Ecosystem Services and Financing Community Forests: An Application to Wallowa County, Oregon

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Bren School of Environmental Science & Management

YARDI

WALLOWA RESOURCES

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The Bren School of Environmental Science & Management produces professionals with unrivaled training in environmental science and management who will devote their unique skills to the diagnosis, assessment, mitigation, prevention, and remedy of the environmental problems of today and the future. A guiding principle of the Bren School is that the analysis of environmental problems requires quantitative training in more than one discipline and an awareness of the physical, biological, social, political, and economic consequences that arise from scientific or technological decisions.

The Group Project is required of all students in the Master of Environmental Science and Management (MESM) Program. The project is a year-long activity in which small groups of students conduct focused, interdisciplinary research on the scientific, management, and policy dimensions of a specific environmental issue. This Group Project Final Report is authored by MESM students and has been reviewed and approved by:

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Abstract

Community forest management (CFM) is the use, ownership, and management of local forests by communities rather than for the benefit of private corporations, investors, or governments. This management practice originated in low-income countries centuries ago, and has been gaining traction in the United States for the last thirty years. Our project serves as a framework for understanding the feasibility of financing forestland acquisition and management in Wallowa County, Oregon by leveraging ecosystem service provision under local ownership. Our client, Wallowa Resources, is a non-profit in Wallowa County whose mission is to "empower rural communities to create strong economies and healthy landscapes through land stewardship, education, and job creation." Ecosystem services evaluated in this project include carbon storage and timber, first foods, and recreation. Ecosystem service potential on community forestland was measured relative to ecosystem service potential under profit-maximizing forest management by timberland investment management organizations (TIMOs). Funding mechanisms considered include grants and investments from non-profits, governments, carbon markets, and natural capital projects. This project can serve as a foundation for other western, rural communities in planning for community forest management.

Key Words: Community Forestry; Ecosystem Services; Carbon Storage; Carbon Market; Recreation; Salmonid Habitat; First Foods; Mixed Capital; Natural Resource Economics

Conifers in Wallowa County, Oregon, Photo by Hollie Pennington

Project Objectives

Our project's primary goals are to understand how Wallowa County will benefit from improved ecosystem services under community forest management versus under timber investment management organizations, and to discover financial mechanisms to acquire and manage the forestland.

To meet our goals, we focused on the following two objectives:

- Assess and model ecosystem services in order to analyze the added intrinsic and economic value to Wallowa County.

- Categorize and explain financial mechanisms that Wallowa Resources can use to acquire and manage forestland.

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Background and Significance

As public priorities have shifted to non-extractive values (e.g. recreation, species habitat, environmental preservation) and national policies have restructured the economy to favor outside shareholder interests, many western, rural communities have struggled to remain afloat. For forest-dependent communities, the shift in private land ownership from local mill-operating companies to large-scale, institutional timber investment management organizations (TIMOs) has meant struggling local economies (Sande, 2002), diminished access to forests for recreation, fewer ecosystem services benefits, land degradation, and potential for forest conversion to developed uses (Fernholz, 2007). Traditionally, mill-operating companies managed their forestlands to ensure a steady supply of local timber to their mills, which meant relatively stable employment for local economies. In contrast, TIMOs manage forestlands to serve the objectives of large, institutional investors, who typically have no connection to the local communities.

Community forest management (CFM) is the use, ownership, and conservation of local forests by communities rather than private corporations, investors, or governments. There is a long tradition of community-managed forestry in lower-income countries (Bowler et al., 2012), however it has only been in the last few decades that community forestry has gained popularity in the United States. Across the world, the needs of local communities are similar in their pursuit of community-managed forests: the provision of ecosystem services (e.g., habitat preservation, recreation, carbon storage) that can provide a foundation for sustainable resource-based employment. This project aspires to provide a framework that other rural, western communities in the U.S. can use to achieve better outcomes for nature and for people.

Community Forest Management

Shifts in Forest Management and Industry Structure

In the 1990s, the forest and wood products industry entered an era of dramatic economic and industrial reconstruction stemming from the rise of neoliberal policies taking place across the globe (Kotz, 2003). Prior to the 1990s, vertically integrated forest product companies (VIFPCs) owned a substantial amount of forestland in the United States to supply their lumber and paper mills. Wood products producers conducted many of their operations within the same region, including accessing local sources of timber and employing local residents. In addition to contributing to the local economy, this sustainable model of forest management provided local recreation areas and healthy wildlife habitat because the success of wood products producers was integrated and dependent on the sustainability of local resources. Under the leadership of Ronald Reagan and Margaret Thatcher, the U.S. and Britain reduced VIFPCs' role in the economy and gave corporations unprecedented market freedom by passing policies that promoted tax cuts, trade liberalization, and industry deregulation (George, 1999; Kotz, 2003).

The wave of global reconstruction that followed resulted in increased resource outsourcing, exportation, and pressure for sectors to consolidate. For the forestry and wood products industry, this meant a dissolution of VIFPCs and a transition to more economically-favorable horizontal ownership (Hickman, 2007; Sande, 2002). Instead of a vertical ownership structure where mills owned and controlled their entire manufacturing process from timberland management to processing, horizontal ownership is the control/dominance of a single process or supply. The "old" VIFPC structure was not efficient under this new economic doctrine because there was not enough control over pricing, sales were inconsistent due to the cyclical nature of the forestry sector, and there were too many producers. Trade liberalization increased foreign wood imports into the United States and large-scale wood producers outsourced their wood supply. To maintain revenue in the more competitive market, VIFPCs restructured themselves by legally separating ownership and control of their forestland from their manufacturing facilities; many also sold their forestlands to TIMOs (Hickman, 2007).

TIMOs - Their Bottom Line

TIMOs buy, manage, and sell forestland and timber for private investors. While VIFPCs are long-term operations (greater than 50 yrs), TIMOs invest funds on behalf of their clients for only about 10-15 years, resulting in higher turnover of ownership and, some argue, less incentive to practice sustainable forestry practices (Damette & Delacote, 2011). Under TIMO management, forestlands are viewed as assets that can be liquidated in order to increase short-term shareholder returns (Gunnoe et al., 2018).

The goal of a TIMO is to manage investments to maximize profits for their client. Although deemed economically efficient, this practice is usually at odds with sustainable forest conservation. For example, timberland investment is attractive because unlike bonds and gold, trees accumulate value as they grow regardless of inflation (Billhorn, 2020). If the market for timber is sometimes unfavorable, TIMOs can wait to log until the market is favorable again (Bob, 2016). However, because investors are looking to make a profit, if the land appreciation is greater than the worth of the trees, forest tracts are sometimes cut down and converted to more profitable uses (e.g. shopping centers or golf courses) (Billhorn, 2020; Bob, 2016). When TIMOs began in the late 1980s, they had limited holdings, but by the end of 2003, the top ten TIMOs managed about 9 million acres of U.S. timberland (Wilent, S., 2004) and by 2010, that number grew to 25 million acres. Today, TIMOs manage almost 13% of forestland in the United States (Oswalt et al., 2019).

Forestland Conversion and TIMOs

With increasingly more forest parcels being managed and owned by TIMOs, there are growing concerns over forest conversion rates (Alig et al., 2010; Damette & Delacote, 2011). TIMOs have been documented to increase the conversion rate of native hardwoods to softwood plantations in the South (Zhang et al., 2012) and TIMO ownership has been associated with increased harvest rates in the Northeast (Jin & Sader, 2006). TIMOs generally opt for even-aged management, or clear-cutting, meaning that they harvest all of the trees in the forest at the same time. Another study of forests in the Northeast found that corporate-owned forests were twice as likely to be harvested in any given year compared to public forests and a quarter more likely to be harvested compared to other private forests, such as family forests (Thompson et al., 2017). Remote sensing analysis showed statistically different disturbance rates between public and private forestland ownership, including TIMOs (Noone et al., 2012).

Economic Effects of TIMOs on Rural, Resource-Based Forestland Communities

Prior to the 1980s, VIFPCs managed forests for long-term sustainability, and typically did not convert their forests to other land uses. Owning both land and manufacturing plants meant that VIFPCs generated billions of dollars for local economies, in terms of both jobs and operations, giving them an important role in upholding small, rural forest economies (Gunnoe et al., 2018; Schick et al., 2020). TIMOs tend to employ fewer foresters to manage timberlands compared to mills.

For example, in a small timber community in Alabama, one TIMO manager explained that it was common for a single forester to manage areas as large as 50,000 acres while local paper mills reported employing 50 foresters to manage around 70,000 acres (Sande, 2002). Moreover, instead of hiring local residents to run mill operations, under TIMOs, the timber is often shipped overseas where labor is cheaper.

Small timberland communities were also severely affected by federal tax laws that essentially prioritized corporate/shareholder profit over the welfare of these communities. Federal tax laws passed in the 1980s and 1990s gave major tax cuts to investors who owned timberland. In Oregon, traditional timber companies that mill their own products are taxed at 35% while investors pay closer to 15% (Hickman, 2007; Schick et al., 2020). Private timber owners used to be required to pay a severance tax in Oregon that was based on the amount and type of timber harvested. That tax revenue would go back to the community to fund public services like schools and libraries. Oregon's severance tax began to dramatically decrease in 1991 and is now a sliver of what it used to be. Although TIMOs have not reduced harvest rates or stopped making profits in the past fifteen years, since 2008, they have not been required to provide any support or compensation to the communities where they operate (Gunnoe et al., 2018; Legislative Revenue Office, 2013). Before federal tax cuts and the reduction of Oregon's timber severance tax, taxes contributed over $120 million per year into county governments and community services in Oregon; now timber only pays about $25 million in taxes (and not to local communities) despite using over 17% of the landmass in Oregon (Schick et al., 2020).

TIMO land in Wallowa County, Oregon, Photo by Cristina Mancilla.

Beyond the local economy, changes in timberland ownership also affects residents' access to forests. Many VIFPC mills gave local communities free, public access to their timberlands – residents were free to hunt, fish, and recreate in those forests. TIMOs stopped this practice in many communities in favor of making more money by leasing the land for hunting – often to tourists (L'Roe & Rissman, 2017; Sande, 2002). In Wallowa County, one TIMO charges $245–$300 per night for camping access when it used to be free under VIFPC ownership.

From TIMO to Community Ownership

The VIFPC mill structure was not perfect, but it did recognize the importance of fostering a connection with the local community. They supported the community through jobs, severance taxes, and access to land, and their business structure was dependent on sustainable forestry practices. Community forest management echoes the structural model of VIFPCs by keeping money and operations local, but it challenges the hegemony of privatization that justifies the ownership and control of natural resources by a tiny majority of wealthy investors. CFM can broadly be defined as the "use, management, and conservation of forests by communities" (Arts & de Koning, 2017; Bowler et al., 2012). CFM offers community members access and rights to forest resources, participation in management decisions, and reinforces connections to the land with the aim to fulfill both local livelihoods and forest conservation (Arts & de Koning, 2017). Community forest management also ensures that the forestland is permanently preserved and management prioritizes long-term economic and ecosystem service benefits for the local community ("Saving America's Forests One Community at a Time," n.d.).

The concept of community forest management has been around for centuries ("Saving America's Forests One Community at a Time," n.d.). There are many examples of long-running, successful CFM initiatives in low-income countries, particularly in the tropics with the goal of conserving tropical rainforests (Pelletier et al., 2016). As a response to the increase of TIMO forestland ownership in the 1990s, there were some efforts to establish community-managed forests in the Northeastern United States. Since then, community forests have begun to make their way west to the Pacific Northwest (Nils Christoffersen et al., 2008). The Trust For Public Land, a U.S. non-profit, started a community forest initiative in 2001 and has since helped establish 30 community forests of varying sizes in the United States. Additionally, the Trust for Public Land was a founding member of the Community Forest Collaborative, which successfully advocated for federal funding to support community forests ("Community Forests - Our Work in NH," n.d.).

Community Forest Management Opportunity in Wallowa County, Oregon

The opportunity has opened up for Wallowa County, Oregon to create a community forest. It is the first time in 15 years that a large portion of privately-owned timberlands are available for purchase and it presents an excellent opportunity for the community to regain control over their forests, leading to enhanced ecosystem services and a growing economy (Christoffersen 2022). The parcels going up for sale are organized into three groups based on region and land owner – the Promise Road and Amos-Evans parcels, which are owned by Hancock Timber, and the Bear Creek parcel, which is owned by RY Timber (Figure 1). Wallowa Resources, a local non-profit, is interested in working with Wallowa County to purchase some of these newly-retired TIMO parcels in order to facilitate the organization of a community-managed forest to be owned and operated by Wallowa County.

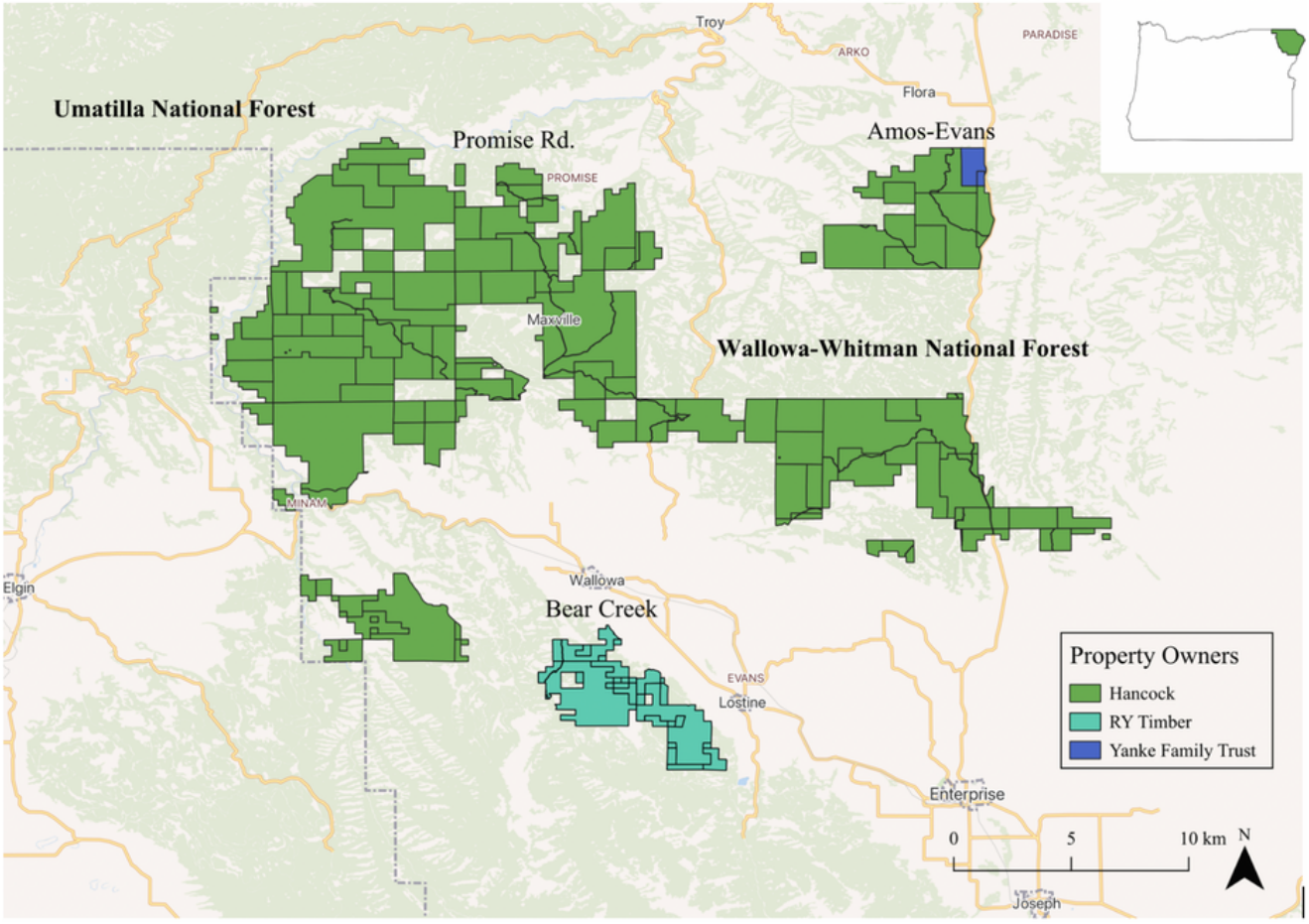

Figure 1: Parcels of interest for this study. A map of the currently TIMO-owned parcels that will be up for sale soon in Wallowa County, Oregon. The Promise Road and Amos-Evans parcels (13,069,543 acres) are owned by Hancock Timber and the Bear Creek parcel (116,627 acres) is owned by RY Timber. As shown, many of the parcels are between two National Forests – the Wallowa-Whitman and the Umatilla.

Background of Wallowa County, Oregon

The Nez Perce and Umatilla Tribes are the original stewards of the land today known as Wallowa County. The tribes were forced to flee shortly after Lewis and Clark arrived in the area in the early 1800s due to settler violence (Nerburn, 2005). Appropriated by white settlers in 1887, Wallowa County is situated in the far northeastern corner of Oregon (**Figure 2**).

Located in thick coniferous forests, Wallowa eventually became a mill town that relied on timber harvesting. People from across the country came to Wallowa in 1939 seeking opportunities to settle the land (Pearl, 2018). Today, more than half of the lands are public lands (58%), and are primarily part of the National Forest System. Seventeen percent of the land is zoned "exclusive farm use" and 24% is zoned "timber/grazing". About 30% of the zoned "timber/grazing" lands is private industrial timberland, 42% of "timber/grazing" land supports forest cover and is non-industrial timberland and 28% is prairie/pasture (**Figure 3**). The lands are the foundation for Wallowa County's natural resource-based economy, which still provides a major source of jobs and revenue. A sense of place is strongly woven into the identity of the people living there and the history of the area (Christoffersen, 2022).

Wallowa County has a population of 7,545, making it Oregon's fifth least-populous county. The total area of the County is 3,152 square miles – 3,146 square miles is land and 5.5 square miles is water. The total employment in the county is about 27% (as of 2020) with a median household income of $53,423 (QuickFacts Wallowa County, Oregon, 2021). Wallowa is located within the borders of traditional Nez Perce tribal lands. The tribe has over 3,500 enrolled members and the reservation spans roughly 770,000 acres in north-central Idaho (About | Nez Perce Tribe, n.d.). Only three Nez Perce individuals were reported to have been living in the County in 2009 (Ore Joseph, 2018) and the numbers remain about the same today (Nils Christoffersen, personal communication, April 19, 2022).

Figure 2: Location of Wallowa County in relation to Oregon and the neighboring states of Washington and Idaho (Abrams & Gosnell, 2012).

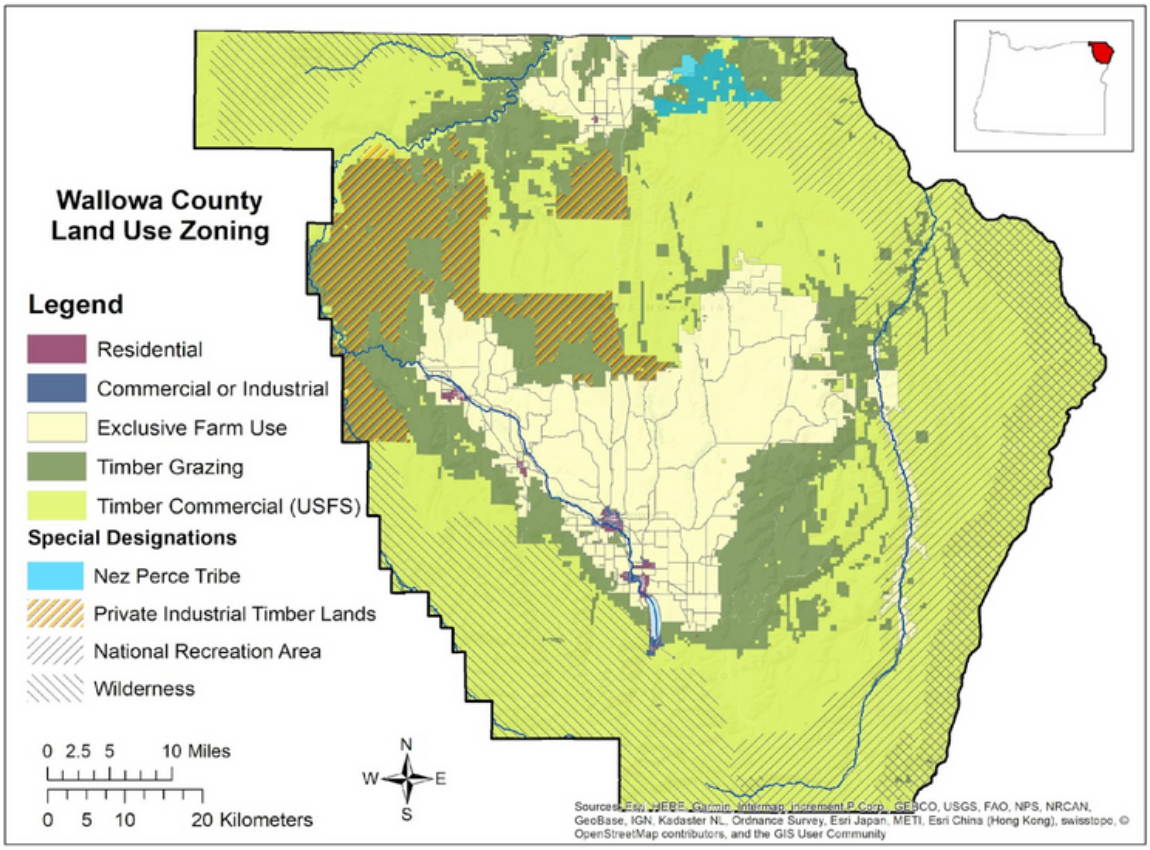

Figure 3: Wallowa County land use zoning. The above map shows that the distribution is 58% public lands (primarily national forest system lands), 17% is "exclusive farm use", 24% is "timber/grazing", 30% is "timber/grazing" lands is private industrial timberland, 42% of timber/grazing land supports forest cover and is non-industrial timberland and 28% is prairie/pasture. Map and information provided by Wallowa Resources.

Rising Concerns and Opportunities

Forests, ranches, and farms cover over 40% of Wallowa County and account for nearly 98% of the County's non-federal land. Family-owned forestlands make up the smallest portion – just 10% – of Wallowa County's working landscape. These lands are already highly fragmented. The industrial forestlands, some of the county's most productive, are slowly breaking up as TIMOs increasingly take ownership. Private industrial timberlands account for about 7% (about 234 square miles) of the total land base. Recent trends point to reduced public access to these lands. Reduced severance taxes further decrease local benefits.

Some of the other stresses on working lands include development pressure, the rising cost of land and operating expenses, global competition impacts on market prices, weather deviations linked to climate change, absentee ownership, and generational land transfers to heirs who are unable or unwilling to maintain the land. In recent years, many people have moved to Wallowa County due to the increase in remote work opportunities with the advent of Covid-19.

This has led to increased development in the area and rural gentrification, making many residents fearful that the price of living will increase. These trends risk the benefits that working lands provide, including jobs, food and fiber production, carbon storage, clean water, wildlife habitat, and the community's connection to the land (Nils Christoffersen, personal communication, April 19, 2022). A community forest could address some of the rising concerns by safeguarding forestland from development and managing it in a way that enhances and preserves wildlife habitat, carbon storage, recreation opportunities and other benefits that communal forestland could provide.

Although Wallowa County currently does not have the funds to purchase enough land to create a community forest, the promise of a healthier forest and enhanced ecosystem services could attract donors and create opportunities for new streams of revenue. Establishing a community forest is a financial feat that requires the support of public and private funding. In order to access that funding, Wallowa County needs to demonstrate that community forest management will benefit the community and environment in a way that appeals to stakeholder interests and values. There are potentially millions of dollars in funding available to support a community forest, Wallowa County just needs to convince stakeholders that they are worth investing in.

Public forestland in Wallowa County, Oregon, Photo by Cristina Mancilla.

Ecosystem Services Under Consideration

Background for Forest Ecosystem Services

For our project, we will promote forest conservation by analyzing the ecosystem services that community-managed forestry would provide to Wallowa County and will leverage the provision of ecosystem services as means for funding. Ecosystem services are the flows of benefits that humans gain both directly and indirectly from ecosystems. They fit into four main categories: provisioning, regulating, cultural, and supporting services (Aznar-Sánchez et al., 2018). Provisioning services are those that allow people to live, such as food and water, and which provide economic potential, such as timber. Regulating services are those that regulate the environment around the ecosystem, for example through storing carbon, improving water quality, or preventing soil erosion. Cultural services are those that provide personal, societal, or spiritual enrichment. Supporting services are the biological and chemical processes, such as nutrient cycling and soil formation, that make the other types of ecosystem services possible. Forests can provide close to 100 different types of ecosystem services (Aznar-Sánchez et al., 2018). However, due to climate change and the increasing threat of forest conversion for development, forests' very existence – and thus the ecosystem services they provide – are compromised (Aznar-Sánchez et al., 2018).

Revenue from ecosystem services can reduce poverty, internalize the positive externality of ecosystem services, and enhance economic development in rural areas (Cho et al., 2019). Because TIMOs manage forestlands for the primary goal of maximizing returns on investments, ecosystem services are generally diminished under this management regime. However, returning a TIMO-owned forestland back to community management would enhance ecosystem services, increasing benefits both for nature and for people (Aznar-Sánchez et al., 2018). The forest ecosystem services we analyzed in this study are introduced below.

Sawmill in Wallowa County, Oregon, Photo by Cristina Mancilla.

Carbon Storage

Forest carbon storage is an efficient, natural, long-term method for removing and storing carbon dioxide from the atmosphere. Forest-stored carbon accounts for close to 70% of U.S. terrestrial carbon stocks and offsets about 15% of U.S. fossil fuel emissions (Ontl et al., 2020). Without compensation for carbon storage, many forest owners around the world rely on other methods to maximize their profits, such as harvesting trees for timber after short rotation periods or permanently converting forests into agricultural lands. Carbon markets provide financial incentives for more environmentally-friendly management methods, such as longer tree growth and more stocking, which better mitigate climate change and benefit both forest ecosystems and surrounding communities (Cho et al., 2019). Participation in a carbon market could be a valuable ongoing funding source for Wallowa County's community forest. While the County wishes to continue harvesting timber within the community forest, trees would be harvested after longer periods than if managed by timber investment management organizations, providing additional carbon storage for the area.

Timber

Timber is a critical economic sector of Wallowa County, accounting for around 10% of employment (Wallowa County, 2019). Historically, Wallowa County has supported itself on timber. However, the current capacity has diminished to only a single small-scale sawmill processing center, meaning that much of the sawtimber is transported out of the county for processing (Christoffersen 2022). Timber is central to the region's identity and would be one revenue stream for the community forest.

Recreation

Wallowa County is located in a picturesque green valley surrounded by snow-capped mountains, glacial moraines, and colorful spring flowers. According to one study, Property owners in Wallowa prioritize recreation and aesthetic beauty above all other land values (M. Nielsen-Pincus & J.E. Force, 2005). Tourists also recognize the beauty of Wallowa, making the travel and tourism industry a powerful force in the local economy. In 2018, travel and tourism employed 670 people, 9.5% of the county's population, and produced 14.4 million dollars in earnings for Wallowa residents (Dean Runyan Associates, 2019). Tourism alone added over 180 jobs to Wallowa County in less than a decade and the industry continues to grow (Birkmaier et al., 2021). Recreation is an important ecosystem service to consider because it is valued by both local residents and tourists. Recreation is versatile because it attracts diverse groups, and allows for opportunities such as hunting, camping, hiking, fishing, mountain biking, and ATV riding. The versatility of recreation opportunities also provides different financial mechanisms that Wallowa Resources and Wallowa County can use to fund their project and maintain the land after acquisition.

First Foods

First foods are founded in the cultural knowledge of native foods that historically provided sustenance for the Umatilla and Nez Perce Tribes, and are an important part of indigenous tradition. This knowledge is passed down from generation to generation. Colonialism attempted to destroy the traditional ecological knowledge kept by the first peoples, but oral traditions were strong enough to retain the sacred and irreplaceable knowledge. The teachings are considered sacred by the knowledge keepers because it connects the tribes back to the start of time (Endress et al., 2019, Wenix Red Elk, 2021).
In the creation story of the Umitilla and Nez Perce, the creator made the land and the water first, and then the people. The creator gathered the men and women along with the other creations. Each of the first foods – starting with salmon (and all fish), followed by deer (and all animals), roots, and berries (along with all plants) – gave themselves to the First Nations to nourish, heal, and provide for the people. In return, the people were to honor them as sacred, and to rejoin with them in the earth when they pass. The last to come forward was the water, who volunteered to wash away everything at the end of time. While eating first foods, it is important to keep the traditions of the original seating formation, stories, and directions. The first food to be served is water because it is the most sacred and the giver of life. The rest of the foods are prepared and set on the table based on the seasons and their role in the creation story (Figure 4) (Endress et al., 2019, Wenix Red Elk, 2021).

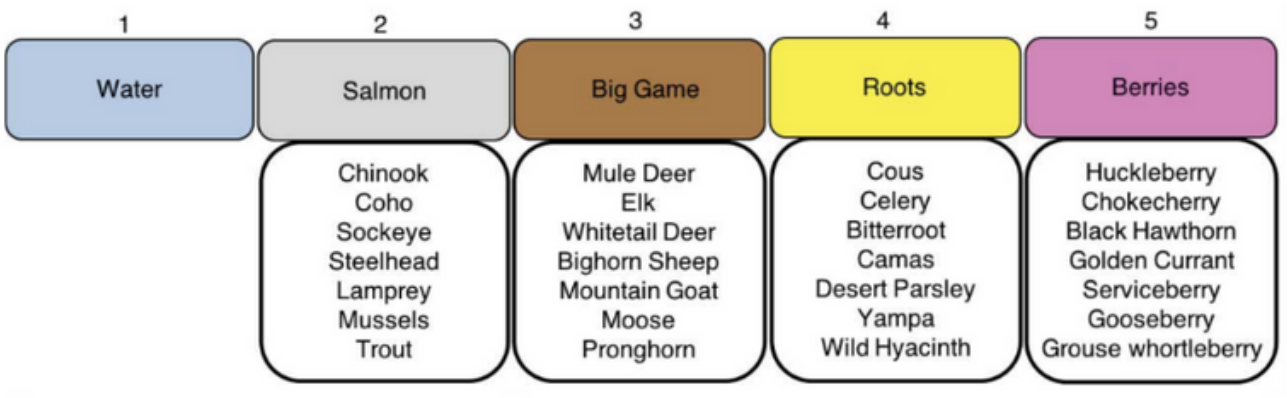

Figure 4: The order in which first foods are served during traditional dinners for the Umatilla and other tribes in the Walla Walla region (the region in and around Wallowa County and southeastern Washington). The first food is water, followed by salmon (and other fish), big game, roots, and berries (Endress et al., 2019).

Gathering of first foods coincides with the seasons because it is important to harvest the foods when and where they naturally occur. However, the foods are often preserved to last throughout the year and be used in different ceremonies. Traditionally, men must have their first kill in order to become a fisher or hunter, and women have to learn to harvest in order to become a digger or a picker. Because food is so entwined with indigenous culture, if the first foods can no longer be found on the land, a tribe will leave the area because their culture is lost (Wenix Red Elk, 2021).

The Umatilla, Nez Perce, and other surrounding tribes had five first foods that were considered the most important: Cúuś (water), Núsux (salmon), Yáamaś (deer), Xáwś (cous/biscuitroot), and Wíwnu (huckleberry). While historically the tribes relied on nature to produce these foods, the tribes now must take a more active role in managing these scarce resources. To convert the land, the tribes use both western science and traditional ecological knowledge, focusing on two key parts: first, provision of habitat and population management; second, natural resource policies and regulatory mechanisms. The tribes strongly recommend that a tribal member who has lived in the area helps with any non-tribal restoration efforts (Wenix Red Elk, 2021). Our project is evaluating the potential to create more availability for three of the first foods listed above: salmon, huckleberry, and biscuitroot. Analyzing best management practices for salmon can also improve the water quality.

The evaluation of first foods could strengthen the relationship between the tribes and the County, as well as with other non-profit organizations, such as Wallowa Resources. The inclusion of first foods in the CFM will demonstrate that the forest truly is for all. Assessing first foods of the Nez Perce and Umatilla and incorporating them into the management of a community forest could increase access to these culturally significant plants to the Tribes. Including first foods in our analysis is critical to managing the community forest in a way that incorporates all values and priorities.

The assessment of first foods under a community forest management is unique because there is little data on previous projects that include this as an ecosystem service. This will appeal to outside investors and organizations who want to be involved in a management plan that incorporates indigenous values and different community members. Other community forestry projects outside of Wallowa County or Oregon can replicate these evaluation methods and incorporate culturally significant first foods within management plans.

Salmon

Environmental modification has significantly impacted and changed the Nez Perce and Umatilla Tribes in cultural, economic, and ecological contexts. Climate change will affect the Snake and Columbia River systems and the salmon species inhabiting them, which will change the livelihood of the Nez Perce and Umatilla Tribes, relating to their diets and cultural ceremonies. Salmon is a cultural icon for the Nez Perce and Umatilla and they believe that the rivers could not survive without salmon living in them. Salmon contribute to the health of marine environments by carrying carbon, nitrogen, phosphorus, and other key nutrients in their body to upstream aquatic environments, which are released after they die there and their bodies decompose. An example of salmon and rivers playing a vital role in Nez Perce and Umatilla culture is in their tribal ceremonies, such as the "first fish" and "first kill" ceremonies, which symbolize their transition to adulthood and are rites of passage (Crate & Nuttall, 2016). Finding ways to restore and manage salmon habitat in Wallowa County will not only provide the tribes with cultural restoration, but will also increase fishing and recreational services for all people with access to the waterways. Redband trout and steelhead are the primary species that occupy these rivers. Northeastern Oregon (Wallowa area) is considered a critical habitat for these species as designated by the National Marine Fisheries Service (NOAA, 2017). Funding for restoration of the riparian areas that salmon rely on could generate revenue for a community forest, which could also be used to improve water quality and salmon fisheries.

Coho Salmon, Photo by Columbia River Inter-tribal Fish Commission

Huckleberry

Huckleberry represents all other types of berry species, such as blueberry and elderberry, as stated in the original creation story (Wenix Red Elk, 2021). These species are gathered by the Nez Perce and Umatilla Tribes as a dried food source for the long winter months. The fruit is also used as an important food source for other animals, such as elk and deer, which are also essential first foods for the tribes. The berries are picked and gathered throughout the summer months and dried out for the winter. The berry juice was used for mouthwash and appetite stimulants as well as to cure sore throats and inflamed gums. Other than for health benefits, this first food is an important ingredient for making pemmican, a sacred food for the tribes (USFS, n.d.).

There are two types of huckleberries – red and evergreen – which grow primarily in eastern Oregon. Both types are used in the same manner by the tribes whether as a food source, medicinal use, or in ceremonial practices. They grow on old decaying stumps and logs in moist coniferous woods, wetlands, and at the transition zone of wetlands, and prefer moist, fully-shaded areas, but can also grow in partial shade. (NRCS, N/A). The Nez Perce and Umatilla both used burning practices in which fires would clear canopies to allow just the right amount of sunlight needed for huckleberries to thrive (Minore et al., 1979). Historically, the presence of this first food has declined drastically due to timber harvesting and improper gathering practices.

Evergreen Huckleberry, Photo by Native Plant Nursery

Red Huckleberry, Photo by Northern Bushcraft

Biscuitroot

Biscuitroot is representative of all the roots the first people used to eat in the area, including camas, spring beauty, yellow bell, bitterroot, desert parsley, cous, spring gold, yampa, and wild hyacinth. It grows in shallow, rocky soil with plentiful sunlight (Endress et al., 2019). These roots were easy to store for the long winters and the Nez Perce relied on them as important food sources. To harvest the roots, tribal members dug, mixed, and aerated the soil. There are also reports of the Nez Perce deliberately burning dry camas meadows to improve food production after invasive plant species were brought in by Euro-American missionaries who settled the area and displaced many of the native plants (Weddell, 2022). The tribe was then encouraged to transition to farming fruits and vegetables instead of harvesting natural food sources from the land. Their culture was impacted significantly because the invasive plant species forced them to find other food sources and change their diets (Weddell, 2022).

Figure 5: Map of areas where the first foods – Cúuś (water), Núsux (salmon), Yáamaś (deer), Xáwś (cous/biscuitroot), and Wíwnu (huckleberry) – were historically located within the Walla Walla region (Wenix Red Elk, 2021).

Methods and Models

Carbon Storage and Timber

Background

Carbon trading has emerged as a way for countries or companies with climate commitments to fulfill them cost-effectively by purchasing or selling carbon offsets to counterbalance emissions. In practice, this scheme allows entities to continue to emit greenhouse gasses by paying others to maintain forests to capture equivalent carbon dioxide from the atmosphere. Wallowa County contains some of the most productive forests east of the Cascades and participation of these forests in the carbon market could bring in additional revenue (Mildrexler et al., 2020).

Community forests typically maintain more biomass in forest stands than in TIMO forests. By curtailing harvest in the short term and allowing trees to grow in volume, less net revenue (in present value terms) would be made from timber, but the forests would store more carbon as they accumulate biomass. If Wallowa County decided to maintain a larger biomass of timber, they could sell the difference in carbon storage between the TIMO status quo and the community forest volume management choice. To explore this option, we analyzed the feasibility of using a mixed carbon market and timber revenue approach to paying for land acquisition under community forest management.

We assumed that stumpage prices would remain relatively constant, but that the price of carbon per ton could change considerably because it is a new market driven by evolving policy priorities (Boyce, 2018). With this in mind, the question that drove this analysis was: if Wallowa County were to purchase TIMO land, what would the price of carbon need to be in order for an investor to break even on their investment under community forest management?

Model

Below is the model used to calculate the price of carbon needed to offset the land purchase:

$$\text{Land Price} = \sum_{t=1}^{t=T} \frac{P_{carbon}(C_t - C_{t-1})}{(1+\delta)^t} + \frac{F(X^T)\,P_{timber}}{\delta(1+\delta)^T} \quad (1)$$

where $C_t - C_{t-1}$ is the annual increment in carbon storage, Pcarbon is the price of carbon, $F(X^T)$ is the steady-state harvest of timber that begins *T* years in the future, and P_{timber} is the price of timber. δ represents the discount rate and $(1+\delta)^t$ is the discount factor for a payment made *t* years in the future, whereas (1+)T is the discount factor for a perpetual stream of payments that begins *T* years in the future. Overall, the model represents the net present value of annual carbon payments starting with the purchase from a TIMO (*t*=1) to the time it takes to reach a target CFM timber stock (*t*=*T*). The model incorporates the present value of revenue from on-going timber harvests once a target CFM stock is reached *(t*=*T*).

To solve for the price that carbon would need to be in order to break even for a stand that reaches a target CFM stock (steady-state equilibrium) at year *T*, we first had to to understand how much revenue could be made from harvesting timber given different timber stock management choices. Most of the private forestland in Wallowa County is uneven-aged, meaning that a stand is managed to maintain multiple age classes. Given this management method, we created a renewable resource growth model to estimate the amount of timber that could be harvested annually to maintain a steady-state volume of timber stock, or to maintain steady-state equilibrium.

Data

We parameterized the renewable resources growth model to growth rates specific to Wallowa County by using tree volume and age data from the USFS Forest Inventory Analysis (FIA) database for forests in Wallowa County sampled in 2019 (*FIA DataMart 2.0: Home*, n.d.). Carbon storage estimates in tons per acre came from Table A20 (*Regional estimates of timber volume and carbon stocks for ponderosa pine stands on forestland after clearcut harvest in the Pacific Northwest, East)* in Smith et al. (2006).

Methods: Evaluating Timber

The following model (2) estimates the mercantile volume of timber for a stand at age t (see Table 1A in the Appendix for stand age and timber volume data used in the regression).

$$Q(t) = e^{a-b/t} \quad (2)$$

Where Q(t) is volume at age t and a and b are model parameters. Coefficients a and b are estimated to parameterize the renewable resources growth model to conditions in Wallowa County. To find these terms, we ran a linear regression to determine the relationship between merchantable timber volume (lnQ(t)) in cubic feet per acre and stand age (1/t) in years. Coefficients *a* and *b* are as follows:

Table 1: Regression estimates from running a linear regression on lnQ(t), stand volume, and 1/t.

	Dependent variable:
	Timber volume
Timber volume coefficient a	-23.795***
	(8.094)
Timber volume coefficient b	8.551***
	(0.286)
Observations	21
R^2	0.313
Adjusted R^2	0.276
Residual Std. Error	1.090 (df = 19)
F Statistic	8.642*** (df = 1; 19)
Note:	*p<0.1; **p<0.05; ***p<0.01

Using the regression coefficients *a* (8.551) and *b* (-23.795) allowed us to parameterize the model to specific age and volume characteristics for forests in Wallowa County.

We took the derivative of volume with respect to time (*dVol/dAge*) to determine the growth in timber volume from age *t* to *t+1*.

$$dVol/dAge = b/t^2 * e^{a-b/t} \quad (3)$$

When dVol/dAge is plotted against volume, Q(t), we obtain the standard growth curve F(X) for a renewable resource, where X is the stock of timber (Figure 6). The height of the curve is the amount of timber that could be harvested annually in order to maintain a stand at the corresponding steady-state volume. That is, we are using the equation of motion for the standard renewable resources model: $X_{t+1} - X_t = F(X_t) - Y_t$ where X_t is the stock of the resource in time t and Y_t is the harvest (Conrad, 2010). Steady states for this model occurs where F(X)=Y

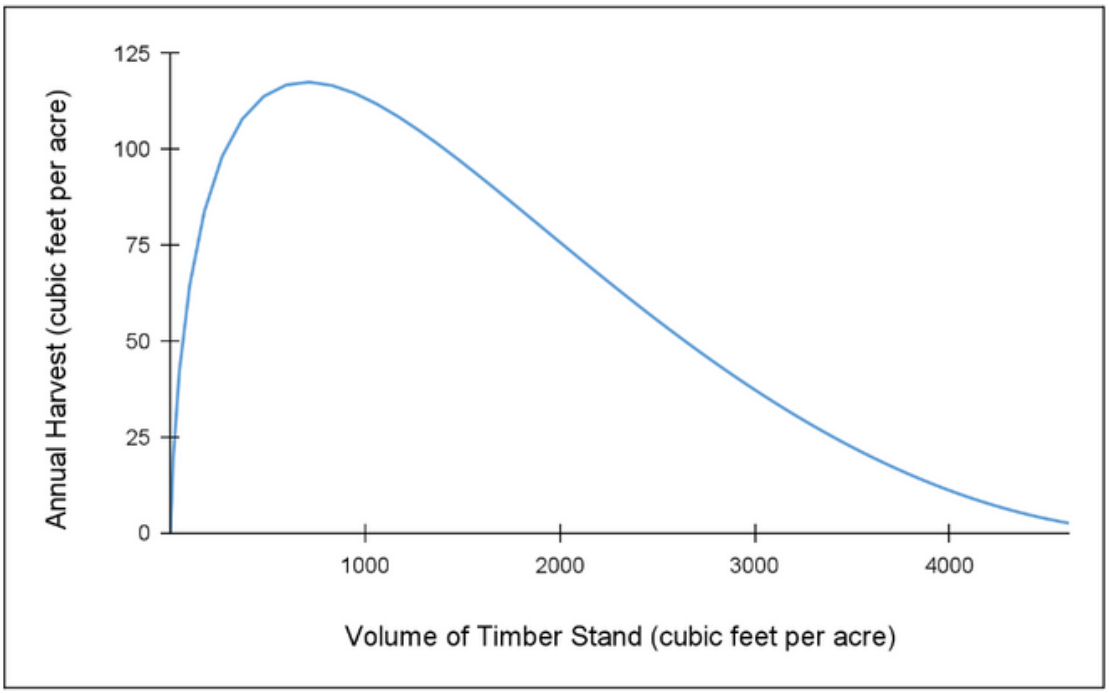

Figure 6: Renewable resource curve for timberlands in Wallowa County, Oregon. The curve shows the amount of timber that could be harvested annually to maintain a steady-state equilibrium stock of timber.

The slope of the curve in Figure 6 is the growth rate of timber at a given stock. This is calculated with the formula:

$$(dVol/dAge_{t+1} - dVol/dAge_t)/(Vol_{t+1} - Vol_t) \quad (4)$$

A standard result from renewable resource theory is that the economically optimal steady-state stock, *X**, occurs at the point where the growth rate in the stock equals the interest rate (Conrad, 2010). Using the above formula, we found the stock at which the growth rate equals 4.5%, which is the interest rate used by TIMOs in practice (Haim, David, personal communication, 2023). Based on this discount rate, TIMOs are estimated to maintain a stand of about 600 cubic feet/acre.

Results: Evaluating Timber

If a community forest were to maintain a larger forest stock than X*, they would need to cease harvest until the stock grows to the desired level. In the model above, this takes T years and results in the target stock of X^T. Once at the desired stock, harvests can begin again, yielding an annual revenue stream. For example, if a community forest wanted to maintain a stand volume of 2,000 cubic feet per acre, it could harvest only 73 cubic feet per acre each year in perpetuity. The annual harvest revenue equals the steady-state harvest $F(X^T)$ multiplied by the stumpage price, P_{timber}, assumed to be $0.385/cubic foot.

Eq-5 gives the present discounted value of an infinite stream of these revenues assuming they begin T years from now and using an interest rate of δ. This calculation makes use of the perpetuity formula, $\frac{CF}{\delta}$, where CF is cash flow, to obtain the net present value of timber revenue; however, this amount has to be discounted from time T because timber revenue would not be collected until the target stock of timber is reached, as in the following formula:

$$NPV\ timber = \frac{F(x^T)\, P_{timber}}{\delta(1+\delta)^T} \tag{5}$$

If a larger stock is maintained in the community forest compared to a TIMO forest, present value profits from timber will be lower, but the stock of carbon will be larger. Next, we evaluate the additional revenues the community forest could generate if it provides offsets to a carbon market.

Evaluating Carbon

The first step in calculating the break-even price for carbon is to estimate the amount of carbon stored for a given volume of timber. We ran a linear regression to determine the relationship between carbon storage and timber volume using the data referenced above from Smith et al. (2006) (Table 2).

Table 2: Linear regression relationship between carbon storage and timber volume.

	Dependent variable:
	Carbon volume
Carbon volume coefficient a	0.013^{***}
	(0.0001)
Carbon volume coefficient b	35.829^{***}
	(0.122)
Observations	14
R^2	1.000
Adjusted R^2	1.000
Residual Std. Error	0.286 (df = 12)
F Statistic	$39{,}441.050^{***}$ (df = 1; 12)
Note:	*p<0.1; **p<0.05; ***p<0.01

We used the above regression coefficients to convert timber volume to an estimate of the amount of carbon in tons per acre:

$$Carbon\ Storage = 0.013 + 35.829 * (Timber\ Volume) \tag{6}$$

Once this relationship was established specific to the carbon and volume characteristics of Wallowa County, we calculated the net present value of the cumulative annual increments of carbon storage from the time of purchase (t=1) to the time the target stock is reached (T). The same discount rate of 4.5% was used in the net present value calculation for carbon.

$$NPV\ carbon = \sum_{t=1}^{t=T} \frac{P_{carbon}(C_t - C_{t-1})}{(1+\delta)^t} \quad (7)$$

Carbon flows are in each year are sold at price P_{carbon} and sold relative to the status quo and are accumulated until the target steady-state volume of forest is reached, at which point harvesting begins and participation in the carbon market ceases. Knowing the present value of cumulative carbon and timber revenue for each stock of timber volume, we calculated the carbon price needed to break even for the benchmark land acquisition price of $1000/acre.

Sawmill in Wallowa County, Oregon, Photo by Cristina Mancilla.

Results: Evaluating Carbon

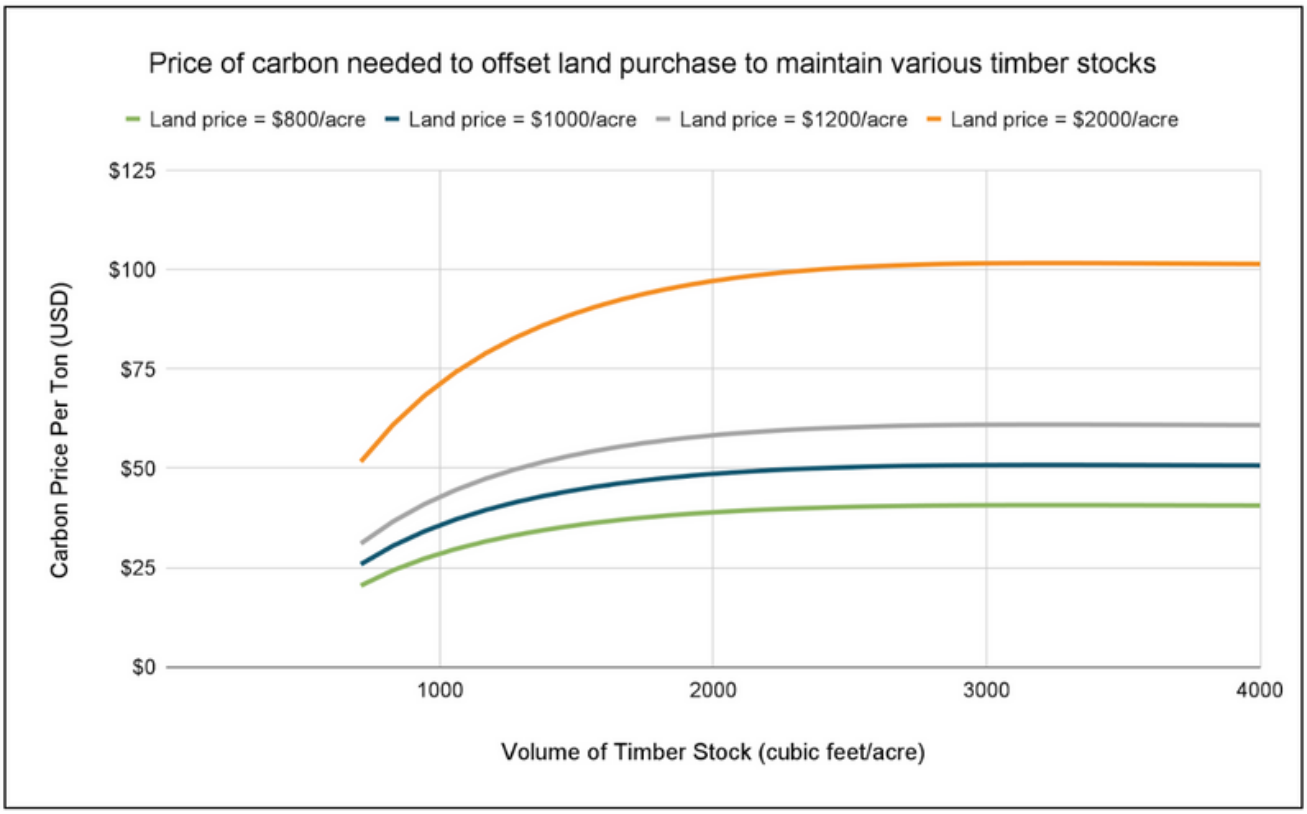

Figure 7: The price of carbon needed to offset forestlands purchased at various prices with different volumes of timber stocks maintained. The curves represent the price of carbon per ton needed to offset the forestland purchase, if forestland was purchased at various prices, ranging from $800–$2000/acre. The required carbon price is dependent on land price values, so the required carbon price starts lower for forestland that was purchased at a lower price, and starts higher for forestland that was purchased at a higher price.

Results: Evaluating Carbon

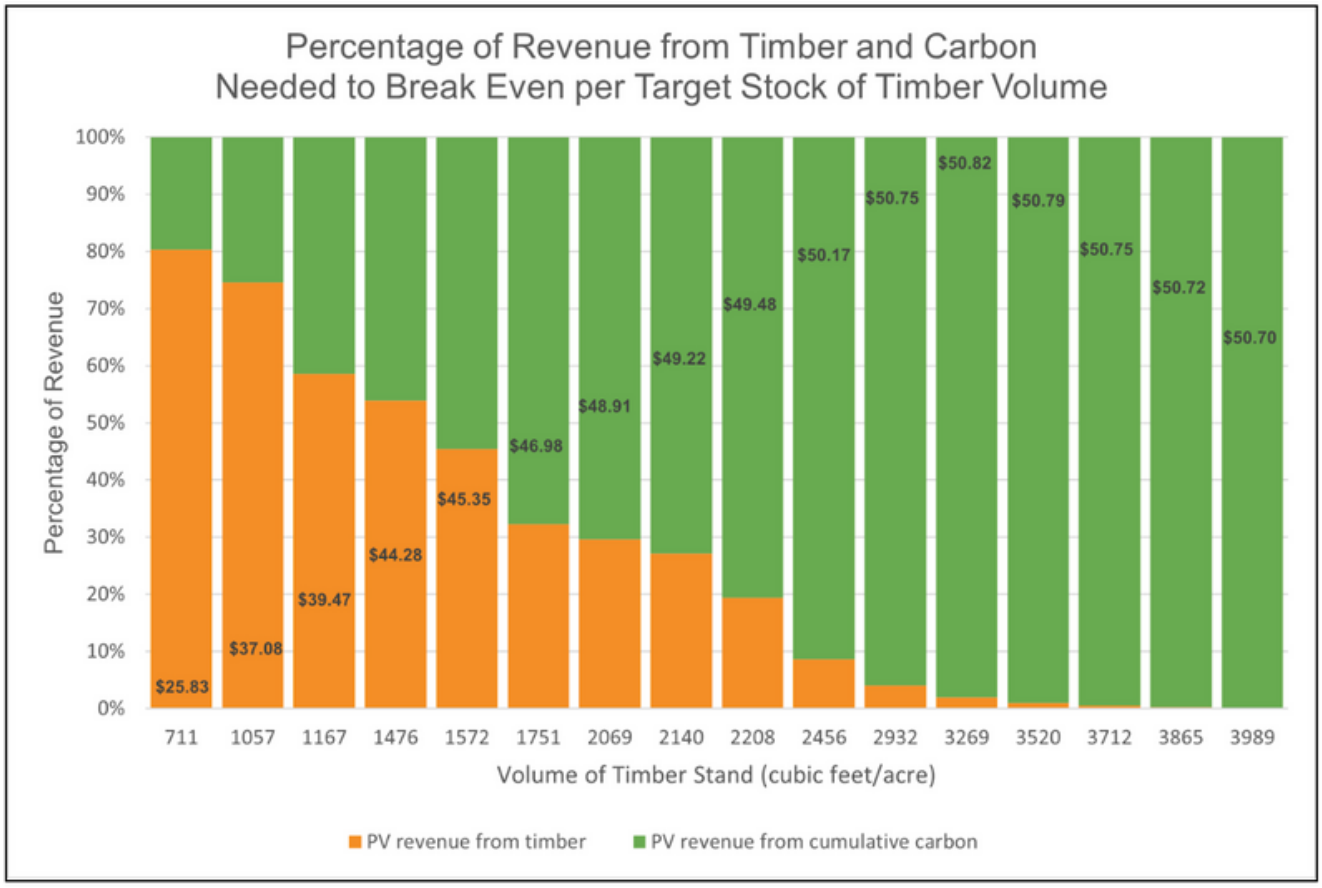

Figure 8: The percentage of present value revenue from carbon and timber needed to break even if forestland was purchased at $1000/acre. Each bar represents a unique steady-state stock of timber volume and the price of carbon needed to break even to maintain that stock is shown on each bar. Orange represents the percentage of revenue from timber and green represents the percentage of revenue coming from cumulative carbon benefits. The percentage of revenue from carbon benefits increases as the target volume of a timber stand increases.

Discussion

Figure 7 presents estimates of the price of carbon needed to break even for various timber volume stock targets and land prices. For the $1000/acre land price (blue curve), the price of carbon could be as low as $25.83/ton, which is close to the buying price in various carbon markets today, but the timber stock associated with that price is not substantially different from the stock that TIMOs maintain. The price of carbon is dependent on land price and the target stock of timber (*T*), so it increases if the land price increases and/or if the target stock increases. For example, with an acquisition price of $1000/acre, if a community wanted to maintain a stock of 2000 cubic feet/acre in its forest, the price of carbon would need to be $48.00/ton compared to a target stock of 1000 cubic feet/acre for which the price would be about $35.00/ton.

Figure 8 breaks down the percentage of revenue generated from carbon and timber for various target volumes and the required price of carbon to break even given land purchased for $1000/acre. As the target volume of the stand increases, the present value revenue from timber decreases because less timber is harvested annually in order to support a greater stand volume. For example, to reach a target stand greater than 3000 cf/acre, almost all revenue generated is from carbon storage because 1) more carbon is being accumulated and sold and 2) the value of harvesting timber has been so heavily discounted that even though harvests do eventually begin, most value in present value terms is coming from the offsets sold in the carbon market.

However, the requirements for the carbon market are limited. Under the $1000/acre land value scenario, carbon price asymptotes around $50.67/ton, which is associated with a timber stock of around 4200 cubic feet/acre. The carbon price levels off two reasons: 1) growth or increase in volume slows down as a stand matures, so there are only minimal changes in carbon storage and 2) the revenue from timber and cumulative carbon is so heavily discounted by that point in time that, in present value terms, little additional revenue is gained from participating in the carbon market.

There were a number of limitations to our analysis that could be improved in future work. To parameterize our model to be specific to Wallowa County, we used forest inventory data from the U.S. Forest Service's Forest Inventory and Analysis data in the eastern Pacific Northwest. However, sampling methods used to collect per-tree data could be considerably improved as sampling errors had the most impact on the outcome and accuracy of our analysis. We only used 21 pairs of volume and age measurements in the regression analysis because of insufficient/inconsistent sampling, which is enough to establish a relationship, but more data would have made the analysis more reliable

When calculating the break-even price of carbon, we assumed that the carbon price would stay constant every year until $t = T$. However, because the carbon market is relatively new and the price of carbon is changing as climate policy is emerging, it is likely that the price of carbon will vary in the coming decades. We assumed that the revenue from timber would remain constant once a target stock of timber volume was reached and annual harvesting began. We also assumed that the stumpage price would not change over time, when in fact it is likely to vary, and may be different with the size of logs.

Conclusions

The State of Oregon does not have its own government-run carbon market, but we recommend that Wallowa County participate in an outside carbon market to capture carbon storage benefits. The county has an unprecedented opportunity to accumulate money by simply letting their forests grow until they have reached a target volume of timberland. Oregon's public growing stock volume density is around 3840 cubic feet/acre (Oregon State University, 2019). If Wallowa County chose to pursue this volume stock target, the carbon price would need to be at least $50.72 (assuming a land price of $1000/acre), which is more than double the carbon prices that are currently in U.S. markets (Dolphin & Xiahou, 2022). However, the Biden administration has established $51.00 as the social cost of carbon and the price of carbon is predicted to increase substantially by 2050, so it is possible that carbon could be bought at this price in the near future (Boyce, 2018; Mindock, 2022; World Bank, 2022).

Working timberland in Wallowa County, Oregon, Photo by Cristina Mancilla.

Methods and Models

Recreation

Background

Recreation can provide financial benefits to a community from both the local population and tourists visiting the area. Wallowa County has increased recreation opportunities and tourist attractions for the last ten years. In the last decade, the tourism industry added 180 jobs to the County (Birkmaier et al., 2021). The County is a popular spot to visit for both locals and tourists to enjoy outdoor recreation because it contains two National Forests, the Umatilla and the Wallowa-Whitman, as well as Wallowa Lake. Some of the outdoor recreation opportunities in the region include mountain biking, hiking, running, swimming, fishing, boating, horseback riding, picnicking, birding, camping, guided tours, and gondola rides during summer months. During winter months, heavy snowfall creates opportunities for downhill and backcountry skiers (Wallowa County Chamber of Commerce, n.d.). Tourists and locals can also enjoy other activities to soak up the local culture. The City of Joseph, located within Wallowa County, is declared an Art and Cultural District where people can enjoy locally-owned galleries, shops and eateries, sculptures of the city's history, live music, and weekly events (Elane Dickenson, 2014).

CFM can potentially provide additional financial benefits for both private and public enterprises and expand the employment opportunities in the County. The local economy benefits from increased access to outdoor recreation because people buy supplies for those activities from local stores. For instance, a person going on a picnic may stop at a local grocery store to buy food, or a fisher may stop by the local tackle store to grab extra bait. Hotels and other sources of lodging for visiting recreationists can also stimulate the local economy. Wallowa County, as the owners of the community forest, could make revenue by charging admission fees. Additionally, financial benefits of recreation for the community forest owners will come from the ability to apply for grants and private funding sources that support recreational programs and spaces.

Methods

Recreational value was calculated in terms of willingness to pay to use the community forest for both locals and tourists. We calculated the maximum potential benefit provided from local recreationists by multiplying the population of Wallowa County by the average number of outings per year by U.S. residents, then by percent of people enjoying specific recreational opportunities, and finally by their willingness to pay per trip:

Maximum Potential Benefit from Locals = Population of Wallowa County x Outings/Year x %Recreation Activity Participation x $/Trip

For the maximum potential benefit from local recreationists calculation, we used the population of Wallowa County (about 7,500 people), and the average number of outings per year for moderate recreationists from the Outdoor Foundation's 2021 Outdoor Participation Trends Report (Outings/Year). The report showed that the average U.S. resident recreated outside between 12 and 51 times between the years 2014 – 2020, so we chose an average value of 30 outings per year per person (Outdoor Foundation, n.d.).

Next, we used data on the percentage of U.S. recreationists aged 16+ who partake in specific recreation activities annually (% Recreation Activity Participation). The different recreation types we chose for both locals and visitors were big-game hunting, small-game hunting, fishing, hiking, and picnicking. These are some of the most common forms of recreation in the region and were the best documented. The percentages for our calculations were derived from the USDA's report on American's Participation in Outdoor Recreation: Results from the National Survey on Recreation and the Environment. Around 8.4% of Americans participate in big-game hunting, 7.1% participate in small-game hunting, 33.9% fish, 32.7% hike, and 54.6% picnic (USDA, 2003).

Finally, we used the average willingness to pay per person per day in 2016 dollars for each recreation activity in or around the Wallowa region from the USGS' Benefits Transfer Toolkit ($/Trip). Big-game hunters were willing to pay $83.50, small-game hunters $186.29, fishers $52.17, hikers $78.40, and picnickers $54.60 (USGS, n.d.). We calculated a total value of $14,747,614 from local visits to the community forests. Of course, this overestimates the recreation benefits generated by community forests because it assumes all recreation in Wallowa County takes place on community forests. Thus, it reflects the maximum potential benefit. We discuss, below, the data needed to refine this calculation

For the maximum potential benefit from visiting recreationists, we took the product of visitor trips to Wallowa County, participation in specific recreation activities, and willingness to pay per trip:

Maximum Potential Benefit from Visitors = Trips to Wallowa/Year x %Recreation Activity Participation x $/Trip

We started by multiplying visitor trips to Wallowa County per year by the percentage of U.S. recreationists who partake in specific recreation activitites. The number of trips to Wallowa County was found in the Economic Impact of Travel in Oregon report. We chose to use trips to the County rather than the number of nights a person stays in the County. We are assuming that in one trip to Wallowa County, a person will visit the community forest one time if it is marketed as a tourist attraction (Dean Runyan Associates, 2022). We then multiplied those results by willingness to pay per trip. For both percentage of recreation participation and willingness to pay per trip, we used the same data we used to calculate the maximum potential benefit by local recreationists. The total value, $17,830,720, is the maximum potential benefit to Wallowa County visitors.

Results

Local recreationists in Wallowa County could contribute a maximum potential benefit of $14.7 million by recreating in a community forest.

Table 3: Calculations of the total maximum benefits locals can provide to Wallowa County by recreating in a community forest. Derived from the population of Wallowa County (~7,500), multiplied by the average number of outdoor outings by Americans (30), multiplied by the percentage of Americans who participate in a specific recreation activity, and the willingness to pay per person per day on specified recreation activities. The maximum potential total benefit is $14,747,613.75.

Recreation Activity	Population of Wallowa County	# of Outings	% Participating in Recreation Activity	$/Trip	Total Revenue
Big Game Hunting	7,500	30	8.4	83.50	$1,578,150
Small Game Hunting	7,500	30	7.1	186.20	$2,974,545
Fishing	7,500	30	32.7	52.17	$3,838,407.75
Hiking	7,500	30	19	78.40	$3,351,600
Picnicking	7,500	30	54.6	24.46	$3,004,911
Total Revenue from Local Recreationists					$14,747,613.75

Tourists could contribute a maximum benefit of $17.7 million to Wallowa County from recreation in a Wallowa County community forest.

Table 4: Calculations of the total maximum benefits visitors can provide to Wallowa County by recreating in a community forest. Derived from the average number of visitor outings to our community forest, multiplied by the percentage of Americans participating in a specific recreation activity, and the willingness to pay per person per day on a specified recreation activity. The maximum potential total benefit is $17,830,719.54.

Type of Recreation	Visitor Outings	% of Recreation Type	$/Trip	Total Revenue
Big Game Hunting	154,450	8.4	83.50	$1,083,312.31
Small Game Hunting	154,450	7.1	186.20	$9,749,162.01
Fishing	154,450	32.7	52.17	$2,634,853.68
Hiking	154,450	19	78.40	$2,300,687.20
Picnicking	154,450	54.6	24.46	$2,062,704.46
Total Revenue from Visiting Recreationists				$17,830,719.64

Combined, locals and tourists could contribute a maximum potential benefit of $32.6 million from the evaluated additional recreational opportunities a community forest could create. This value is based on willingness to pay estimates from other studies, which reflect the costs recreationists are willing to incur to participate in certain activities. Wallowa County can choose to provide additional recreational opportunities depending on how they manage the land. Other opportunities to consider include off-road ATV paths, horse riding trails, camping, birding, and mountain biking.

One of the limitations of the analysis was assuming that all recreationists, both local and visiting, would go to a new community forest in Wallowa County. There are other larger and highly attractive recreation options in the vicinity including the Wallowa-Whitman and Umatilla National Forests and Wallowa Lake. We do not have data that provides the proportion of locals and visitors that would visit a community forest when it is in close proximity to larger recreational opportunities. Future research could include a survey of residents and visitors to estimate the number of visits they would make to a new community forest.

We evaluated recreational activities for people 16 years and older because we assumed that people under 16 would not have the same visitation rates at a community forest because they may not have access to resources such as transportation or expendable income. Nevertheless, young people may still derive significant value from community forests. Additional research could be conducted to estimate benefits from family trips to recreate in community forests.

Recreators at Wallowa Lake, Oregon Photo by Cristina Mancilla.

Conclusion

Recreation in a community forest could provide indirect financial benefits to the people who live in Wallowa County through wages and employment. Increasing recreation opportunities could also provide direct benefits to the residents themselves. Currently, TIMOs in the area that do allow recreation often charge a significant amount for use – far more than what National Forests or a community forest would charge. This is largely because the economic benefit from TIMOs is coming from timber sales and holdings. The labor and costs associated with allowing recreation on the land is high and not aligned with TIMO management.

The recreational opportunities provided on community forests may allow the community to leverage a number of grants and other funds. Several grants only provide funding if there is access to outdoor recreation options and some grants rely on access to specific types of recreation. While some grants will help with acquisition of the land, other grants will help maintain the forest for future use.

Methods and Models

Salmon

Importance of Riparian Areas

The importance of salmonids to the County and to the Nez Perce and Umatilla Tribes has been emphasized earlier in the report. Salmon is a cultural icon for the Nez Perce and they believe that the rivers could not survive without salmon living in them. An example of salmon and rivers playing a vital role in Nez Perce culture is in their tribal ceremonies, such as the “first fish” and “first kill” ceremonies, which symbolize their transition to adulthood and are rites of passage (Crate & Nuttall, 2016). Finding ways to restore and manage salmon habitat in Wallowa County will not only provide the Nez Perce Tribe with cultural restoration, but will also increase fishing and recreational services for all people with access to the waterways. We therefore decided to look into conditions that are vital for salmonid recovery. A critical factor is the management of riparian areas around waterbodies where salmon and other species are found. Riparian areas are lands next to streams, lakes, rivers, or wetlands, which shape the surrounding soils, vegetation, and microclimates. Specifically, riparian areas are known to provide the following benefits to salmonids and the overall ecosystem:

- Floodplain and channel development
- Nutrients to aquatic habitat
- Contribution of root mass for bank stability
- Shade for temperature control
- Energy dissipation associated with high flows
- Cover, large woody debris and other aquatic habitat components
- Sediment movement

The function and benefits of riparian areas depend on their width. Most riparian functions and inputs come from vegetation within 100 feet or less of a stream. For example, in order to get nearly 100% of the potential large woody debris recruitment, a riparian management area width of 200 feet is needed, while over 80% of the large woody debris input would be provided from vegetation retained within 100 feet. Other inputs and functions, such as litterfall and shade, generally are provided by vegetation within 20–50 feet of a channel (ODF Technical Report, July 2001).

There are laws that require special management practices of riparian areas in order to protect water quality, hydrological functions, and/or fish and wildlife habitats. A riparian management area (RMA) is defined by the Oregon Secretary of State Administrative Rules as an "area along each side of specific waters of the state within which vegetation retention and special management practices are required for the protection of water quality, hydrologic functions and fish and wildlife habitat" (2022). However, RMA widths are selected to meet the water quality standards and to provide 'good fish habitat', not 'ideal fish habitat'.

Prioritizing riparian areas to meet water quality standards rather than provide maximum ecosystem health for wildlife has resulted in smaller riparian buffer widths. Human interference including logging practices, channelization, flood control projects, and navigation development have exacerbated the decline of healthy riparian areas. Some of the detrimental effects include increased water temperature, depletion of large woody structures, and reduced sedimentation. (National Research Council, 2002).

The aim of this analysis is to determine how RMAs could be managed under CFM to best support salmonid populations. We assessed existing riparian management laws and regulations and compared it with recommendations from scientific literature.

Riparian Areas as per Forest Practices Act, 2022

The Forest Practices Act, 2022 prescribes guidelines for maintenance of riparian areas under chapter 629, division 635 – Water Protection Rules: Purpose, Goals, Classification and Riparian Area Management (OAR 629-635-0310). Along with these regulations, certain additional steps such as classification of stream type were undertaken to estimate necessary riparian widths for streams in the land parcels under consideration:

1.Identification of waterbodies
Streams, wetlands, and lakes in the parcels of interest were mapped using GIS data provided by Wallowa Resources (procured from the Wallowa County Assessor's Office) as well as data from Geofabrik.
The waterbodies considered for assessment are as follows:

1. On RY Timber property– West Bear Creek, Buford Creek, Bear Creek, Gunderson Creek, Weelikeecet Creek
2. On Hancock Properties – Wallowa River, Minam River, Fisher Creek, Wise Creek, Howard Creek, Wallupa Creek, Sickfoot Creek, East Grossman Creek, Grossman Creek, Deep Creek, Clear Creek, Shamrock Creek and Courtney Creek
3. On Yanke Family Trust, we do not have any prominent water bodies to be assessed

2. Classification of waterbodies under Forest Practices Act, 2022

Water bodies such as streams, wetlands, and lakes are classified based on size and use as prescribed by the Forest Practices Act, 2022. Since most of the waterbodies in our land parcels are streams, the focus here has been on stream parameters.

Streams are classified based on their size into large, medium, and small, which is in turn based on the average annual flow (measured in cubic feet per second or CFS). This kind of categorization helps in tailoring the protection measures to fit size conditions. Stream classifications are usually determined by the State Forester as described in OAR 629-635-0200(15).

1. Small streams – annual flow of less than 2 CFS or drainage area of less than 200 acres
2. Medium streams – annual flow between 2–10 CFS
3. Large streams – annual flow of 10 CFS or greater

Streams are also classified based either on presence or absence of fish and their utilization for various purposes including domestic use as per the Forest Practices Act, 2022. The classification is as follows:

1. Type F – stream with fish use, or both fish use and domestic water use
2. Type SSBT – stream with salmon, steelhead or bull trout present or otherwise used by salmon, steelhead or bull trout at any time of the year as determined by the State Forester
3. Type D – stream that has domestic water use, but no fish use
4. Type N – stream that meets the criteria of a Type Np or Ns stream
    a. Type Np – largest Np stream by basin size that is immediately upstream of the end of a Type F or Type SSBT stream; all perennial streams that are not Type SSBT or Type F
    b. Type Ns – all seasonal stream reaches that are not Type SSBT, Type F or Type Np streams

3. We then identified the riparian management area requirements for each stream as prescribed by the Oregon Forest Practices Act, 2022, defined in OAR 629-635-0310

Table 5: Riparian Management Area Widths for streams of various sizes and beneficial uses (OAR 629-635-0310).

	Type F	Type SSBT	Type D	Type N
LARGE	100 feet	N/A	70 feet	70 feet
MEDIUM	70 feet	80 feet	50 feet	50 feet
SMALL	50 feet	60 feet	20 feet	Apply specified water quality protection measures, and see OAR 629-642-0400.

Private Forest Accord

In November 2022, amendments were made to the above standards due to the Private Forest Accord Report, presented to the Oregon Legislature by Oregon Governor Brown and the Oregon Board of Forestry on February 2, 2022. Changes have been made in OAR Chapter 629, divisions 603 through 699 (Private Forest Accord, 2022) which will be in effect from January 2024. The changes to the RMA width in this amendment allow far more flexibility or lesser RMA width requirement than the previous regulations. Details are given in the table below.

Table 6: Indicating Eastern Oregon Standard Practice Vegetation Retention Riparian Management Area Distances (As per Private Forest Accord, Nov 2022)

Stream Type	Large		Medium		Small		Upstream distance[1]
	Inner	Outer[2]	Inner	Outer[2]	Inner	Outer[2]	
Type F or Type SSBT	30	70	30	70	30	45	-
Type N	30	45	30	45	-	-	-
Type Np, Terminal					30	30	RH Max = 500 feet
Type Np, Lateral					30	N/A	RH Max = 250 feet
Type D	30	-	30	-	30 or 20 feet[3]	-	See OAR 629-643-0150

[1] Upstream distance from either Type F or Type SSBT
[2] Outer zone shall retain 60 square feet of basal area per acre; apply OAR 629-643-0120
[3] 20 feet outside of Type Np vegetation retention requirements

Similar widths have been prescribed for Eastern Oregon Small Forestland Owners with minor changes recommended for riparian areas of the outer zone of medium creeks and both inner and outer zones of smaller creeks (Refer table 5 below).

Table 7: Indicating Eastern Oregon Small Forestland Owner Minimum Option Vegetation Retention Riparian Management Area Distances.

Stream Type	Large		Medium		Small		Upstream distance[1]
	Inner	Outer	Inner	Outer	Inner	Outer[2]	
Type F or Type SSBT	30	70	30	50	30	30	N/A
Type N	30	45	30	30	-	-	
Type Np, Terminal	-	-	-	-	20	20	RH Max = 500 feet
Type Np, Lateral	-	-	-	-	20	N/A	250 feet
Type D	30		30		20		See OAR 629-643-0150

[1] Upstream distance from either Type F or Type SSBT
[2] Outer Zone shall retain 60 square feet of basal area per acre; apply OAR 629-643-0120

Ideal Riparian Area Management

A scientific literature review was then conducted to compare riparian area management width requirements as per the Private Forest Accord and ideal riparian management width recommended by fish biologists. The results have been summarized in the form of a table described in the appendix (Table 2). According to the literature, a minimum of 100 feet, or 30 meters, must be maintained on either side of a stream to provide for good salmonid habitat.

Results

Prior to the amendment of the Oregon Forest Practices Act in 2022 under the influence of the Private Forest Accord, the prescribed RMA widths were more in accordance with width areas recommended by scientific literature and fish biologists, which is 100 feet. TIMOs have very little incentive to adopt sustainable forest management practices and are most likely to adhere to RMAs prescribed after the amendment, a bare minimum of 30 feet, which will be implemented beginning in January 2024. Alternatively, if the land parcels are purchased and managed under community forest management, the county could maintain a riparian area of 100 feet as per the ideal width recommended by scientific literature and provide for good fish habitat. In terms of acreage, a total of 370 acres of land would be taken up by the riparian buffers under TIMO management versus 1230 acres under community managed forests. Although the land consumed is far higher under community management, it would benefit hugely by preserving the fish habitat.

Below is a map of the waterbodies within our parcels (**Figure 9**), as well as maps showing the likely riparian area widths within TIMO-managed forests (**Figure 10**) versus community-managed forests (**Figure 11**). These riparian management areas were mapped graphically using QGIS and are presented below:

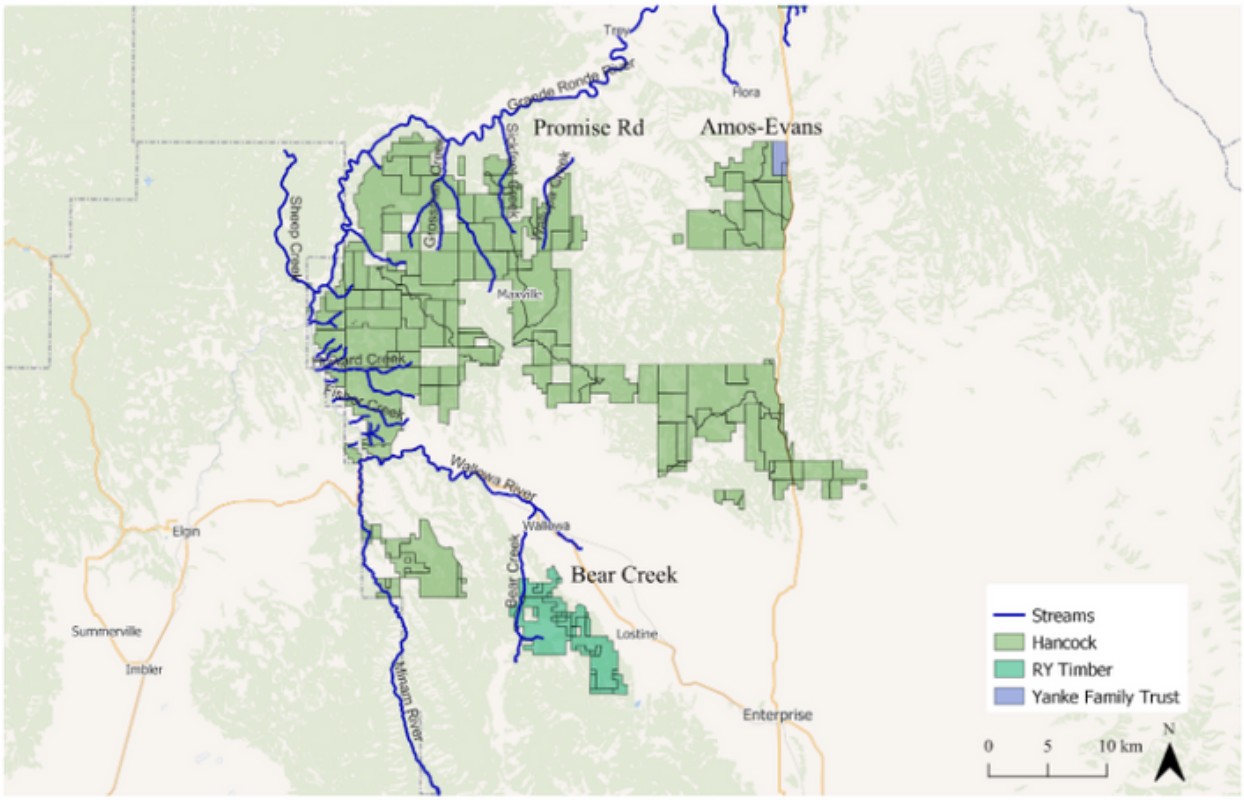

Figure 9: Map of the waterbodies within the land parcels under analysis.

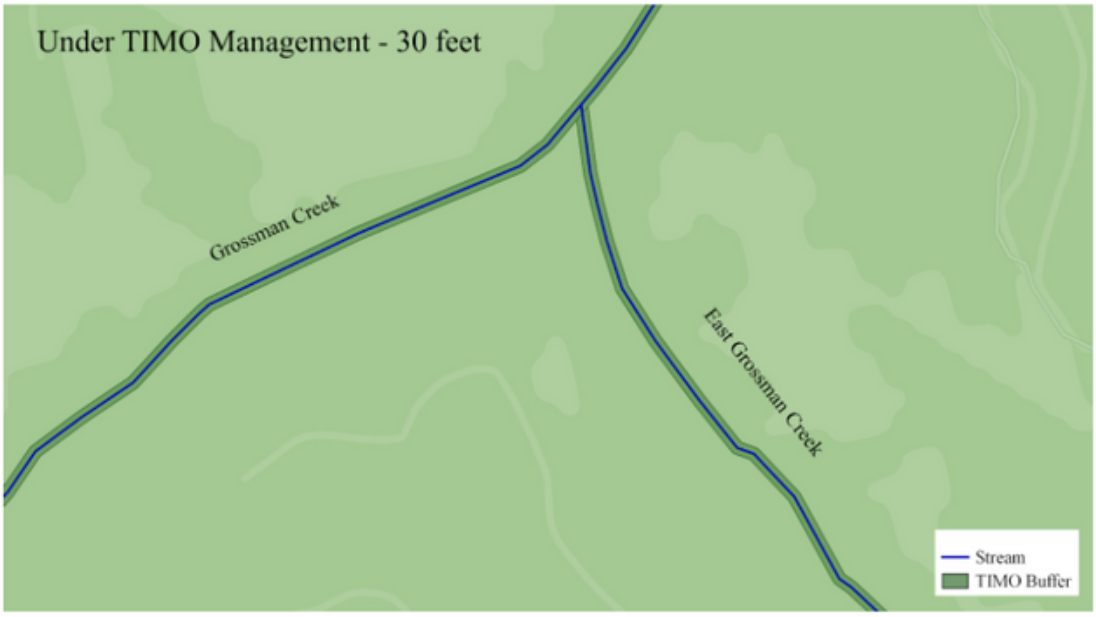

Figure 10: Riparian area width that would likely be implemented under TIMO management.

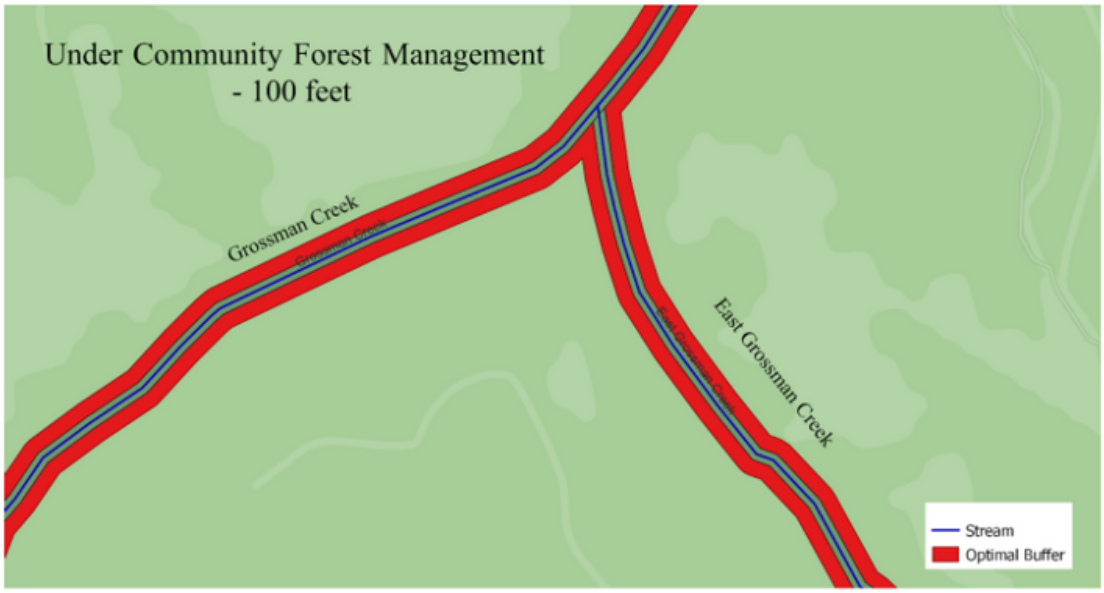

Figure 11: Optimal riparian area width of 100 feet that could be implemented under community forest management.

Conclusion

Riparian buffer widths have been significantly reduced by law based on the petition by the private landowners. It is therefore recommended that the County adopts the ideal riparian management areas, which is a minimum of 100 feet on either side of the streams as prescribed by scientific literature to support good salmon habitat.

Methods and Models

First Foods - Huckleberry and Biscuitroot

Background

We decided to assess two different types of first foods based on cultural significance as well as the feasibility of growing them on potential community forest properties. Huckleberry and biscuitroot are culturally significant foods and historically have grown in our parcels of interest. Due to forced exile, violence, and relocation, the tribes' population and the presence of first foods in Wallowa County have declined. There are reservations located hundreds of miles outside the County, in Washington, Idaho, and Oregon. Despite the decline in population and first foods presence, the Umatilla and Nez Perce still have strong ancestral and sacred ties with the land within the County. Encouraging huckleberry and biscuitroot growth can support the tribes' connection with their homelands. Incorporation of this ecosystem service in community forest management plans will raise awareness and educate others about the history and the cultural importance of first foods while improving access to these culturally significant plants.

Photo by Native Foods Nursery.

Methods

Our goal for this analysis is to focus on measuring the potential for first food growth because this is considered intrinsically valuable for the Umatilla and Nez Perce Tribes. Since there is no current, publicly accessible data on the presence of huckleberry and biscuitroot in the County, we chose to find potential spots that contain the optimal growing conditions for both first foods within the parcels of interest. A model was built to find the areas of suitable growing habitats for both first foods by using QGIS shapefiles to overlay areas that are suitable habitat for biscuitroot and huckleberry and finding the total areas in acres. The total areas of the parcels were calculated to find out what percent of the property areas contain suitable growing conditions for huckleberry, biscuitroot, or both first foods together.

Huckleberry and biscuitroot were evaluated using the same overarching process, but different parameters were used by analyzing the specific growing conditions and where these suitable habitats are on the parcels of interest. The growing conditions needed for huckleberry and biscuitroot differ. The different conditions are listed below. Other GIS layers from various government databases were used and all data was obtained through public-access sites. Information on these databases can be found below (**Table 8**), as well as the characteristics or values that each shapefile layer contains..

Table 8: This table shows the growing conditions and data sources for huckleberry and biscuitroot analysis. The ideal growing conditions for huckleberry are partial shade, wetland soil, a soil pH between 4.3-5.2, and temperature zones 3-7 which are average lows between -15 to 30 degrees Fahrenheit. The ideal conditions for growing biscuitroot are dry,shallow soil and plenty of sunlight (Krista L. Jones et al., 2008).

Huckleberry

Growing Condition	Value/Characteristic	Data Source
Hillshade	Partial shade, full shade	NASA *Digital Elevation Model* (2023).
Temperature Zone	3-7	USDA *Plant Hardiness Zone Map*. (n.d.).
pH	4.3-5.2	USDA *Web Soil Survey*. (2019).
Wetland Soil	Yes	The Wetlands Conservancy. *Oregon Spatial Data Library*. (n.d.).

Biscuitroot

Growing Condition	Characteristic	Data Source
Soil Drainage	Well-drained soil	USDA *Web Soil Survey*. (2019).
Hillshade	Full sun	NASA *Digital Elevation Model* (2023).

Results

According to the overlap of the optimal growing condition layers for each plant, huckleberry and biscuitroot can grow within many of the parcels. The purple layer shows the area where all the growing conditions for huckleberry are met (partial and full shade, temperature zone 3-7, pH 4.3-5.2, and wetland soil) and the green layer shows the area where all growing conditions for biscuitroot are met (well-drained soil and full sun). The orange layer is the intersection and represents the area where both huckleberry and biscuitroot growing conditions are met (using well-drained soil and full sun conditions were omitted).

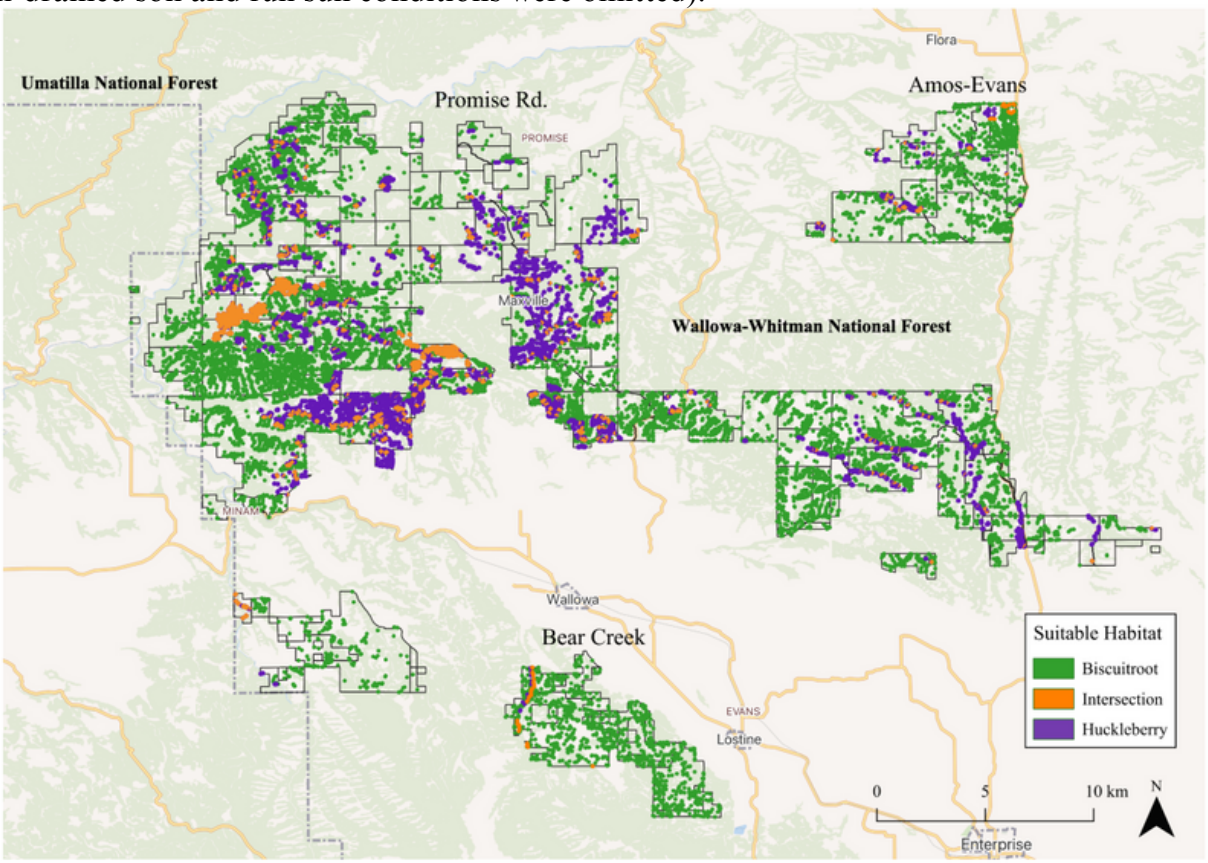

Figure 12: This figure shows the areas containing suitable growing conditions for huckleberry and biscuitroot, and the overlap where both plants can grow. The areas are shown for all three parcels: Promise Rd., Bear Creek, and Amos-Evans.

The total sum areas of all three parcels, as well as the percentages of the total areas where the first foods can grow, are shown below (**Table 9**). The percentages were calculated by dividing the total sum areas of the suitable growing habitats by the total sum areas of the parcels.

Table 9: This table shows the calculations (sum area and the % of the total area) for huckleberry and biscuitroot, and the intersection of both plants.

Huckleberry

Calculations	Promise Rd.	Bear Creek	Amos-Evans
Sum Area	1,000 acres	3 acres	2.5 acres
% Total Area	0.7%	0.03%	0.03%

Biscuitroot

Calculations	Promise Rd.	Bear Creek	Amos-Evans
Sum Area	6,400 acres	5,500 acres	340 acres
% Total Area	5%	47%	4%

Intersection

Calculations	Promise Rd.	Bear Creek	Amos-Evans
Sum Area	116 acres	0.2 acre	0.1 acre
% Total Area	0.1%	0.002%	0.001%

Conclusion

These models are reproducible to determine if other parcels in the County contain suitable areas of huckleberry and biscuitroot habitat. There is a potential for first food growth based on the total acreages of suitable habitat which shows that these parcels can generate cultural and intrinsic value for the Nez Perce and Umatilla Tribes. The low percentages of the total parcel areas show that there is space for other ecosystem services, such as recreation, to be incorporated into the CFM plan. It is important that these calculated growing condition areas be considered with the incorporation of tribal members and indigenous knowledge.

Under TIMO ownership, the provision of first foods like huckleberry or biscuitroot is not taken into account, however a community-managed forest could plant these species. Suitable growing conditions for huckleberry are compatible with riparian buffer zone management for salmonid habitat. Thus, CFM can enhance cultural value for the two tribes in the region and ultimately increase access to first foods.

Exploring Finances

General Funding Sources

One of the main objectives of the project is to address the question – What are some of the potential mechanisms that could fund the acquisition and management of community forestland? We took the approach of assessing ecosystem services that can be enhanced on specific land parcels, which could in turn be leveraged to appeal to grantors/donors who may want to support the respective ecosystem or enhancement of natural resources. Wallowa Resources could use the funds raised for acquisition and/or maintenance of these lands for community forest management. Funding options recommended are from diverse sources including government agencies, private companies, individuals/family foundations, non–for-profit organizations, and communities that are broadly investing in natural resource conservation.

The range of funding options for the overall acquisition and/or maintenance of the forestland includes government agencies and not-for-profit organizations, as well as private corporations with goals of corporate social responsibility. Land acquisition is likely to require a large amount of funding. We have therefore focused more on federal and state government entities that Wallowa Resources or the County could reach out to, simply due to the funding bandwidth that they possess. Federal options include the Forest Legacy Program by the U.S. Forest Service in partnership with respective state agencies. The Forest Legacy Program is a conservation program to encourage protection of privately-owned forestlands through conservation easements or land purchases. The Program is ideal as it supports sustainable forest management with strong markets for forest products. Since its creation, the program has conserved over 2.8 million acres of forestland and provided grants across all states and territories. Funding is provided for protection of water quality, fish and habitat wildlife, opportunities for recreation including hunting, fishing and camping, and other public benefits.

Wallowa Resources and the County could follow in the footsteps of the East Moraine Community Forest (which both organizations also worked together towards establishing), which received a total of $3,645,855 in funding from the Program. Other projects in the region that have received funding from the Program include the Blue Ridge Heritage Project, which is a family-owned working forest. This project received $2,511,450 in funding for a total of 4,838 acres in 2017. In 2015, the Gilchrist Forest in Klamath County received a grant amount of $5,971,279 for a total of 17,000 acres. Since its inception, a total of 456 projects have been funded through this program.

The Community Forest and Open Space Conservation Program is another program by the U.S. Forest Service that supports communities in acquiring and conserving forests. The program also provides for public access and recreational opportunities, protects vital water supplies and wildlife habitat, and provides economic benefits from timber and non-timber products. The program is open to local governments, tribal governments, and qualified nonprofit entities for forest acquisition and is not applicable to conservation easement purchases. About 64 projects, 28,140 acres, and $23.3 million worth projects have been funded so far. In 2023, 24 projects are currently being funded and are in progress. Projects can request a maximum amount of $600,000. The program provides for up to 50% of total allowable project cost. The other 50% must be funded from non-federal sources. A scoring mechanism is used to rate the project applications with maximum points allocated to projects that focus on public benefits - economic, educational, environmental and recreation. Points are also allocated for public participation/community involvement, strategic contribution and connection, and marked down for likelihood of conversion to a non-forest use.

Wallowa Resources or the County could also benefit from several non-profit organizations, including the Conservation Fund's conservation acquisition funds or loans. The organization has protected more than 8.5 million acres of land and water in 50 states valued at $7.2 billion. The non-profit often steps in at times when the landowner is unable to align with funding timelines of private or public sources. Their capital supplies act as timely bridge financing that is critical to help save natural resources. The organization's Working Forest Fund works towards preserving forests that are at risk of degradation and also provide benefits to communities around these areas. A successful example of this initiative is the Central Oregon project that impacted 3,020 acres of land. It helped store 526,000 metric tons of carbon, enhancing 5 miles of stream area and 8 acres of wetlands in 2022. Another organization that offers smaller reimbursement grants up to $5000 is the Oregon Wildlife Foundation. This supports fish and/or wildlife habitat restoration, public access preservation, restoration, or improvement, natural resource or outdoor education, invasive species removal or control studies that support improved fish/wildlife management, and land acquisition. Such funds could be utilized for timely maintenance.

Carbon Markets

Several land trusts in the United States have explored the option of a 'forest-carbon offset' project. A good example of one such project is the Downeast Lakes Land Trust (DLLT) which has registered a project with California Air Resources Board (CARB) for California's greenhouse gas cap-and-trade program. The land trust specializes in working forests and supports biodiversity, recreation opportunities and sustainable timber economy. To qualify for offsets, the trust has agreed to follow the CARB's Compliance Offset Protocol for U.S. Forests, which requires forest-management projects to maintain or increase forest carbon stocks above the expected levels under typical commercial forest management for 100 years – objectives that were compatible with the DLLT's existing stewardship actions and stocking plans. This carbon project covers more than 19,000 acres of the trust's 33,700 Farm Cove Community Forest in eastern Maine, and registered nearly 200,000 offsets; each offset is equivalent to one ton of carbon dioxide. In 2013, offsets from the 19,118 acre project were purchased for $1.5 million – money which the land trust is reinvesting to support the acquisition of a keystone portion of neighboring working forest land for the creation of the West Grand Lake Community Forest.

The Land Trust Alliance is another organization that, in association with Finite Carbon and The Climate Trust, has created a carbon offset pilot program. The program will provide land trusts access to voluntary carbon markets and a new source of conservation funding. The pilot consists of two parts. First, Finite Carbon assists land trusts with forested fee-land ownerships that are too small to qualify for carbon projects on their own to gain access to the voluntary carbon offset market by combining their holdings with those of other land trusts or forest easement landowners. The Climate Trust will then facilitate the protection of grasslands by providing upfront cash payments to land trusts based on anticipated future carbon revenues to help finance the purchase of no-till conservation easements. The Alliance will facilitate the participation of land trusts, coordinate the various stages of the project and provide grants to help select land trusts cover their staff and out-of-pocket expenses. The Climate Trust and Finite Carbon will serve as technical project developers for grassland and forest projects respectively, including assessing project feasibility, negotiating commercial terms and marketing and selling carbon offset credits. There have also been examples of The Climate Trust developing projects to capture and utilize renewable methane from dairy farms which is further used to offset Oregon Department of Transportation's natural gas purchases.

Another vendor that the County could explore is the Bonneville Environmental Foundation (BEF) which has helped in procuring a carbon price of $7-9 per 1 MT Co2e for avoided grassland conversion in Oregon, $12 per 1 MT for a forestry project in Washington and $13 per 1 MT for a project in California. A few other projects have been registered with the American Carbon Registry, Carbon Action Reserve, Verra Verified Carbon Standard, City Forest Credits etc. The detailed working of these projects can be found in the Appendix.

Funding for Recreation

Several government as well as not-for-profit agencies fund projects that aim to create recreation opportunities for the public. One of the most prominent organizations that Wallowa Resources or the County could tap into is the Rocky Mountain Elk Foundation's (RMEF) State Grant Program or the Project Advisory Committee Grant Program. Through this program, the RMEF provides financial support for hunting heritage, conservation outreach, habitat enhancement, wildlife management and research projects and activities. Dollars raised by voluntary committees and donations across the country are leveraged with partner (state agencies) dollars to amplify on-the-ground impact for elk, other wildlife, and their habitat to ensure the future of hunting heritage. Since 1984, RMEF and its partners have enhanced more than 8.6 million acres of land. Several different public land protection and access projects, elk restoration projects, and conservation easements on private land and state conservation projects have been managed by the organization in Wallowa County alone. This includes the Little Sheep Creek project which helped protect 678 acres, previously owned by private landowners, which was then donated as a conservation easement to the Foundation. The parcel was a mixture of native grassland and forests and provided excellent habitat for elk, winter range for mule, white-tailed deer, bears, mountain lions and other regional Oregon wildlife.

Government entities such as the United States Environmental Protection Agency (EPA) and the USDA Forest Service administer the Recreation Economy for Rural Communities funding, which aids rural communities in growing their recreation economy. A main component of this program is revitalizing 'Main Streets' and marketing them as a gateway to nearby natural lands and amplify outdoor recreation. In 2019, the program supported John Day in Oregon to diversify its economy by growing outdoor recreation, including cleaning up and reusing a riverfront former industrial site and developing hotels and new outdoor recreation enterprises.

The Oregon Department of Fish and Wildlife's Access and Habitat Program is another mechanism to seek funds to improve wildlife habitat, increase public hunting access to private lands. Some of the projects that have received aid in the past have focused on improving hunting leases, land acquisition, seasonal road management, and hunter access through private lands to inaccessible public lands. Projects could be submitted by individual landowners, conservation agencies, or even local government agencies. Advance payments are made for up to 90% of approved funding, or ODFW reimburses the grantee for project expenses. At the end of the project, the grantee is expected to submit a project completion report, and then the remaining 10% of approved funding is paid.

Another potential source of funding is Recreational Trails Program (RTP) by Oregon State Parks, which is a federally-funded grant program administered by the Oregon Parks and Recreation Department. Over 500 projects have been approved under this program, which helps develop, improve, or expand motorized (OHV, snowmobile) and non-motorized (hiker, biker, equestrian) land trails, water trails, and other facilities. Projects that construct new trails, aim to rehabilitate existing trails, or acquire lands or easements for the purpose of trail development are considered for funding. Approximately $1.6 million is allocated to Oregon's annual RTP quota. At least 30% of the funds are dedicated to motorized trail projects. Grantees can request for a minimum of $10,000 or a maximum of $150,000 for non-motorized projects, with no maximum cap for motorized projects. Grantees must also commit to match at least 20% of the project budget and can receive donations.

Funding for First Foods

There is no primary dependence on this ecosystem service as a revenue generator for acquisition of lands to establish community forests. First foods are considered for tribal cultural value rather than for financial value.

Funding for Riparian Area Management

Funding sources for salmon restoration and/or riparian area management can broadly be divided into federal funds, state funds, and funding from not-for-profit organizations. Federal funding sources include the U.S. Fish & Wildlife Services' Partners for Fish and Wildlife Program that provides technical and financial assistance to private landowners who voluntarily wish to restore, enhance, and manage riparian, wetland, instream, and upland habitats. The program emphasizes the reestablishment of native vegetation and ecological communities for the benefit of fish and wildlife. Other entities who are eligible for funding are Native American tribes, counties, and cities. The program contributes up to $25,000 in cost-share funding per project and requires a 50:50 split. Landowners can also receive a reimbursement for the program's portion of the project cost after the work has been completed. The program has been successful in neighboring Idaho.

The U.S. Department of Agriculture's Natural Resources Conservation Service helps landowners restore, enhance, and protect forestland resources on private or tribal lands through easements and financial assistance through its Healthy Forest Reserve Program. Landowners can promote recovery of endangered and threatened species, improve animal and plant biodiversity, as well as enhance carbon sequestration. Similarly, the Department's Riparian Buffers Program helps landowners achieve conservation goals such as soil conservation, water quality protection, and wildlife habitat enhancement. 90% of the funding is covered through the

program with 50% covered from a cost-share payment and 40% from a practice incentive payment (PIP). Additional incentives are available through the State's Conservation Reserve Enhancement Program (CREP). Detailed information on incentives are often decided by the local USDA Farm Service Agency.

Oregon's state agencies such as the Oregon Watershed Enhancement Board (OWEB) and Oregon Department of Fish and Wildlife (ODFW) provide numerous funding opportunities for maintenance of fish and wildlife and riparian areas. ODFW's Fish Screening Cost Share Program provides up to $75,000 per project with 60% cost sharing to install fish screen or bypass devices. OWEB's Conservation Reserve Enhancement Program, Watershed Enhancement Program, and Restoration Grants provide for protection or restoration of watershed functions including riparian habitat – enhancing riparian vegetation communities, treating invasive weed species, reconnecting floodplains, moving roads out of riparian areas, and more. The amount of monetary support provided by these programs depends on the scope of the project and is often decided by the local agencies.

Finally, prominent non-profit organizations, such as Trout Unlimited, support fish and wildlife restoration initiatives by providing matching funds equivalent to federal funds and funds from state wildlife management agencies. The National Fish and Wildlife Foundation is ye another organization that is dedicated to sustaining, restoring, and enhancing fish, wildlife, plants, and habitat for current and future generations. The organization leverages public funds to raise private donations and distributes funds to projects with objectives of natural resources conservation. Their Bring Back the Native Fish program invests in conservation activities that restore, protect and enhance native populations of fish species by coordinating between private landowners, federal agencies, tribes, corporations and states. They have funded pacific lamprey, chinook salmon, and steelhead restoration in the Columbia River Basin, native trout in Snake River, along with many other projects. Funds have been granted up to $800,000 for initiatives to support native fish species across the country in 2022 in association with USFS, US Fish and Wildlife Service, and Bezos Earth Fund.

Summary

In summary, Wallowa County should not rely on one type of funding source or only one ecosystem service that could yield revenue, but should diversify their land acquisition portfolio to include all of the ecosystem services examined and their supporting funding opportunities. An extensive list is provided in the Appendix. Although a large number of opportunities are identified here, the list is not exhaustive and we recommend that Wallowa County use it as a launching point for funding community forests.

Conclusion and Discussion

Community forest management is beneficial for both nature and surrounding communities. The transformation from timber investment management organizations to community forest management restores ecosystem services through provision of healthier forestland and expanded public access. All the ecosystem services analyzed provide important value to the environment as well as to community members: carbon storage will increase because the community forest allows trees to grow longer before harvesting; first foods provide an intrinsic value to the land by providing more areas for local tribal members to access significant cultural resources; recreation can provide greater access to the outdoor opportunities and stimulate the local economy. Not only are ecosystem services inherently valuable to communities, but they can also be used as assets to leverage funding for the acquisition and management of a community forest. Early investors will pave the way for future national community forest management as the trend grows. Government funds which are used towards community-managed forestry can advance conservation goals and initiatives set by state and federal administrations.

While this report is written with specific analysis to aid Wallowa County and Wallowa Resources in funding a community-managed forest, our hope is that other western, rural communities can use it as a framework for applying similar analyses to their own regions. Selection of the ecosystem services to analyze in a particular region should be based on the potential natural and cultural assets present there. Some ecosystem services, such as timber, carbon storage, and recreation should be analyzed for any potential community forest site. Others, such as water quantity and quality or riparian buffer management, are of course dependent upon the presence of waterbodies. Recreation, habitat connectivity, and the suitability of first foods habitat can be tailored to the particular cultural values of the community at hand. In a highly agricultural region such as Wallowa County, grazing leases for the community forest could be considered. Fire resilience should be considered if the community forest is in an area prone to fires. To improve the recreation analysis, surveys could be sent to local residents and visitors in order to understand what their recreational desires are within a community forest and what would attract them to a community forest over a National Forest.

Ecosystem Services Not Considered

A few ecosystem services were not able to be considered due to the limited duration of this project as well as difficulty finding data to accurately assess them in this region. However, we recommend including the following ecosystem services in other community-forest planning frameworks for additional funding leverage, and provide some suggestions for analysis.

Habitat Connectivity

Many wildlife species are dependent upon movement within and between suitable habitat patches in order to feed, breed, and find shelter. Some species need additional access to more widely dispersed patches in order to migrate from their natal ranges (Cameron et al., 2022). Not only is it important that large enough habitat patches are preserved for each species to thrive in, it is equally important that species are able to move safely between one habitat patch and another. Habitat connectivity is the ability of species to move unimpeded across habitats (Science: Habitat Connectivity, n.d.). Human development, such as roads, residential areas, and agricultural areas, often act as barriers to safe wildlife movement, limiting connectivity.

Our analysis of habitat connectivity in Wallowa County with regards to community forest planning would have focused on improving connectivity between the Umatilla and Wallowa-Whitman National Forests through community management of some of the Hancock Promise Road forestland parcels (see Figure 3). The National Forests are habitat patches with limited human disturbance where wildlife of many kinds live – from megafauna such as black bears, Rocky Mountain elk, and bighorn sheep, to smaller mammals like the American marten and wolverines, and a plethora of birds, reptiles, and amphibians (Wallowa-Whitman National Forest - Resource Management, n.d.). While logging does take place within these National Forests, it is generally more dispersed over larger areas compared to logging in the neighboring TIMO-owned forestlands, where trees are clearcut about every 40 years (Outside of TIMOs, average logging rotations within the County are about 60-80 years; Nils Christoffersen, personal communication, April 19, 2022). Clearcutting destroys habitat for many forest-dwelling species because they rely on trees for shelter, food, and rearing their young.

It was difficult to accurately assess habitat connectivity in the region between the two National Forests because there is no data on the current forest cover of the TIMO-owned forestlands there. National landcover databases showed the TIMO-owned parcels as having the same land cover categorization as the National Forests, which we know misses important heterogeneity in forest conditions.. Therefore, running a connectivity model in a program such as Circuitscape would provide no clear connectivity path estimates between the National Forests through the TIMO-owned forestlands.

The amount of connectivity provided through a community forest will also be largely impacted by the ownership and harvesting regimes of the surrounding areas. If the community forest is surrounded by TIMO-owned forestlands, it likely will create little if any additional connectivity value, although it would provide a new habitat patch. This may be useful for birds that are not as impacted by terrestrial disturbances, however it would not be useful for most migratory terrestrial species. However, if the community forest is adjacent to a National Forest, connectivity would be improved by providing additional, easily accessible habitat for species already in the National Forest.

Water Quality and Quantity

Forested waterbodies provide plentiful ecosystem services, including water purification, habitat and resources for both terrestrial and aquatic species, and landscape protection such as flood control (Aguilar et al., 2018). Logging on forested land near waterbodies negatively impacts water quality by altering natural properties of the water including color, temperature, turbidity, electrical conductivity, and pH (Gökbulak et al., 2008). A study by Gökbulak et al., (2008) discovered that any vegetation disturbance will impact the water quantity and quality of the water. The farther vegetation removal is from the waterbody, the less are the negative impacts. Our research on protecting salmonid habitat recommends creating a buffer zone of 100 feet for logging near waterbodies (see Figure 11).

Along with ecosystem services, water can have cultural significance. For both the Nez Perce and Umatilla Tribes, water is the most important first food. Water gives life to the people and at the end of time, water will wash everything away. Because of its importance, when serving ceremonial meals, water is placed down first and drunk prior to eating (Wenix Red Elk, 2021).

To evaluate water quantity, we suggest using the Annual Water Yield Model in InVEST to compare annual precipitation with evapotranspiration given the vegetation cover and other characteristics of the landscape (such as slope, soil absorption, and permeable surfaces). Due to limitations in accessing sufficient data and the large amount of specific data that InVEST requires, this analysis was not feasible for us. We recommend future projects to evaluate the water quality and quantity to receive water specific grants and partake in the emerging water quality markets, creating more revenue streams from ecosystem services.

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Appendix

Carbon

Table 1A: Table used to perform the merchantable timber volume and stand age regression

Plot	n_trees	ht(ft)	stdage	volume(tons/acre)	volume (ft3/acre)	sicond	carbon_ag_tons_acre	carbon_bg_tons_acre	sum_carbon_bg_ag
52227	37	73.00	7	6.61	520.69	103	17.86	4.65	22.51
58482	27	81.05	160	106.15	8358.60	48	88.57	20.34	108.91
59860	16	86.5	NA	90.81	7150.58	70	78.10	17.77	95.86
63529	62	73.83	170	211.94	16687.97	91	158.09	35.98	194.08
66335	18	40.67	60	10.59	833.79	101	8.62	1.97	10.59
68060	56	50.94	141	39.62	3119.57	67	38.83	8.90	47.73
69550	26	70.92	120	107.08	8431.44	109	76.10	17.12	93.22
71000	31	79.26	210	187.48	14762.20	87	123.17	28.48	151.66
73551	27	86.04	176	145.54	11459.58	81	110.69	24.94	135.63
75900	55	71.98	143	176.14	13869.31	95	120.94	27.77	148.71
79370	19	37.92	23	3.57	281.05	NA	4.20	0.98	5.18
81347	49	70.96	125	191.71	15094.90	97	133.40	30.17	163.57
81487	13	55.62	53	18.13	1427.23	94	13.60	3.09	16.69
82126	80	62.41	81	96.58	7604.40	90	84.95	19.53	104.48
84675	30	45.63	39	25.15	1980.41	129	20.35	4.62	24.97
86192	34	42.09	28	15.30	1204.67	121	14.01	3.21	17.22
87958	22	44.55	85	26.32	2072.77	107	21.17	4.79	25.96
91597	27	50.46	79	17.39	1369.41	66	18.06	4.13	22.19
92654	11	66.50	195	23.22	1828.06	82	19.03	4.35	23.38
97353	36	75.38	160	121.82	9591.79	87	97.10	21.86	118.96
97528	20	39.78	47.57	6.32	498.03	108	6.91	1.60	8.51
98675	27	40.88	151	67.55	5318.87	91	51.14	11.48	62.62

Salmon

Table 1B: Table 1B: Summary of the scientific literature for ideal riparian width areas

No.	Source	Details of recommended RMA (in feet)	Remarks
1	EPA - Riparian buffer width, vegetative cover, and nitrogen removal effectiveness: A review of current science and regulations	According to Wenger and Fowler (2000), "The most effective buffers are at least 30 meters, or 100 feet, wide composed of native forest, and are applied to all streams, including very small ones."	Page 3 of the report
2	Management Recommendations for Washington's Priority Habitats: Riparian (inhabit freshwater, native salmon stocks) by WDFW	Type 3 streams; or other perennial or fish bearing streams 1.5-6.1 m (5–20 ft) wide - 61 (200 ft) Type 3 streams; or other perennial or fish bearing streams <1.5 m (5 ft) wide – 46 (150 ft) Type 4 and 5 streams; or intermittent streams and washes with low mass wasting* potential– 46 (150 ft) Type 4 and 5 streams; or intermittent streams and washes with high mass wasting* potential – 69 (225 ft)	Executive Summary of the report
3	Best Management Practices for Riparian Areas	Comparative table of RMAs width and harvest restrictions from various states	Page 278 of the report
4	Riparian Areas: Functions and Strategies for Management by National Academies	Describes the riparian management criteria under various federal plans. Most plans for INFISH streams with fish bearing streams recommend an RMA of at least 2 trees height and 1 tree height for perennial streams without fish or ephemeral/intermittent streams. For full details, see Page 259. Sources : USFS and BLM (1994 a,b); USFS (1995)	Page 259 of the book Average height of the tree on our parcels is 61.2 ft
5	Riparian Areas: Functions and Strategies for Management by National Academy of Sciences: USDA's Three-Zone approach to riparian buffer design	Recommended widths for all three zones range from a minimum of 100 feet to 150 feet, depending on soil type and land use (Welsh, 1991). There are no published studies on the overall effectiveness of the three-zone forest buffer design for water-quality protection. According to the Natural Resources Conservation Service, the minimum width for a riparian forest buffer is 100 feet or 30% of the floodplain width, whichever is less.	Page 378 of the report
6	A review of the scientific literature on riparian buffer width, extent and vegetation - by Seth Wagner for the Office of Public Service & Outreach, Institute of Ecology, University of Georgia (1999)	Over 140 articles and books were reviewed to establish a legally-defensible basis for determining riparian buffer width, extent and vegetation The most common recommendation in the literature on wildlife (most of which focuses on birds) is for a 100 m (300 ft) riparian buffer. Although this is not practical in many cases, local governments should preserve at least some riparian tracts of 300 foot width or greater. Long-term studies suggest the need for much wider buffers. It appears that a 30 m (100 ft) buffer is sufficiently wide to trap sediments under most circumstances, although buffers should be extended for steeper slopes. An absolute minimum width	Executive Summary & Page 47 of the report

No.	Source	Details of recommended RMA (in feet)	Remarks
		would be 9 m (30 ft). To be most effective, buffers must extend along all streams, including intermittent and ephemeral channels. Buffers are short-term sinks for phosphorus, but over the long term their effectiveness is limited. Buffers can provide very good control of nitrogen, including nitrate. In most cases 30 m (100 ft) buffers should provide good control, and 15 m (50 ft) buffers should be sufficient under many conditions. To maintain aquatic habitat, the literature indicates that 10-30 m (35–100 ft) native forested riparian buffers should be preserved or restored along all streams. This will provide stream temperature control and inputs of large woody debris and other organic matter necessary for aquatic organisms. While narrow buffers offer considerable habitat benefits to many species, protecting diverse terrestrial riparian wildlife communities requires buffers of at least 100 meters (300 feet). To provide optimal habitat, native forest vegetation should be maintained or restored in all buffers. To provide habitat for forest interior species, at least some riparian tracts of at least 300 ft width should also be preserved.	
7	Applying the "Goldilock Rule" to Riparian Buffer Widths for Forested Headwater streams across the contiguous US - How much is 'Just Right? (2022) Department of Sustainable Resources Management, SUNY College of Environmental Science and Forestry, Syracuse, NY	Study watersheds in states such as Arizona, Idaho, and Oregon would require more riparian land area protected using the functional allocation approach compared to existing state guidelines. For Oregon, guidelines recommend a buffer zone of 70 feet for a medium Type F stream and 50 feet for a small Type F stream	Executive summary of the article
8	Riparian Management Practices - A summary of state guidelines (2001) by Charles R Blinn and Micheal A. Kilgore in Journal of Forestry	A commonly recommended riparian management zone is 50 feet wide with 50 to 75 percent crown closure (or 50–75 square feet per acre of residual basal area); however, the specific guidelines in each state vary tremendously. Although science cannot specify the management prescriptions needed to protect all riparian functions across all sites, understanding site-specific conditions is critical to effective guideline implementation. Our analysis of state RMZ guidelines found the fixed-width approach is most commonly applied to define RMZ width. A 50–foot minimum RMZ width from either the edge of the water body or the ordinary high-water mark is frequently recommended for perennial streams, intermittent streams, and lakes. Some states also note that, despite their fixed width values, the	Table 2 on Page 13

No.	Source	Details of recommended RMA (in feet)	Remarks
		recommended for perennial streams, intermittent streams, and lakes. Some states also note that, despite their fixed width values, the actual RMZ width should be determined during an onsite evaluation that considers factors such as size and type of water body, topography, soils, vegetative cover, and special site conditions. Landowner objectives are infrequently cited as being a modifier of RMZ width recommendations.	
9	Streamside Forest Buffer Width needed to protect stream water quality, habitat and organisms: A literature review (2014) Journal of American Water Resources Association	Overall, buffers ≥30 m (100 ft) wide are needed to protect t physical, chemical, and biological integrity of small streams. Literature on eight major stream or streamside ecosystem factors (properties, components, or functions), that streamside forest buffers ≥30 m wide are needed to protect water quality, habitat, and biotic features of streams associated with watersheds ≤100 km^2, or about fifth order or smaller in size. Papers have confirmed the widespread importance of streamside areas to the maintenance and restoration of diverse fish communities (Meador and Goldstein, 2003) and have shown that manipulating forest cover in the first 30 m of the streamside area can have a greater impact on fish assemblage integrity than changes to instream habitat (Brazner et al., 2005). Jones et al. (2006) established and quantified the relationships in rural watersheds (in Georgia) among streamside forests, aquatic habitat (stream temperature, fine sediment load), and trout reproductive success (biomass of young) to assess the impact of reducing forest buffers from 30 to 15m. They found that reducing streamside forest to 15m resulted in higher peak temperatures (~2°C higher) and more fine sediments (~25% higher). Their linear regression models and Monte Carlo uncertainty analyses predicted an 87% reduction in young trout biomass. They concluded that a 30m buffer would enable ~63% of Georgia's second- to fifth-order trout streams to support trout, whereas reducing the buffer to 15m would likely decrease the number of trout supporting streams to ~9%. Jones et al. (1999) also demonstrated the importance of streamside forest to fish communities with an unusual approach of documenting the impact of removing patches of streamside forest of different lengths and widths in otherwise completely forested watersheds. They showed that deforesting >30 m of the streamside zone for only ~1 km of length caused significant reduction in density, abundance, and structure of fish communities, with the impact intensifying with longer patch lengths of deforestation. Since the areas adjacent to the deforested streamside patches remained as intact forest, this study demonstrates the importance of streamside forest to the quality of instream habitat for fish.	Report

No.	Source	Details of recommended RMA (in feet)	Remarks
10	Sensitivity of Riparian Buffer Designs to Climate Change—Nutrient and Sediment Loading to Streams: A Case Study in the Albemarle-Pamlico River Basins (USA) Using HAWQS (2021) Journal : Sustainability	A study by Hairston-Strang recommended a minimum width of 11 m (35 ft) and suggested 100 m (300 ft) and wider buffers for wildlife and biodiversity. Fischer and Fischenich provided RBZ width recommendations based on functions of water quality protection (5 to 30 m), riparian habitat (30 to 500 m), stream stabilization (10 to 20 m), flood attenuation (20 to 150 m), and detrital input (3 to 10 m). Yet another study by Dosskey, et al. recommended minimum RBZ width from 7.6 m to 9.1 m (25–30 ft) to filter sediment, up to 30.5 m (100 ft) to provide shade, shelter and food for aquatic organisms, and variable widths for wildlife habitat dependent upon desired species.	Article 1; Article 2
11	How did fixed-width buffers become standard practice for protecting freshwaters and their riparian areas from forest harvest practices? (2012) Freshwater Science, Vol 31, No 1	Some studies provided evidence that widths had to be 30 m on each side of a stream to protect most of the aquatic community (Erman et al. 1977, Newbold et al. 1980), and this distance seems to have been used widely as a basis for buffer widths. Protection of riparian-associated terrestrial organisms has become an explicit conservation objective associated with protection of streams. The FEMAT approach used buffer widths equivalent to up to 2 tree heights for the sake of protecting riparian obligate and riparian associated species because forest harvesting of the upslope affects microclimate of the remnant riparian area (e.g., Darveau et al. 1995, Brosofske et al. 1997). The results of most assessments of effectiveness of riparian buffers suggest that typically mandated widths are insufficient to prevent some alterations of stream and riparian function, but effectiveness depends on the objectives, which are often vaguely stated (Castelle et al. 1994, Naiman et al. 2000, Richardson and Thompson 2009). Some buffer widths are insufficient for conservation of riparian organisms (Darveau et al. 1995, Marczak et al. 2010), and if the objective is to maintain populations of some riparian dependent amphibians and reptiles, forested buffers 100 m may be necessary (Semlitsch et al. 2009).	Article

Potential Financial Mechanisms

General Funding Sources

Table 1C: Funding sources that do not target specific ecosystem services, but could fund establishment or maintenance of community forests broadly.

No.	Name of the Fund	Funding Agency	Description	Funding Amount	Fund for Acquisition and/or Maintenance
1	USFS Forest Legacy Program	USFS Oregon State Coordinator Amy Singh: amy.s.singh@oregon.gov	The purpose of the Forest Legacy Program is to identify and conserve environmentally important forest areas that are threatened by conversion to non-forest uses. Administered by the U.S. Forest Service in partnership with State agencies to encourage the protection of privately owned forestlands through conservation easements or land purchases.	Up to several million	Acquisition
2	Community Forest and Open Space Conservation Program (Community Forest Program)	US Forest Service	Offers a unique opportunity for communities to acquire and conserve forests that provide public access and recreational opportunities, protect vital water supplies and wildlife habitat, serve as demonstration sites for private forest landowners, and provide economic benefits from timber and non-timber products. Community forests can be owned by local governments, tribal governments, and qualified nonprofit entities.	Full fee title acquisition is required. Conservation easements are not eligible. The program pays up to 50% of project costs and requires a 50% non-federal match	Acquisition
3	Conservation Fund	The Conservation Fund Contact: webmaster@conservationfund.org	Provides green bonds for preservation of ecosystem services and carbon capture in forests.	Up to several million	Acquisition/Maintenance
4	State Grant Program/PAC Grant	Rocky Mountain Elk Foundation Contact	State Grant Program provides financial incentives for eligible hunting and conservation areas or conservation programs. The PAC grant provides funding for eligible habitat enhancement, wildlife management, and research projects. Programs can include scientific research or youth outreach.	Up to several thousand	Acquisition/Maintenance
5	Acres for America	National Fish and Wildlife Foundation and Wal-Mart	Purpose is to permanently conserve critical habitats for birds, fish, plants and wildlife; provide for habitat connectivity; provide access for people to enjoy the outdoors and ensure good future of local	Up to several thousand	Acquisition/Maintenance

No.	Name of the Fund	Funding Agency	Description	Funding Amount	Fund for Acquisition and/or Maintenance
			economies that depend on forestry, ranching and recreation.		
6	Conservation Alliance Funds	The Conservation Alliance	Makes grants to protect wild and natural areas, including campaigns for land acquisition, with a focus on recreational lands.	Up to several thousand	Acquisition/Maintenance
7	The Infrastructure Investment and Jobs Act (IIJA)	Oregon Department of Fish and Wildlife Contacts: Wallowa River Fish Passage and Flow Restoration Jeff Yanke (Jeff.yanke@odfw.oregon.gov) Wildlife Habitat Restoration/ Good Neighbor Authority Sara Reif (Sarah.J.reif@odfw.oregon.gov) Connectivity and Wildlife Passage: Rachel Wheat (Rachel.E.WHEAT@odfw.oregon.gov)	The Infrastructure Investment and Jobs Act has over 11 billion dollars to invest in creating healthy natural areas that support our wildlife, recreation, and economy. This is a once in a lifetime opportunity for conservation and communities in Oregon.	Up to several thousands or millions	Acquisition/Maintenance
8	Oregon Wildlife Foundation Small Grants	Oregon Wildlife Foundation	Small grant awards to projects that fall within the following areas: fish and/or wildlife habitat restoration public access preservation, restoration, or improvement, natural resource or outdoor education, invasive species removal or control studies that support improved fish/wildlife management, land acquisition.	Up to $5,000. Cost reimbursement grants only. Foundation funds must be matched dollar-for-dollar, in cash or in-kind from other sources. It is appealing to the Foundation if the applicant's organization is also contributing cash, even a	Maintenance

No.	Name of the Fund	Funding Agency	Description	Funding Amount	Fund for Acquisition and/or Maintenance
				small amount, to the project.	
9	Inflation Reduction Act Investments in FPAC Programs	NRCS	IRA assistance is now available through NRCS's conservation programs through their Environmental Quality Incentives Program, Conservation Stewardship Program Approximately $19.5 billion of Inflation Reduction Act funds will support USDA's conservation programs within the NRCS beginning in fiscal year 2023 and continuing over the following four years. This includes: • $8.45 billion for the Environmental Quality Incentives Program • $4.95 billion for the Regional Conservation Partnership Program • $3.25 billion for the Conservation Stewardship Program • $1.4 billion for the Agricultural Conservation Easement Program • $1 billion for the Conservation Technical Assistance Program	Up to several thousand	Maintenance
10	Sustainable Forests and Communities Initiative	Weyerhaeuser Family Foundation	The goal of the Sustainable Forests and Communities Initiative is to promote the creation of environmentally and economically sustainable forest communities in the regions of the United States where the Weyerhaeuser Family's business interests originated. The Initiative supported projects within specific communities that promoted, in an integrated fashion, forest ecology, the creation of jobs or businesses based on sustainable forestry, and public consensus-building on how best to go forward in these areas.	Up to $25,000	Maintenance

No.	Name of the Fund	Funding Agency	Description	Funding Amount	Fund for Acquisition and/or Maintenance
11	The Voluntary Public Access and Habitat Incentive Program (VPA-HIP)	USDA- Natural Resources Conservation Service	VPA-HIP is a competitive grant program that helps enhance public access to private lands for hunting, fishing, and other wildlife-dependent recreation opportunities such as hiking and bird-watching. State access programs incentivize landowners to open their land to the public for outdoor recreation by providing lease payments, liability coverage, or technical assistance.	$3 million for a single award	Maintenance
12	The Oregon Conservation & Recreation Fund	Oregon Department of Fish and Wildlife	The Oregon Conservation and Recreation Fund (Fund) is a new way for Oregonians to support projects that protect and enhance the species and habitats identified in the Oregon Conservation Strategy and create new opportunities for wildlife watching, urban conservation, community science, and other wildlife-associated recreation. The OCRF will prioritize projects that implement the Oregon Conservation Strategy, a blueprint for conserving Oregon's fish and wildlife and their habitats before they become more difficult to protect. The OCRF will also invest in outdoor recreation opportunities that connect Oregonians to the natural world and increase equity for underserved communities.	Up to $50,000 A newly required cap on institutional/ organizational indirect overhead rates at 20% of the requested project budget	Maintenance
13	Oregon Wildlife Foundation	Oregon Wildlife Foundation Grants	Small grant awards to projects that fall within the following areas: fish and/or wildlife habitat restoration, public access preservation, restoration, or improvement, natural resource or outdoor education, invasive species removal or control; studies that support improved fish/wildlife management, land acquisition.	A typical funding award is $5,000 or less but can be more	Maintenance

Table 2C: Carbon markets are a valuable continuous funding tool. Funding amounts vary based on the carbon marketplace, the current value for carbon, and the amount of carbon being sequestered by the forest.

No.	Name of the Fund	Funding Agency	Description
1	Reforest America Carbon Program	American Forests Ben Rushakoff – brushakoff@americanforests.org	Opportunity for public, private and tribal land managers to access carbon finance in order to plant and maintain climate-adapted, carbon-rich forests that remove carbon from the atmosphere. It allows companies to directly support reforestation projects.
2	American Carbon Registry	Winrock International Contact here	The contracting of offsets for purchase or retirement takes place directly between buyer and seller through over-the-counter transactions outside of the Registry system or on an approved, linked offset exchange.
3	New Forests	New Forests Submit an inquiry here	Forestry investments in the United States can be optimized for sustainable timber production, carbon markets, and nature conservation. New Forests' strategy creates value in U.S. forestry investments through optimized management of forests for timber and carbon credits sold in the California-regulated carbon market, with the aim of driving higher investment returns.
4	NCX	NCX Contact	NCX connects corporations to the landowners, habitats, and communities they impact through our carbon marketplace. *No acre minimums, one-year contracts, and no enrollment fee. No costs to the landowner.
5	Forest Carbon Program	U.S. Endowment for Forestry and Communities Brandon Walters at 864-233-7646 or brandon@usendowment.org	The goal of the Endowment Forest Carbon Program is to invest in catalytic climate resiliency solutions that benefit forests, markets, and communities. The Endowment's investments within this portfolio will prepare the sector to address the effects and implications of the changing climate by delivering the following impacts: • The health and resiliency of North American forests are enhanced to expand and safeguard the ability to store carbon. • Forest markets and products are advanced as carbon solutions. • Rural communities and landowners are valued as key participants in, and beneficiaries of, markets for carbon.

Funding for Recreational Activities & Communal Benefits

Table 3C: List of funds available for establishment and maintenance of recreational activities that are accessible to the general public.

No.	Name of the Fund	Funding Agency	Description	Funding Amount
1	Access and Habitat Program	Oregon Department of Fish and Wildlife	Incentive-based program to improve public hunting access and wildlife habitat. The program supports hunting leases, seasonal road management and hunter access through private lands to inaccessible public lands.	Advance payment up to 90% of approved funding. 10% after project completion.
2	The Conservation and Outdoor Recreation Division - Challenge Cost Share Program	National Park Service	Provides local communities with cost-effective, partnership based support in achieving America's conservation and outdoor recreation goals. Supports projects that increase public access to new and restored outdoor recreational opportunities.	Maximum of $25,000 per project.
3	T.R.A.I.L.S	Polaris	The program was launched for OHV clubs, associations and grassroot groups. The grant program grants funds for trail development and maintenance projects.	Maximum of $10,000
4	Recreation Economy for Rural Communities	EPA	Helps rural communities grow outdoor recreation economy and help city infrastructure to meet recreational needs	Up to $200k for trail development and other recreation programs Eg: $5 million was awarded to the Saint-Raymond region of Quebec for a trail system that is maintained by at-risk youth.
5	Recreation Trails Program	Oregon State Parks	RTP funds help develop, improve, and expand motorized and non motorized trails and their facilities	The minimum grant request amount is $10,000. There is a recommended grant request maximum of $150,000 for non-motorized proposals and no maximum for motorized proposals. Applicants must commit to at least 20% match.
6	2023 Camp Maintenance Grant Program	Gray Family Foundation	Forests have to be: currently hosting outdoor school programs or actively working towards becoming a host site for outdoor school programming; AND licensed in the state of Oregon as an organizational camp.	All requests should be between $5,000–$30,000 per organization/year, up to 3 years. For a collaboration of up to 4 organizations, the maximum request is $100,000/year, up to 3 years.

Funding for Salmon Restoration through Riparian Area Management

Table 4C: The list below indicates organizations that might support creating conditions such as riparian areas that are necessary for salmon restoration.

No.	Name of the Fund	Funding Agency	Description	Funding Amount
1	Oregon Watershed Enhancement Program	Oregon Watershed Enhancement Board	Landowners are eligible for funds to enhance and manage riparian and associated upland areas to improve water quality. Funds may also be used to benefit fish and wildlife. Program funds help implement the Oregon Plan for Salmon and Watersheds. Landowners or other partners must supply a minimum of 25% cost share. Landowners must agree to secure all the necessary permits, continue maintenance of the land, and write monitoring reports.	Per case basis
2	Recovering America's Wildlife Act	Federal Funds to State Wildlife Management Agencies and NGOs like Trout Unlimited	If enacted into law, the act will dedicate $1.39 billion annually to state wildlife management agencies and tribal nations for on the ground efforts to help at-risk wildlife and restore fish and game habitat. It is meant to recover and sustain coldwater species such as bull trout, chinook salmon and wild steelhead.	$1.39 billion annually (combined fund value)
3	Riparian Buffers Program	USDA	Helps landowners achieve conservation goals such as soil conservation, water quality protection and wildlife habitat enhancement.	Payments are covered up to 90% - 50% from a cost-share program and 40% from a Practice Incentive Payment (PIP)
4	Conservation Reserve Enhancement Program	Oregon Watershed Enhancement Board	State-Federal partnership that allows landowners to receive incentive payments from USDA Farm Service Agency for establishing long-term riparian buffers on eligible land. The purpose of the program is to restore, maintain and enhance streamside areas along agricultural lands to benefit fish, wildlife and water quality.	USDA FSA provides 50% cost-share on eligible restoration practices; OWEB, the lead state agency provides 25% cost share on eligible projects
5	Access and Habitat Program	Oregon Department of Fish and Wildlife	Incentive-based program to improve public hunting access and wildlife habitat. The program supports riparian fencing, wetland habitat.	Advance payment up to 90% of approved funding. 10% after project completion.
6	Conservation & Recovery Plans	Oregon Department of Fish and Wildlife	Several recovery or conservation planning efforts under Oregon's Native Fish Conservation Policy (OAR 635-007-0502) • Lower Columbia Conservation & Recovery Plan • Mid Columbia Conservation & Recovery Plan	Per case basis

No.	Name of the Fund	Funding Agency	Description	Funding Amount
7	Partners for Fish & Wildlife	US Fish & Wildlife Service	Private landowners who wish to restore, enhance and manage riparian, wetland, instream and upland habitats can receive technical and financial assistance from the U.S. Fish and Wildlife Services Partners for Fish and Wildlife Program. The program emphasizes the reestablishment of native vegetation and ecological communities for the benefit of fish and wildlife, in concert with the needs and desires of private landowners.	Project contributions are typically limited to 50% of project costs, up to $25,000 and landowner maintains the restoration projects for at least 10 years
8	Healthy Forest Reserve Program	USDA Natural Resources Conservation Service (NRCS) Contact: Abe.Clark@or.usda.gov or call 541-263-3044	Program that helps forest landowners restore, enhance and protect forestland resources on private and tribal lands through easements and financial assistance –- easements are either permanent, 30 year or 10 year easements.	Per case basis
9	Restoration Grants	Oregon Watershed Enhancement Board	These are grants provided for watershed areas to protect or restore watershed functions including riparian habitat – enhancing riparian vegetation communities, treating invasive weed species, reconnecting floodplain, moving roads out of riparian areas etc.	Per case basis
10	Bring Back the Native Fish	NFWF	The program invests in conservation activities that restore, protect and enhance native populations of sensitive or listed fish species across the United States, especially in areas on or adjacent to federal agency lands. The program emphasizes coordination between private landowners and federal agencies, tribes, corporations and states to improve the ecosystem functions and health of watersheds.	Up to several thousand
11	Conservation Funding	Trout Unlimited	Trout Unlimited volunteers and staff around the country are actively engaged in restoration projects and partnerships that rely on federal resource agency programs and staff to help spur investments—from repairing culverts on streams damaged from floods, to working with our agricultural partners to improve on farm water efficiency to increase instream flows—Trout Unlimited leverages federal program dollars with matching funds and volunteer investments to achieve incredible results.	Matching fund

No.	Name of the Fund	Funding Agency	Description	Funding Amount
12	Private Forest Accord Mitigation Fund Grant Program	Oregon Department of Fish and Wildlife Contact the ODFW Private Forest Accord Grant team at pfa.grants@odfw.oregon.gov	The Private Forest Accord Mitigation Fund was established in the 2022 Legislative Session (Senate Bills 1501 and 1502; House Bill 4055) as an outcome of the landmark agreement between timber and conservation groups to recommend changes to the Forest Practices Act. The Private Forest Accord allows for forest practices to proceed with increased protections for natural resources, including the development of a habitat conservation plan (HCP) for aquatic species. The Private Forest Accord Mitigation Fund's purpose is to fund projects that help aquatic species and habitats covered by the HCP, and is to be administered by the Oregon Department of Fish and Wildlife. Learn more about this important effort at the Oregon Department of Forestry's webpage.	Per case basis
13	Water Program	Oregon Department of Fish and Wildlife	Instream water rights, an important tool for improving watershed health and resilience in a changing climate.	Water rights trading
14	Fish Screening Cost Share Program	Oregon Department of Fish and Wildlife	When a fish screen or bypass is required, the diversion owner must contact ODFW prior to design of the project. An application is required if the diversion owner applies for state cost sharing funds and/or state tax credits, which are available for many fish screening and bypass projects. ODFW, the diversion owner, or private contractors may design, construct, and install the fish screen or bypass device.	The cost share is up to 60 percent of the total project cost up to $75,000 per project. The tax credit is 50% of the total project cost not to exceed $5,000. The cost share and tax credit may be used for each project depending on eligibility.
15	Bonneville Power Administration Fish & Wildlife Investments	Bonneville Power Administration (BPA)	Funded through the electric rates of utilities that purchase power from BPA, BPA's fish and wildlife investments are reviewed by the Northwest Power and Conservation Council's Independent Scientific Review Panel to ensure that projects address the factors that affect fish health, and that results are scientifically valid. Evaluation results are used to continually improve the program.	

Other Potential Sources

Table 5C: List of potential organizations that might indirectly help towards financing the various ecosystem services:

No.	Agency/Program/Organization	Description
1	US Forest Capital	Founded in 2000, US Forest Capital works with people seeking impact investment and conservation finance opportunities in various natural resource sectors. We help our clients assess and access the burgeoning ecosystems services marketplace and purchase and sell natural resources with important environmental, social and governance values.
2	U.S. Endowment for Forestry and Communities	The Endowment is committed to keeping working forests as forests and advancing family-wage jobs in forest-rich rural communities. Through strategic and deliberate investment, we support research and development in traditional forest product markets, ensuring that forests and forest-based economies grow and thrive.
3	The Climate Protection Program by Oregon DEQ	Check for collaborative opportunities.

Below is a list of funding information directories that could be helpful in seeking information about additional funding agencies and their programs:

- BoardSource
- Build Back Better for Rural Communities
- Charles Stewart Mott Foundation
- Environmental Grantmakers Association
- Grants.gov
- Terra Viva Grants
- The Grantsmanship Center

List of a few publications on buying land for conservation:

Conservation Capital: Sources of Public Funding for Land Conservation
Ann Ingerson. The Wilderness Society, 2004.
A comprehensive guide describing the primary federal programs that fund land and resource conservation in the United States, summarizing both little-known federal funding sources and available state and local programs, with a focus on the Eastern U.S.

A Field Guide to Conservation Finance
Story Clark. Island Press, 2007.
A comprehensive book on land conservation financing aimed at local and regional organizations; covers both traditional and cutting-edge financial strategies, outlining tools for raising money, borrowing money, and reducing the cost of transactions; covers transfer fees, voluntary surcharges, seller financing, revolving funds, and Program Related Investments (PRIs).

Conservation Finance Handbook
Kim Hopper and Ernest Cook. Trust for Public Land, 2004.
A guide to generating public financing for local, state and private conservation projects through local, voter-approved conservation finance measures.

Doing Deals: A Guide to Buying Land for Conservation
The Trust for Public Land. Land Trust Alliance, 1995.
A comprehensive guide to buying land for conservation, covering working with landowners and government agencies, surveys, appraisals, and negotiating.