply agreements would provide amortization opportunities for industry investments in infrastructure and encourage the establishment of additional infrastructure necessary to complete the restoration activities identified. These long-term landscape-scale (50,000 to 200,000 acre) projects focusing on the utilization of areas where trees are overstocked and unhealthy may provide the greatest level of support from landowners and stakeholders within currently established guidelines and policies.

A "champion" and leader is needed in each agency and tribal entity to collaboratively prioritize and direct management of Anchor Forests. Leaders must be committed to the process by continually seeking to build trust and relationships between collaborators and remain engaged in projects through completion. Collaborative leadership from tribes, due to their place-based culture, can provide the greatest benefits to cross-boundary forest ecosystem stewardship at scales that can outpace current forest losses.

If the collaborative process was binding, similar to the concept of baseball arbitration, where a member of the National Association of Arbitrators could make a decision that would "stand" throughout the duration of a collaborative project, this would improve collaborative efficiency and encourage participation from additional stakeholders. Research has shown that many cases against the USFS involve administrative technicalities rather than environmental impact issues; thus, policy that inhibits the misuse of legislation could be valuable to collaborative efforts. The ability of nonparticipating parties to appeal is being discussed in some legislation. However, there is a need for these actions to be minimized in regard to forest restoration activities focused on public safety and the future of entire ecosystems. When stakeholders can come together in a collaborative environment of respect, the opportunity to build a framework of trust and bridge differences toward a singular goal is much more accessible.

Monitoring is needed to evaluate environmental performance and the practices applied as well as assess new opportunities that can sustain and expand activities that outpace the currently-increasing insect, disease, and wildfire impacts throughout eastern Washington and the west. With monitoring of environmental performance, progress made toward more resilient forest

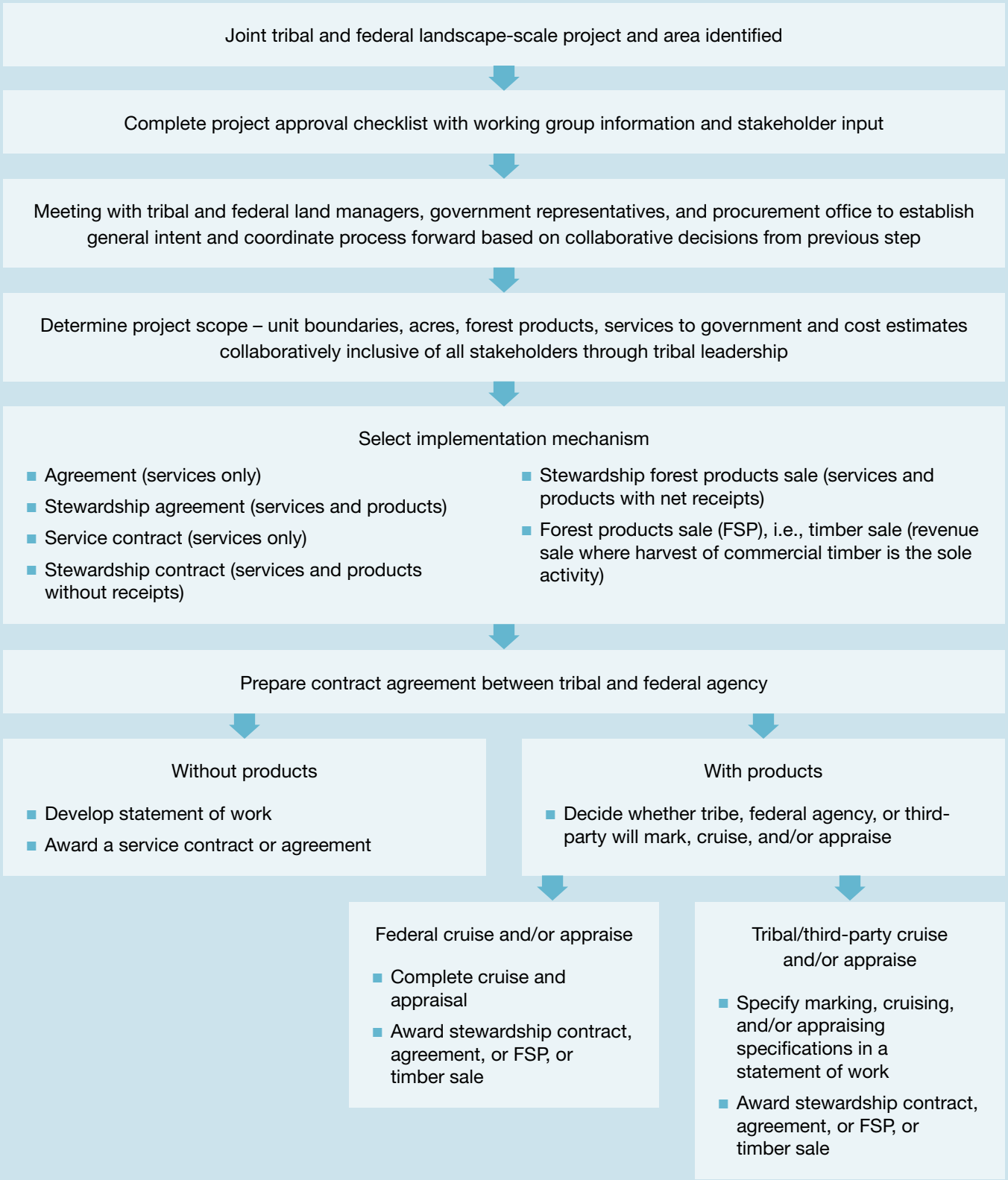


Figure 16. A general Anchor Forest landscape-scale project design matrix that identifies collaborative input for a proposed project with tribal leadership, inclusive of cross-boundary management on tribal, federal, and other land ownerships. *(Adapted with permission from Cook and Wilson (2015))*

conditions can be used to assess opportunities to maintain or establish additional infrastructure such as co-generation facilities and transportation efficiencies. Currently, long-term project monitoring is required of many projects utilizing federal funding and, regardless of requirements, will help land managers gain a better understanding of environmental performance and assess improvements that maximize resources and achieve the desired conditions at a landscape scale.

There are programs and legislation available to support Anchor Forests within the designed framework of multi-ownership coordination and management. These include the Tribal Forest Protection Act, Collaborative Forest Landscape Restoration Program, Reserve Treaty Rights Lands, and the Environmental Quality Incentives Program. Additionally, there are several programmatic funding sources available for landscape-scale technical assistance such as the National Insect and Disease Risk Maps, the Analysis of Forest Restoration Needs and Mechanical Treatment Opportunities, and The Nature Conservancy/USFS Region 6 Joint Analysis of Forest Restoration Needs. Additionally, cross-agency Memoranda of Understanding (MOUs) can provide a directive option between the Departments of Interior and Agriculture with the Bureau of Indian Affairs to move funding to on-the-ground applications of forest health for collaborative projects on federal lands and tribal lands held in Trust.

The prioritization and ranking of treatment areas within an Anchor Forest, using measurable metrics focused on social, environmental and economic goals, would assist collaborative groups in focusing their efforts. This would also provide support for the need to identify ecosystem services within areas to be managed, describe their current conditions, potential benefits from forest management, drawbacks from forest manage–ment, and the monitoring programs suited to assess changes, and provide feedback for adapting future actions. Anchor Forests guided by tribal stewardship and a legacy of ecosystem knowledge can expand forest land management to include the values and benefits of ecosystem processes and services to the public, while strengthening coordinated management efforts.

Monetizing water-related ecosystem services may offer one approach for protecting or valuing both timber and non-timber forest ecosystem services. For example, identifying the direct and indirect impacts associated with ecosystem services is often not examined. Therefore, employing methods such as value-based accounting may provide a measure of the effects of changes over time, and evaluate the results of alterations to forest conditions brought about by collaborative management activities.

Public communication and outreach efforts are needed at many levels to build trust through respect and understanding. This will improve the social license that supports forestry and silviculture which will in turn offer insights for the public regarding the losses on forested lands throughout the west. By providing a transparent public forum for dissemination of collaborative decisions, examples, results, and successes, Anchor Forests can play a substantial role in improving human health, well-being, safety, and rural communities as well as forest health, resilience and sustainability. For example, social media (website, blog, etc.) that formally recognize, monitor/follow the benefits received from forest ecosystems through time could broaden the suite of forest products and services valued across the landscape and increase the variety of management actions available to collaborative leaders.

Summary

Anchor Forests define the triple bottom line by providing the necessary "balance" of natural resource management required to bridge interests across multi-jurisdictional landownership boundaries. Within eastern Washington, Anchor Forests offer valuable tools for prioritization of investments and maximization of opportunities for protecting sensitive species and their habitats as well as increasing overall forest ecosystem resiliency. The Anchor Forest concept combines opportunities for landowners, communities, agencies, and tribes, and provides a framework for landscape-scale projects to address increasing forest losses from insects, disease, and wildfire while simultaneously providing cost-effective forest management. Anchor Forests spanning multiple ownerships provide support for participation in carbon sequestration, ecosystem resilience, and alternative energy markets utilizing wood at larger scales than previously available.

The assessment findings draw attention to the Anchor Forests concept as a framework that recognizes and respects the prerogatives and obligations of individual landowners, and offers a foundation for the development of actionable strategies targeting collaborative landscape-scale management that will accrue shared benefits for all willing to work together in a respectful, trust-based atmosphere. Anchor Forests have the potential to address many of the challenges

"Indian tribes are here to stay. We will not sell our land or sheer down our forests during wavering economic times and relocate our operations elsewhere. Our ancestors, our culture, is committed to the land upon which we live"

Former ITC President Jaime Pinkham of the Nez Perce Tribe, 1995 testimony, NIFRMA Oversight Hearing

facing landscape-scale forest management through the inclusion of diverse stakeholders, support for collaborative actions, and an arena to develop balanced social/cultural, economic, and ecologically collaborative solutions. This enables landowners and stakeholders to more effectively achieve the activities necessary to increase forest resiliency, support local communities, and mitigate additional losses.

Key Findings from the Anchor Forest Pilot Project Study Assessment

- Improved collaboration is needed to address fragmentation of forest lands through management. With reasonable objectives, strengthened organizational capabilities, and creative leadership, Anchor Forests can provide a means to break legacy barriers to collaboration within the assessed regions. Several collaborative experiences throughout the west, suited to local temperaments and circumstances, have enabled diverse interests to gain a sense of community and purpose that has led to shared understandings and realized forest health objectives.
- There is a need to be able to demonstrate how enhanced forest resilience and reduction of wildfire risk can be made possible through utilization of responsible forest harvest and use of woody biomass. Demonstrating the value of forestry and silviculture has the potential to establish their importance in addressing climate change, energy security, economic development (e.g., homes, jobs, biodiversity, carbon sequestration, etc.) and the value of effective cross-ownership planning and partnerships, coordination of leveraged resources, investments in working forests, and the improved quality of life and societal well-being these lands provide.
- Chronic agency funding and expense challenges, staff and leadership shortages, personnel turnover and inconsistencies in federal action that influence management decisions must be overcome in order to sustain ecologically and economically viable forests across the landscape.
- There are 90 funding sources within 24 different organizations available to supported implementation of Anchor Forests. These include a comprehensive range of ecosystem management activities in support of restoration and management, research, biodiversity enhancement, community assistance, and regional climate challenges.
- There is a growing urban population culturally removed from the functions of forestry and silviculture. This contributes to the challenges associated with improving forest ecosystem health and will require a balance of ecosystem stewardship, silviculture, forestry infrastructure, collaboration, leadership, public outreach, and diligence.
- There is a belief that currently deteriorated forest conditions

should be the greatest priority and that particular legislation, local laws, and policies are often unreasonably time consuming and too slow to effectively achieve the actions needed on these forestlands. Focus group participants voiced concerns regarding the need for a measure of "protection" for the collaborative process to discourage non-participant appeals, litigation, and delay to more effectively move collaborative projects forward when parties, unwilling to participate challenge the decisions of collaboratives.

- Non-market services and returns can be difficult to assess with confidence. Without assessment data and long-term project monitoring to detect changes in the status of services using quantifiable metrics, quantification of ecosystem services will remain a challenge for natural resource managers. Anchor Forests can provide the framework needed to maintain and expand working forests on the landscape that perpetuate sustainable ecosystem processes and increase the value and extent of available ecosystem services.
- Current forest treatment levels on USFS lands are insufficient to keep pace with deteriorating forest ecosystem conditions, thereby promoting increases in wildfire frequency and severity across the landscape that threaten adjacent forestland ownership.
- The ability to actively manage lands administered by the USFS is essential to cross-boundary forest management in eastern Washington. These lands must be maintained for forest health and ecosystem functions, to reduce vulnerability to severe wildfires, and to provide opportunities for adaptation strategies to mitigate the effects of a changing climate and perpetuate a viable forest infrastructure.
- Tribal leadership can be instrumental in fostering cross-boundary collaboration given their history of proven long-term stewardship, political status as sovereign governments, unique rights, and management capabilities.

Recommendations for Anchor Forests

- Implement forest conservation and management projects at a sufficient spatial and temporal (15+ year) scale to make a significant difference at the landscape (1,000,000 plus acre) level to outpace tree mortality by insects, disease, and wildfire in the face of a changing climate and provide sufficient economic benefits to retain viable processing infrastructure, working forests, and rural communities. These long-term contract commitments could achieve management and timber supply sufficient to encourage the capital investments needed to outpace deteriorating forest ecosystem conditions.
- Classify landscape conditions or regions with similar attributes using measureable metrics, where social/cultural, economic, and ecologic goals are prioritized and monitored, so divergent interests can more effectively focus their energy on "target areas." This could facilitate the development and application of long-term sustainable management actions and maximize the value gained from collaborative efforts.
- Identify the direct and indirect impacts associated with ecosystem services through long-term monitoring. Employing methods such as value-based accounting may provide a temporal measure of the effects brought about by management activities. Additionally, monetizing water-related services offers an alternative

applied-approach for valuing both forests and other ecosystem services [65–67].

- Involve diverse landownerships as stakeholders through third-party facilitation and structured communication outreach programs to attain a foundation to develop actionable strategies of collaborative landscape management that will accrue shared benefits for all willing to work together in a respectful, trust-based atmosphere that improves forest resilience and ecosystem function.
- Develop a measure of "protection" for the collaborative process and stakeholder efforts in order to minimize administrative appeals and objections, and focus on environmental performance.
- Support efforts to engage tribal leadership in collaborative efforts for cross-boundary forest management. Tribal advocacy for balanced forest management focusing less heavily on timber commodity production and more on multi-resource stewardship built upon the integration of Western science with traditional ecological knowledge can overcome barriers to collaboration among diverse stakeholder groups.
- A "champion" and leader is needed in each agency and tribal entity to collaboratively prioritize and direct management of Anchor Forests. Leaders must be committed to the process by continually seeking to build trust and relationships between collaborators.
- The various funding sources available should be integrated within a structured "one-stop" shopping investment framework to facilitate effective leveraging and efficient application.
- Provide a transparent public forum for dissemination of collaborative decisions, examples, results, and successes. This could take the form of a website or blog that formally recognizes the benefits received from forest ecosystems to allow ecosystem services to play a larger role in management and funding decisions.

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Final Report

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