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Final Ecosystem Goods and Services Scoping Tool: Analysis of Beneficiaries and Environmental Attributes for the Tillamook River Wetlands

by

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Cover photographs of the Tillamook River Wetlands: *Left: Flooding on high tide; middle: Existing wetlands; right: Intact spruce swamp adjacent to the TRW on the eastern boundary. From the Tillamook Estuaries Partnership*

Box 1 FEGS Photo attribution: *Great Heron: Creative Commons CC0 license; Yaquina Bay (Oregon) tidal wetland: Ted DeWitt, U.S. EPA; Birdwatchers: Creative Commons CC0 license.*

Acronyms

EPA	U.S. Environmental Protection Agency
ES	Ecosystem Services
FEGS	Final Ecosystem Goods and Services
FST	FEGS Scoping Tool
MCDA	Multi Criteria Decision Analysis
NCLC	North Coast Land Conservancy
NEP	National Estuary Program
NESCS Plus	National Ecosystem Services Classification System Plus
ORD	Office of Research and Development
OWEB	Oregon Watershed Enhancement Board
TEP	Tillamook Estuaries Partnership
TRW	Tillamook River Wetlands

Executive Summary

Stakeholders often have different priorities regarding the purpose or goals for restoring specific sites (or areas), particularly regarding the nature-derived benefits (i.e., ecosystem services, ES) that the restoration might provide to them or the communities they represent. EPA's Office of Research and Development (ORD) researchers recently developed a tool, the Final Ecosystem Goods and Services (FEGS) Scoping Tool (FST), to guide decision makers toward understanding what ES are of greatest shared interest among stakeholder groups and what are the associated environmental attributes by which stakeholders obtain benefits. This technical report documents the application of FST to inform Tillamook Estuaries Partnership (TEP) restoration managers about the priority ES and environmental attributes of 15 stakeholder groups regarding proposed restoration of tidal wetlands on Tillamook River, Oregon. There are four steps to an analysis using FST: 1) articulating the relative influence of decision criteria for decision makers; 2) assessing relative stakeholder prioritization based on those decision criteria; 3) building beneficiary profiles for each stakeholder group; and 4) finding the shared interests in environmental attributes based on what beneficiaries need or care for. Further, depicting how top priority environmental attributes are distributed among stakeholder groups represents a novel approach for using the FST, and can be used to help decision makers anticipate priorities held in common among stakeholders. Results of the study could be used by TEP restoration managers to guide constructive conversations with stakeholders during the development of a tidal wetland restoration plan.

The FST analysis revealed that the restored Tillamook River wetland site could provide the most benefit if the restoration plan focused on flooding concerns, which would benefit multiple beneficiaries including some of the most influential ones (e.g., transporters of people and goods and residential/municipal/government property owners). Additionally, restoration focused on improving the ecological condition of the site would benefit other high-priority beneficiaries, including people who care about nature, students and educators, and researchers. The third priority environmental attribute was edible fauna (e.g., fish, game animals), which are of interest to recreational anglers and hunters, and people who care about their existence in nature. These results may be useful to TEP restoration managers and restoration teams in several ways, including: focusing discussions with stakeholders on prioritizing ES and environmental attributes to include in the restoration goals; developing a restoration effectiveness monitoring and assessment plan that includes metrics for the prioritized ES and environmental attributes; and/or for building a stakeholder-focused communication strategy to report on progress toward cultivating prioritized ES at the Tillamook River Wetlands site.

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1. Introduction

The Tillamook River Wetlands (TRW) project, a partnership of the Oregon Watershed Enhancement Board (OWEB), Tillamook Estuaries Partnership (TEP), and the North Coast Land Conservancy (NCLC), is engaged in developing a plan to restore tidal wetlands on a 73-acre site at mile three of the Tillamook River (Figure 1). The NCLC acquired the TRW property as an easement for perpetual conservation and management following OWEB's mission statement, and the TRW partners are currently developing alternatives for restoration actions to propose to regulators and stakeholders. Historically, the site was home to Sitka spruce (*Picea sitchensis*) swamp habitat, a decimated wetland habitat type in Tillamook Bay and in the greater Pacific Northwest (Brophy 2019). Tillamook Bay and its five watersheds have a history of impaired water quality due to elevated water temperature and fecal bacteria concentrations, and substantial portions of Tillamook Bay tidal wetland habitat have been lost or are in degraded condition (TBNEP 1999; TBNEP 2019). Restoration of tidal wetlands is a priority of the partners. The National Wetlands Index classifies 86.8% of the total proposed restoration site as palustrine emergent wetland, 2.7% as palustrine forested wetland, and 10.5% as upland/other land cover. The tidal wetlands in Tillamook Bay are used by the federally threatened Oregon Coast Coho Salmon (*Oncorhynchus kisutch*) in addition to seven other salmonid species and 17 other known federally or state recognized species of concern (OWEB 2017).

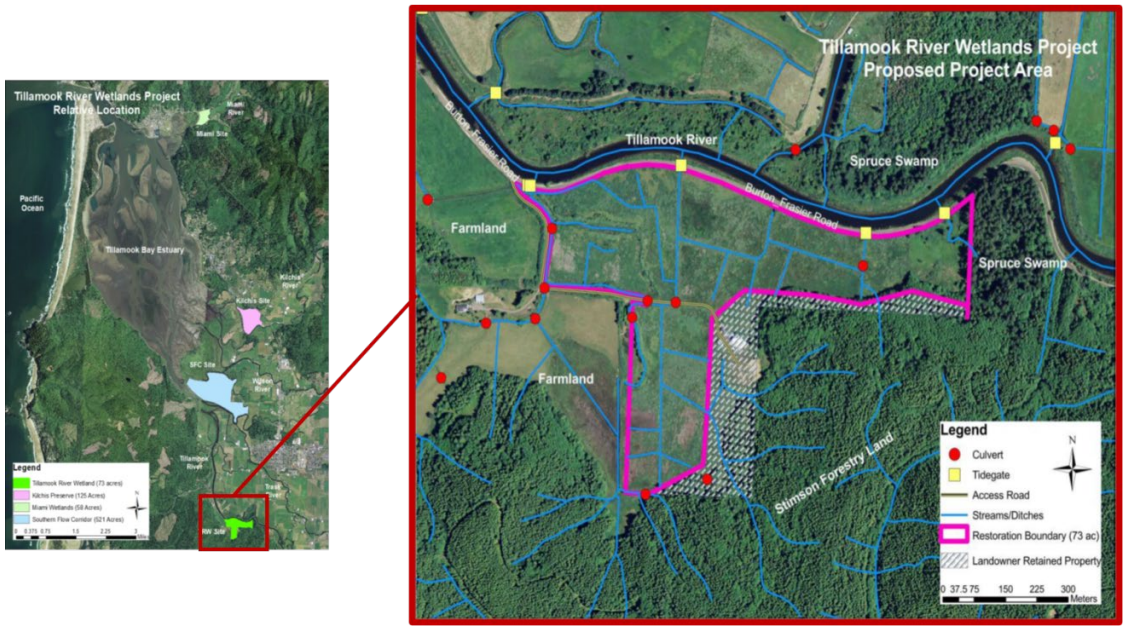


Figure 1. Proposed Tillamook River Wetlands project area and its surrounding location within Tillamook Bay. Burton-Fraser Road runs along the northern edge of the property, along Tillamook River (OWEB 2017).

The restoration design will follow an evaluation study to understand the physical conditions and processes (hydrologic connectivity, surface elevations, water quality, surface and groundwater levels, channel morphology, sediment loading) and the habitats and biological resources (vegetation, fish, avian, invertebrates, mammals) that currently exist at the site (D. Harris, TEP, personal communication). The study will also evaluate several engineering alterations that could be made to existing tide gates, roads, and other infrastructure. Burton-Fraser Road separates the site from Tillamook River and is subject to frequent flooding. This road is used by the public and is the main emergency evacuation route for some residents. Options under consideration include modifying or abandoning the section of Burton-Fraser Road that fronts the site and creating wider passages for tidal water exchange.

The TEP is collaborating with scientists at the U.S. Environmental Protection Agency (EPA) Office of Research and Development (ORD) to identify the ecosystem services that might be gained or lost as a result of the TRW restoration project using the Final Ecosystem Goods and Services (FEGS) Scoping Tool (FST; Sharpe et al. 2020). For TEP, the goals of the FST analysis were: (1) to better understand who within the Tillamook Bay community might be affected by this tidal wetland restoration project, and thus who might provide input to decisions about the design of the project; and (2) to better understand what ecological resources might be used by people interacting with the site. For the EPA scientists, the goals were: (1) to test the utility of the FST; and (2) to identify priority ecosystem services for tidal wetlands for which monitoring metrics might be developed. This application of the FST was conducted through a series of discussions between TEP restoration managers and EPA scientists. Data inputs for each step of the FST were provided by TEP restoration managers based on their restoration expertise, site-specific knowledge, and knowledge of stakeholders and the adjacent communities at the time of discussions. The authors and TEP restoration managers were mindful that the input data about stakeholder interests could not be completely accurate since stakeholders were not consulted. The exercise was conducted in this fashion to demonstrate the utility of FST to provide restoration managers with insight about potential areas of common interest among stakeholders. Since the FST can be used iteratively, TEP managers have an option to obtain more accurate information about stakeholder interests (e.g., from 1:1 discussions or group meetings) to update the data inputs and re-run the FST analysis.

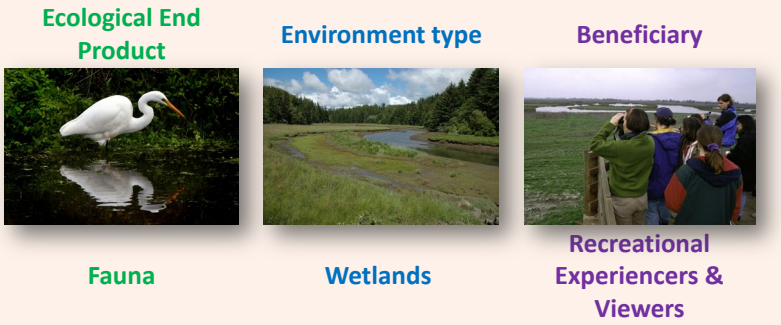
The FST is a publicly available tool designed to help communities incorporate the benefits of local ecosystems into their environmental decisions and planning. The tool is based on identifying the ecosystem products and processes that are directly enjoyed, used, or appreciated by people, which are FEGS (Box 1; Landers and Nahlik 2013; Yee et al. 2017; DeWitt et al. 2020). The FST uses the structured decision-making methodology known as Multi-Criteria Decision Analysis (MCDA), which aims to explicitly evaluate decision criteria to inform decision goals (Sharpe et al. 2020). Key concepts and terms for FST are defined in Box 1.

Box 1. Key concepts used in the FEGS Scoping Tool, from the FEGS Scoping Tool User Manual

Final Ecosystem Goods and Services (FEGS): The aspects of the environment that are directly enjoyed, used, or consumed by humans. They are specified as *final* because of the *direct* benefit they provide to humans. For more discussion about FEGS, see Boyd and Banzhaf (2007), Landers and Nahlik (2013) and DeWitt et al. (2020). Figure inspired by Amanda Nahlik.

FEGS: final ecosystem goods & services

The components of nature within an environment that are directly enjoyed, consumed or used to yield human well-being



Stakeholder groups – Stakeholders are interested and affected parties. Their inclusion is an important part of the environmental decision-making process and can lead to better informed and more accepted decisions. Stakeholder groups are based on the roles the parties within them play in the community. For example, a tourism industry group representing snorkeling and fishing tours could be considered a stakeholder group or the collection of those businesses could be considered a stakeholder group. Alternatively, if some of those businesses have differing interests or perspectives it might be more appropriate to treat them as separate stakeholder groups.

Stakeholder prioritization criteria – Stakeholder prioritization criteria were developed specifically for this tool and encompass all aspects of stakeholder groups that decision makers might consider when prioritizing one group over another. Inclusion of diverse stakeholder perspectives can lead to improved decision-making, but for many projects it is not logistically or financially feasible to include every possible stakeholder. These criteria offer a transparent, repeatable, and sharable approach to prioritizing stakeholder perspectives. The stakeholder prioritization criteria were designed to cast as wide a net as possible to cover all potential criteria that decision makers currently consider when doing informal or subconscious prioritizations of stakeholder interests. It is not expected that all the criteria would be meaningful and relevant for all decision makers or decision contexts. Table 1 contains the full set of criteria used in the tool and their definitions. For more discussion on stakeholder prioritization, see Sharpe et al. (2021).

Beneficiary roles – Beneficiary roles are the ways an individual or group enjoys, uses, or consumes some aspect of the environment. Transitioning from stakeholder groups to beneficiary roles helps decision makers better articulate the ways stakeholder groups are benefiting from the environment. Beneficiary roles are based on how individuals within them interact with the environment. For example, the snorkeling tour industry stakeholder group would be composed of several beneficiary roles covering the different aspects of their interaction with the environment (i.e., boating, swimming, etc.). The FEGS Classification System (Landers and Nahlik 2013) defined a list of all potential beneficiary roles. The National Ecosystem Services Classification System Plus (Newcomer-Johnson et al. 2020) updated that list of beneficiary roles. This updated list, including definitions, is used in the Beneficiary step of the tool. The complete list of beneficiary categories and their definitions can also be found in Appendix A.

Environmental attributes – Environmental attributes are the specific aspects of the environment that are enjoyed, used, or consumed by beneficiaries. An initial list of these attributes was developed as part of the FEGS Classification System (Landers and Nahlik 2013). That list was refined and updated in the National Ecosystem Services Classification System Plus (Newcomer-Johnson et al. 2020) and the FEGS Metrics Report (USEPA 2020). The updated list, including definitions, is used in the Attribute step of the tool. The complete list of attributes and their definitions can also be found in Appendix A.

The purpose of the tool is to use an MCDA approach to identify the environmental attributes most relevant to stakeholders so that valued FEGS can be articulated along with environmental attributes and with other socioeconomic factors in the restoration design and in management decisions (Sharpe et al. 2020). The tool and user manual guide the process of inputting the user's information all the way through interpreting tool output for decision making. However, it does not guide the process for how to define which stakeholder groups to include. The user manual also describes the rationale and methods for each step of the tool and provides examples of the user interface and output.

In this EPA-TEP collaboration, restoration managers from TEP provided the decision criteria weights, stakeholder identities and scores, and beneficiary profiles for each stakeholder; together the TEP restoration managers and EPA scientists identified the environmental attributes used by each beneficiary, and then EPA scientists put that information into the FST. The results produced by the FST analysis are presented and discussed in sections below.

2. Decision Criteria

The first tier of the FST asks the tool users (TEP) to review and weight the stakeholder prioritization critieria found in Table 1. The decision makers (TEP) ask themselves which of these decision criteria are most meaningful to them when distinguishing among the stakeholder groups that they are prioritizing. Weighting the criteria is how decision-makers express their priorities (Sharpe et al. 2020; Sharpe et al. 2021). The most important criterion is assigned a weight of 100, and all other criteria are weighted relative to that criterion on a 0-100 scale. Criteria that are not considered relevant by decision makers are given a weight of 0 (Sharpe et al. 2020; Sharpe et al. 2021). For the TRW project, six criteria had scores greater than 50 (out of 100) (Table 2).

Table 1. Stakeholder prioritization criteria used in the FST (Sharpe et al. 2020; Sharpe et al. 2021).

Stakeholder prioritization criteria	Definition
Level of interest	The amount of interest a stakeholder group has in the decision-making process or the decision outcome
Level of influence	The amount of influence a stakeholder group has over the decision-making process
Magnitude and Probability of impact	The degree and likelihood of potential impact to the stakeholder group as a result of the decision
Urgency/temporal immediacy	The degree to which a stakeholder group would like to see a decision made or an action taken
Proximity	How frequently a stakeholder group comes into contact with the environment for which a decision is being made
Economic interest	Whether a stakeholder group's livelihoods or assets could be impacted by the decision outcome
Rights	Whether a stakeholder group has legal, property, consumer, or user rights associated with the decision-making process, the decision outcome, or the environment for which the decision is being made
Fairness	Whether the exclusion of a stakeholder group from the decision-making process would lead to the process being viewed as unfair by the community
Underrepresented/Underserved Populations	Whether a stakeholder group includes any underrepresented or underserved populations

Table 2. Weights assigned to each criterion and considerations used by TEP restoration managers to assign those weights. Weights range 0-100; criteria with a weight of 100 are the most important for the decision, and other criteria are subsequently weighted relative to those.

Criterion	Weight
Level of Influence Managers felt that having the authority to approve restoration interventions or disapprove the design of the project was very meaningful for distinguishing among stakeholder groups. Some stakeholders may have significant informal influence on those authorities or other stakeholders, thereby affecting decisions about the design and implimentation of the project. TEP managers felt those groups with the ability to block or significantly influence plans should be prioritized. The critical effect that an authority could have on the project itself led to weighting the criterion as one of the most important.	100
Rights Managers wanted to distinguish those groups that had legal or other rights to affect the progress of the project. Some stakeholders have the authority or legal standing to approve or block the restoration design or implementation. TEP managers felt that groups that have the legal, property, and other rights would have authority to block or approve decision-making and should be highly prioritized.	100
Magnitude and Probability of Impact The possibility of abandoning a large stretch of Burton-Fraser Road could potentially impact a number of stakeholder groups. This criterion was weighted highly in order to increase the ranking for those groups that are potentially impacted as one of the decision alternatives would be to abandon a stretch of the Burton-Fraser Road and force alternative road use.	90
Proximity Managers wanted to consider how people who are nearest to the site will be affected by modifications to Burton-Fraser Road. They may also be concerned about how uses of the restored TRW property may affect surrounding property values, businesses, etc. Hence, this criterion was weighted highly and at the same weight as Magnitude and Probability of Impact.	90
Economic Interest No expected significant direct economic impact from the possible removal of a section of Burton-Fraser Road adjacent to the TRW site. The adjacent farm would be most affected by the road change, but the impact would be small. A road closure would cause commuters and tourists to take a slightly longer route, but the county would be relieved of the expense to frequently maintain and repair the road. Modifications to the land use might affect neighboring property values or land uses, although whether the likely net effect of TRW restoration would be to increase or decrease property value has not been determined. Economic interest was seen as a criterion that would be less impactful to decision-making that the higher prioritized criteria.	70
Urgency and Temporal Immediacy The need to make a decision or implement changes within a certain timeframe varies from stakeholder to stakeholder, and managers are willing to consider time constraint needs. There are already existing expectations for when the decision should be made based on the availability of funding. There are additional temporal considerations based on the poor condition of the Burton-Fraser Road; costs to Tillamook County to repair the road may be avoided if an early decision is made to allow the TRW project to remove or modify the road.	65
Level of Interest Interest from the public is sought but will have less influence on the restoration design and plan approval decisions than other criteria. TEP managers want to consider the expressed interests from all stakeholders, but other factors such as influence, rights, impact, and proximity were given greater weight as decision criteria.	50

Table 2 (continued). Weights assigned to each criterion and considerations used by TEP restoration managers to assign those weights. Weights range 0-100; criteria with a weight of 100 are the most important for the decision, and other criteria are subsequently weighted relative to those.

Criterion	Weight
Fairness Decision makers are likely to consider economic and property rights issues more heavily than fairness. TEP managers want to make sure that stakeholders do not feel left out of the process but consider that other criteria were persuasive to the decision.	50
Underrepresented & Underserved Representation Managers do not know of underrepresented and underserved communities that would be affected by the TRW restoration, including possible road removal. Using EPA's environmental justice screening and mapping tool, EJSCREEN), EPA researchers assessed that no significant under-represented/under-served communities occur in proximity to the TRW site. A 2.0-mile ring centered at the TRW site has an approximate population of 4,415 people, includes large parts of the town of Tillamook, and has a higher rate of low-income population compared to state and national averages (55% in the area vs. 33% for both national and Oregon rates). All other EJSCREEN indicators for environment, demographics, and environmental justice within this radius were comparable to or below state and national averages. Thus, consideration of the concerns of Underrepresented/Underserved Populations was given a low weight. If this assessment is incorrect, this criterion could be given greater weight and the analysis repeated; that is a great advantage of using the FST.	10

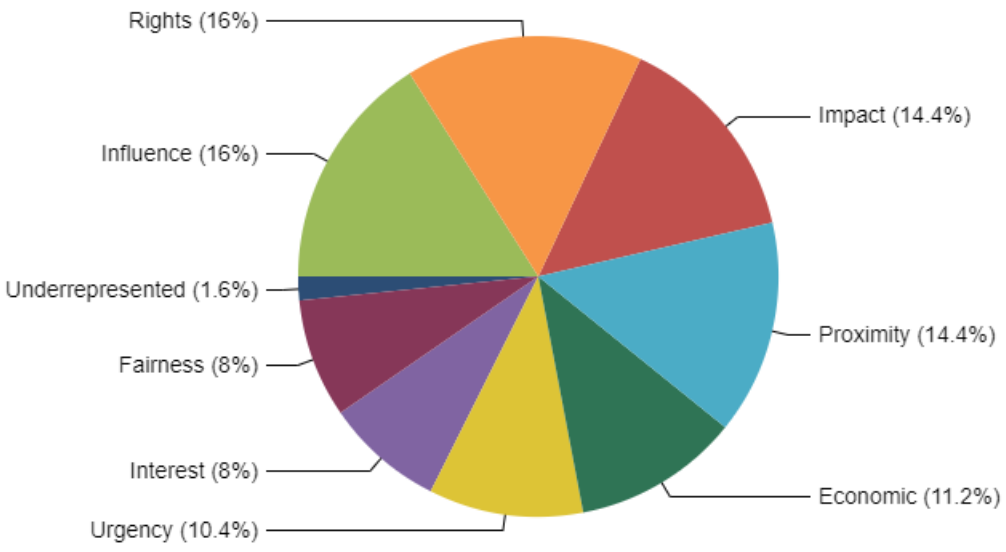


Figure 2. Relative weight of each stakeholder prioritization criterion. Names of the criteria were shortened from those used by FST and are defined in Table 1.

Based on the weights that users assign each of the nine criterion (Table 1), Figure 2 shows the relative influence of each criterion on the prioritization. Level of *Influence* and *Rights* were both weighted 100, so they are each are driving 16% of the overall decision compared to the other criteria that were weighted less. Magnitude and Probability of *Impact* and *Proximity*, assigned a weight of 90 each, drive 14.4% for the total decision.

3. Stakeholders

The TEP restoration managers determined that there were 15 stakeholder groups who would be interested in and/or affacted by the proposed restoration of the TRW site (Table 3). They identified stakeholder groups ranging from adjacent residents to government, industrial, and conservation entities (Table 3; see Appendix B for a full evaluation of each stakeholder group). Once the stakeholder groups were identified, each was evaluated as to how well they met each decision criterion. The FST includes a suggested scoring rubric for each criterion to assist in this task (Sharpe et al. 2020). For example, those groups with formal influence over the decision-making process were given a score of 100 for the Level-of-Influence criterion, those with informal influence were given a score of 50, and those with no influence were given a score of zero. However, the scores for each may differ from the rubric, based on logic specific to the setting of the case study and reflecting how a stakeholder's characteristics apply to the criterion. For example, discussions between TEP restoration managers and EPA scientists led to a score being assigned to stakeholders who advocate for and work directly with underrepresented communities, even though they themselves are not characteristically underrepresented.

Table 3. Stakeholder groups and a brief description of who they represent.

Stakeholder	Description of the Group
NCLC Site Landowners	Non-profit conservation organization. Primary landowners of the site. They require wetland restoration as part of the property acquisition.
TEP & Partners	The Tillamook Estuaries Partnership and other organizations involved in facilitating the decision making, restoration implementation, and management/monitoring. (TEP helps steer the project)
Funders	Organizations that fund site acquisition and restoration interventions. Includes OWEB and private donors.
Rural Resident Neighbors	Residents who live on adjacent properties and have direct access to Burton Fraser Road. Excludes the Tillamook Shooters Association.
Tillamook Shooters Association	Landowner that sold the property; owners of adjacent property with interest to create a hunting/gun club and who share wetland habitat with the site.
Industrial Timber Neighbors	Non-residential, for-profit timber companies maintaining harvested growth forests in adjacent property lands. Potential decision outcomes may require additional small land acquisitions from them.
Industrial Dairy Neighbors	Adjacent dairy operators who may be directly impacted from decision outcome.
Commercial Community	Other commerce – fishing industry, aquaculture operators that stand to be impacted from downstream effects due to decision outcome. Rock quarry in the greater neighborhood uses Burton-Fraser Road occasionally; they are not expected to receive other direct ecological benefits from the site.
Dairy Community	Represents the influence and interests of the broader coalition of dairy operators/farmers and the dairy industry in Tillamook Bay.
Utilities	Added to consider roles of cable & electricity providers who may have infrastructure in/near the site, although no services infrastructure was known to exist in the immediate restoration site at the time of discussion.
Commuters	Locals who use the roads in question on a frequent basis to commute to & from adjacent communities.
General Public	Any resident within the county who can comment on or [collectively] influence the decision process including the potentially affected road.
County Agencies	Public Works, planning commissions. Will be very involved in road maintenance and permitting & planning potential road infrastructure changes.

Table 3(continued). Stakeholder groups and a brief description of who they represent.

Stakeholder	Description of the Group
State Agencies	Includes Oregon Department of Fish and Wildlife. Have permitting roles with interests in recreation (angling, hunting, etc.) and conservation. There is interest in seeing research done at this site.
Federal Agencies	Includes National Oceanic and Atmospheric Administration, U.S. Fish and Wildlife Service, and U.S. Army Corps of Engineers. Overall, have permitting and management roles, comment on Clean Water Act regulations, with missions to sustainably manage natural resources for existence, current and future benefit/use.

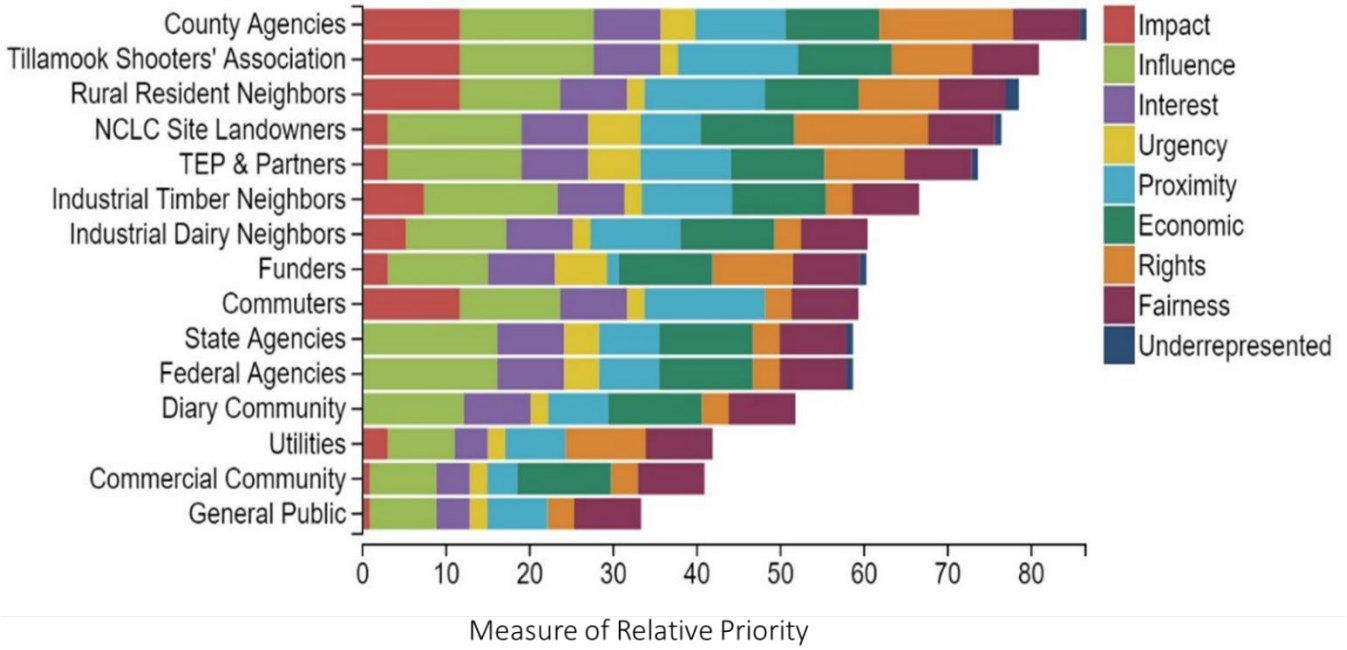


Figure 3. Relative priority of stakeholders based on their scores for each weighted decision criterion.

The weights of the decision criteria in the first step are used to prioritize the stakeholder groups. Each stakeholder group is scored for each criterion (Table 2), and the combination of a criterion's weight with how a stakeholder group scores for that criterion contributes a segment to the stakeholder's bar in the prioritization results (Figure 3; see Sharpe et al. 2020 for calculation methods of the prioritization results). The weight of a criterion and individual stakeholder's score produce a segment of a stakeholder's overall result. For example, the Rural Resident Neighbors stakeholder had a score of 100 for both Proximity and for Underrepresented criteria but because Proximity is weighted much higher than Underrepresented (Table 2), the lengths of those two segments are significantly different (Figure 3, Appendix Table B-1). County Agencies, the NCLC Landowners, TEP & Partners, Rural Resident Neighbors, and the Tillamook Shooters Association ranked highest, whereas the General Public, Utilities, and the Commercial Community ranked lowest (i.e., had the lowest cumulative values across all decision criteria). Even the lowest ranked stakeholder (General Public), had scores for 7 of 9 criteria (i.e., all except the Economic and Underrepresented criteria). Though General Public is the lowest-ranked stakeholder, it still had some score for most of the decision criteria; the order in which the stakeholders are prioritized is often a product of very small differences.

Industrial Dairy Neighbors, Funders, Commuters, State Agencies, and Federal Agencies are all clustered close together in the ranking. The differences come mostly from their scores in the Impact, Proximity, Economic Interest, and Rights criteria. County Agencies and Tillamook Shooters Association may seem like disparate

groups in terms of their interests, yet the two have similar scores across most criteria except Urgency, Proximity, Rights, and Underrepresented or Underserved Groups. The TEP & Partners and the NCLC Landowners do have similar characteristics with regard to the decision at hand for the site, and mainly vary in Proximity and Rights. All groups scored to some degree for Influence, Interest, Urgency, Proximity, and Rights. Additionally, all groups have scores of 100 for Fairness, as it is likely that each would perceive the process as unfair if they were left out of consideration during the decision-making process. Three stakeholder groups, State Agencies, Federal Agencies, and Dairy Community did not score for Impact (lack of red colored bar segments in Figure 3); and Utilities, Commuters, and General Public did not score for Economic Interest (lack of emerald green bar segments in Figure 3).

The initial step of assigning weights to the nine decision criteria is to transparently convey which criteria matter most to those using the tool and/or making the decisions. The second step of scoring each stakeholder on those criteria transparently conveys to what degree the group meets each criterion. The values recorded in the initial step propagate through the FST analysis as the prioritized stakeholder groups affect the prioritization of the environmental benefits and the ecological attributes associated with restoration of the TRW site (i.e., the final output of FST).

4. Beneficiary Profiles

Once the relative prioritization of stakeholder groups has been achieved, FST asks that the beneficiary types be characterized for the interests of people comprising each stakeholder group. A beneficiary type describes the way an individual or group directly engages with (i.e., uses, consumes, enjoys or appreciates) an aspect of the environment in order to obtain a benefit that enhances their well-being (Box 1; Newcomer-Johnson et al. 2020; Sharpe et al. 2020). The FST uses the beneficiary typology defined in EPA's National Ecosystem Services Classification System Plus (NESCS Plus; Newcomer-Johnson et al. 2020), and it guides users to identify the relative representation of each beneficiary type within each stakeholder group. The results of the stakeholder prioritization in the previous step of the FST become the weights used to produce a portfolio profile for each stakeholder group (Figure 4) and an overall prioritization of beneficiaries across all stakeholders (Figure 5). Ultimately, beneficiary types associated with high-ranking stakeholder groups (those with the longest bars in Fig. 3) will have a greater influence on the final decision analysis than beneficiary groups that are primarily associated with low-ranking stakeholder groups. This is how stakeholder ranking propagates through FST to identifying the environmental attributes of greatest shared interest (see the next section).

Keeping in mind the ecological setting of the site, its geographic boundaries, and the interests of stakeholder groups, a beneficiary profile for each group is created to better understand the ways in which a group benefits from changes to the TRW site (Sharpe et al. 2020). The ways in which each beneficiary benefits from the ecological setting and geographic boundary informs what nature-based benefits are potentially produced by the site. Some benefits are used or enjoyed primarily at the site (for example, viewing wildlife or minimizing flood damage) whereas other benefits are realized over an area larger than the site (i.e., vistas of wetland habitat, production of game fish) (Ringold et al. 2013). This variability in location where ecosystem service benefits are enjoyed relative to where they are produced affects the range of types of beneficiaries that will be affected by restoration of the TRW site.

The interests of a stakeholder group inform what specific activities and benefits people within the group are most likely to desire from the site. For example, the Tillamook Shooters Association is interested in youth education and training in safe hunting practices on adjacent property; thus, their beneficiary profile includes

recreational hunters who are interested in production of game animals from the restored site that may migrate onto the Association's property. The General Public group includes students and educators who will potentially visit the restored site to learn about wetland vegetation, habitats, and wildlife. Rural Residential Neighbors may include homeowners or renters who appreciate viewing wetland plant communities. Identifying the beneficiaries associated with each stakeholder group helps decision makers take a more holistic view of how the different groups of people interact with the environment and creates opportunities to identify what uses or benefits are shared among stakeholders (Sharpe et al. 2020).

Figure 4 illustrates the beneficiary profiles for each stakeholder group thought to be concerned about the TRW restoration, as identified by TEP (See Appendix B for a detailed breakdown of each stakeholder group's beneficiary profile). The figure also reveals that there are several subclasses of beneficial uses (beneficiaries) shared among multiple stakeholder groups. For example, Transporters of Goods is a beneficiary type that is shared by the Commercial Community, Dairy Community, Industrial Timber, Dairy Neighbors, and County Agencies stakeholder groups; Students and Educators is a beneficiary type shared by the NCLC Landowners, TEP & Partners, Funders, the Tillamook Shooters Association, and the General Public stakeholder groups.

A total of 21 beneficiaries were identified amongst all stakeholder groups (Figure 5). Table 4 identifies the 12 prioritized beneficiaries, defined as those having a result value greater than 3.0 on the axis scale in Figure 5 (see Appendix C Table C-1 for full results of the identified beneficiaries). Lower-scoring beneficiaries likely would have minor influence in the final prioritization of ecosystem attributes (i.e., the next FST step), but they were included in the analysis, nonetheless. This assessment elucidates that a stakeholder group can be associated with a diverse array of beneficiary types and how a single beneficiary type can be shared by multiple stakeholder groups. While the FST assessment focuses on the highest ranked beneficiaries, it is also evident that there are beneficiary types that are relevant to more stakeholder groups (e.g., Experiencers/Viewers, Hunters, Anglers) but are ranked lower than others with fewer stakeholder groups represented (e.g., Transporters of People & Goods, Students and Educators, Researchers).

Utilities is a stakeholder group that was identified when considering the roles of electric, cable, or similar utility providers that may have lines or other infrastructure near the site or under Burton-Fraser Road. As the beneficiary profiles were considered, the restoration team assessed that there were no beneficiary roles for Utilities in the context of the TRW site. However, if it is determined that they need to re-route infrastructure or care about specific biophysical attributes, the FST can be adjusted to include their beneficiaries.

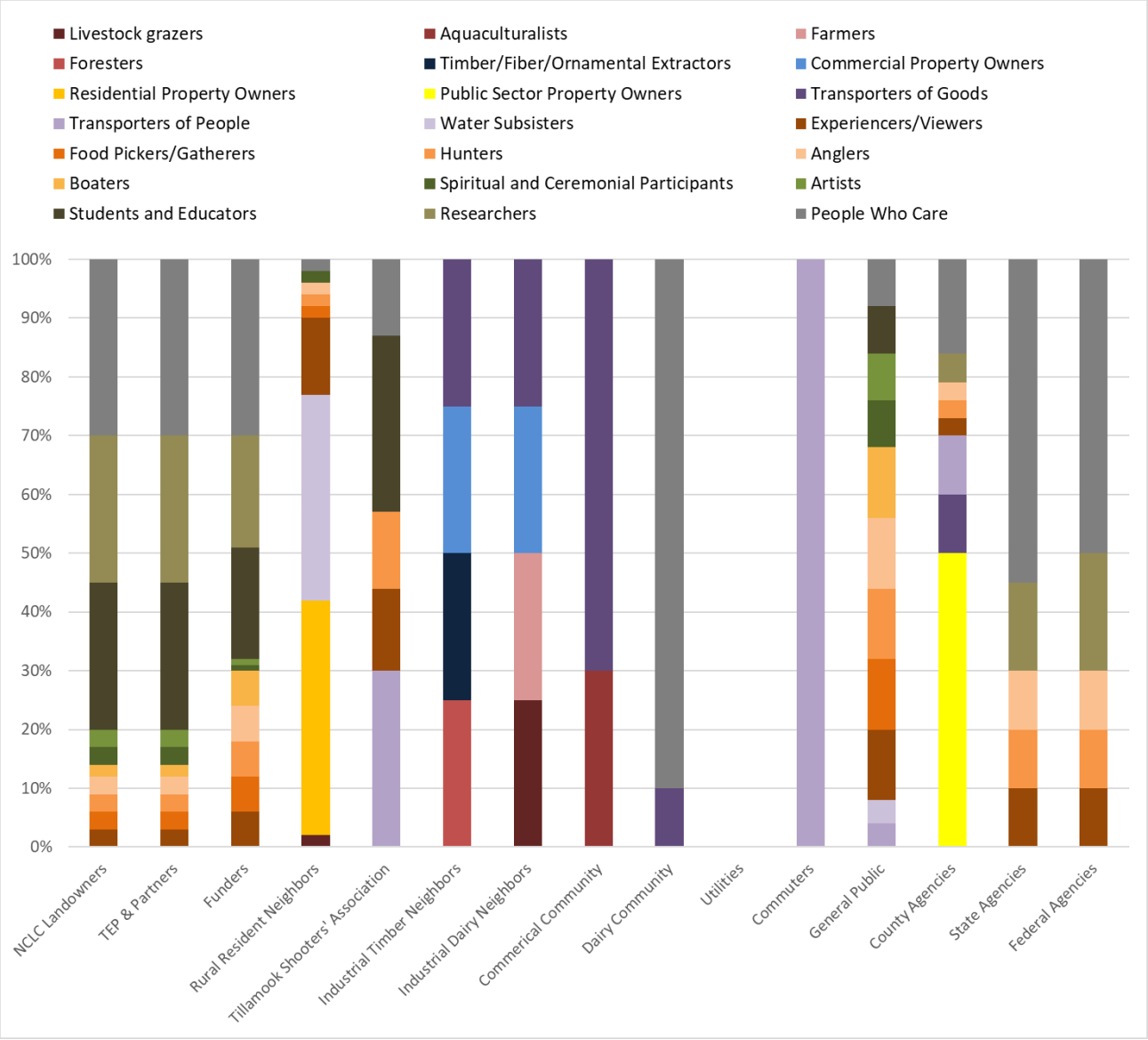


Figure 4. The beneficiary distribution for each stakeholder group.

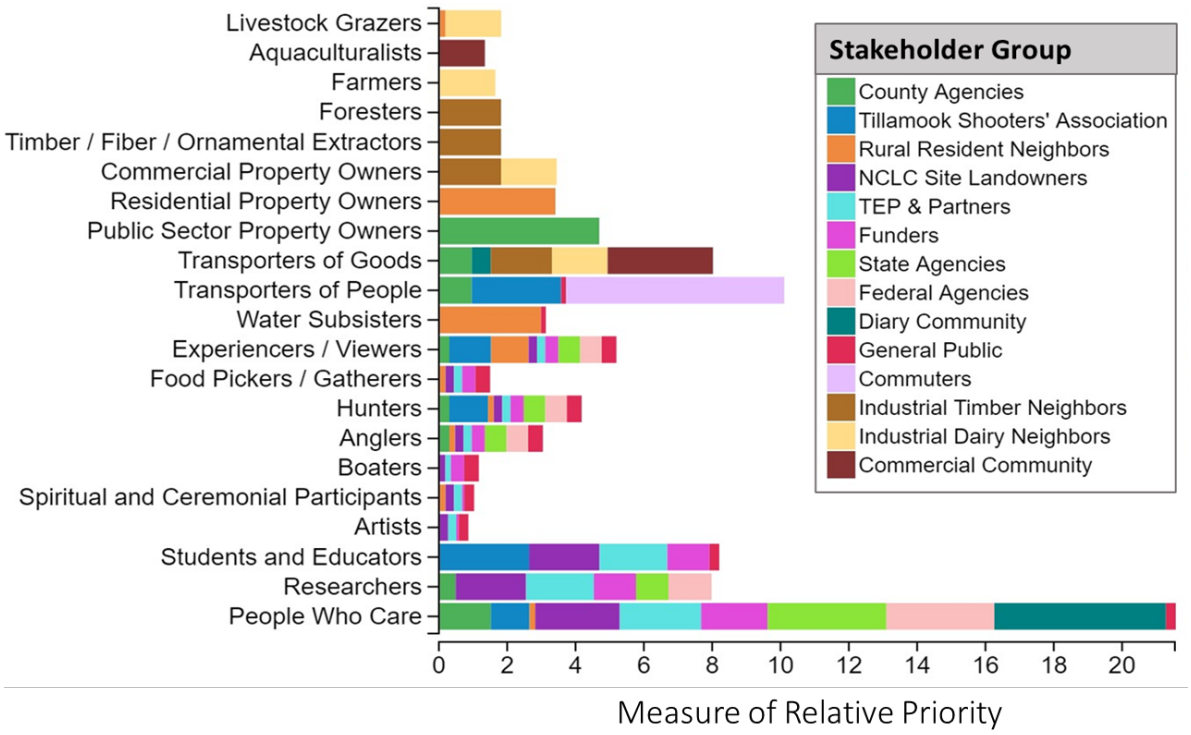


Figure 5. Relative priority of beneficiaries potentially affected by TRW restoration decisions, determined by the beneficiary roles of each stakeholder.

Table 4. Top 12 prioritized beneficiary groups, with a result value of 3.00 or higher in Figure 5.

Beneficiary	Result
People Who Care This group was present in the beneficiary profiles of ten stakeholders. The Dairy Community stakeholder group includes people who care about sustaining farms and the economic livelihoods from farming and agriculture, which is different than caring about tidal wetland ecosystems per se. However, other stakeholder groups that make up this beneficiary were identified as caring that the TRW site would be restored to tidal wetlands. This is the only beneficiary subclass in the Non-Use beneficiary class (Table A-2).	21.55
Transporters of People The Transporters of People beneficiary ranked very high because the Commuters stakeholder group only includes this type in its beneficiary profile. The Tillamook Shooters Association stakeholder groups includes Transporters of People beneficiary as 30% of its entire profile. County Agencies and General Public stakeholder groups are also part of the makeup of this beneficiary. (Figures 4-5). Transporters of People are part of the Transportation beneficiary class (Table A-2).	10.09
Students and Educators Students and Educators were present as beneficiaries within the Tillamook Shooters Association, NCLC Landowners, TEP & Partners, Funders, and General Public stakeholder groups (Figures 4-5). There is interest by all these stakeholders to create opportunities for environmental education at the site and to educate the public about ecological and wildlife features at this site. In 2016, TEP and 10 partners launched the “Explore Nature Program”, with this site being a potential destination. Additionally, EarthWatch has a program called “Seed to Swamp” which aims to use this site to track the restoration of spruce swamp from seed collection and propagation to the restoration and development of this rare habitat (OWEB/NCWCGP proposal, 2017). Students and Educators are part of the Learning beneficiary class (Table A-2).	8.18

Table 4(continued). Top 12 prioritized beneficiary groups, with a result value of 3.00 or higher in Figure 5.

Beneficiary	Result
Transporters of Goods Transporters of Goods was included in the beneficiary profiles of County Agencies, and the industrial/commercial stakeholders (Commercial Community, Industrial Timber, Industrial Dairy Neighbors, and greater Dairy Community; Figures 4-5), who use the stretch of Burton-Fraser Road adjacent to the site for transporting their goods. This is especially true for commercial stakeholders located close to the TRW site. Transporters of Goods are part of the Transportation beneficiary class (Table A-2).	8.00
Researchers The NCLC landowner, TEP & Partners, Funders, County Agencies, State Agencies, and Federal Agencies included Researchers in their beneficiary profiles (Figures 4-5). All these stakeholders are interested in conducting or supporting environmental research at (or including) the TRW site. This includes research on tidal wetland restoration. Researchers are part of the Learning beneficiary class (Table A-2).	7.96
Experiencers/Viewers The Experiencers/Viewers beneficiary was included in the profiles of nine stakeholder groups (County, State and Federal Agencies, Funders, NCLC, TEP & Partners, Tillamook Shooters Association, Rural Resident Neighbors, and General Public; Figures 4-5). While a less tangible benefit, and often a very subjective one, a popular recreational draw in Tillamook Bay and the Oregon coast is the composite features of nature that are regarded as aesthetically pleasing. Opportunities and access for outdoor experiences and views may serve alongside a diverse set of other activities that these stakeholder groups are interested in benefitting from and sustaining. Experiencers/Viewers are part of the Recreational beneficiary class (Table A-2).	5.17
Public Property Owners Public Property Owners were only associated with County Agencies, but it comprised 50% of that influential stakeholder's beneficiary profile (figure 4, Appendix B Table B-13). The county owns Burton-Fraser Road which floods frequently and is in need of repair. Modification or removal of the road are major considerations in the TRW restoration design decisions. Public Property Owners are part of the Government/Municipal/Residential beneficiary class (Table A-2).	4.67
Hunters Hunters were included in the beneficiary profiles of nine stakeholder groups (County, State, and Federal Agencies; Funders, General Public, NCLC Landowners, Rural Resident Neighbors, TEP & Partners, and Tillamook Shooters Association; Figures 4-5). State and federal agencies regulate hunting and have interest in maintaining recreational benefits and resources for hunters. The county sherriff is interested in maintaining hunter safety. The TEP & Partners and NCLC have interest in creating and managing habitats for wildlife used by recreational hunters. Hunters are part of the Recreational beneficiary class (Table A-2).	4.15
Commercial Property Owners Industrial Dairy and Industrial Timber Neighbors include Commercial Property Owners as beneficiaries (Figures 4-5). These agricultural businesses rely on properties that are upland of the restoration site. Commercial Property Owners are part of the Commercial/Industrial beneficiary class (Table A-2).	3.42
Residential Property Owners This beneficiary group was only associated with Rural Resident Neighbors, but it comprised 40% of that stakeholder's beneficiary profile (Figure 4). While small in number, this beneficiary group could have outsized influence on the restoration plan which has the potential to affect the economic value of their property. Residential Property Owners are part of the Government/Municipal/Residential beneficiary class (Table A-2).	3.39

Table 4(continued). Top 12 prioritized beneficiary groups, with a result value of 3.00 or higher in Figure 5.

Beneficiary	Result
Water Subsisters The General Public and Rural Resident Neighbors were the only stakeholder groups that included Water Subsisters as beneficiaries (Figures 4-5). Ninety six percent of the score for this beneficiary was contributed by Rural Resident Neighbors (Figure 5), who likely depend on private well water for daily needs. Water Subsisters are part of the Subsistence beneficiary class (Table A-2).	3.11
Anglers Anglers were included in the beneficiary profiles of eight stakeholder groups (County Agencies, Rural Resident Neighbors, NCLC landowners, TEP & Partners, Funders, General Public, State, and Federal Agencies; Figures 4-5). State agencies permit and regulate fishing. All groups have interest in maintaining recreational benefits and resources for anglers, and the habitats of the species targeted by recreational anglers. Anglers are part of the Recreational beneficiary class (Table A-2).	3.02

The FST results in Figures 5 and Table 4 depict a nuanced identification of beneficiary groups that are likely to be interested in the TRW restoration. Using the beneficiary classification of NESCS Plus (Newcomer-Johnson et al. 2020), those groups can be sorted to coarser classes of beneficiaries and using the results of the across-stakeholder prioritization (Figure 5, Table 4), the FST calculates the relative priority of each of those coarser groups (Figure 6). This result can help decision makers generalize which users (i.e., beneficiary groups) will have greater or lesser interest in the restoration outcome. In this case, Non-Use (beneficiaries that care about the preservation of the environment for moral or ethical reasons and future generations), Transportation, Learning, and Recreational beneficiary classes in combination make up 74.1% of the beneficiary prioritization (Figure 6).

Figures 5-6 and Table 4 provide valuable information about which user groups (i.e., beneficiary types) are likely to have substantial interest in the TRW restoration project. This in turn suggests which beneficiary types and stakeholder groups should be consulted, or engaged in some manner, while developing the restoration plan.

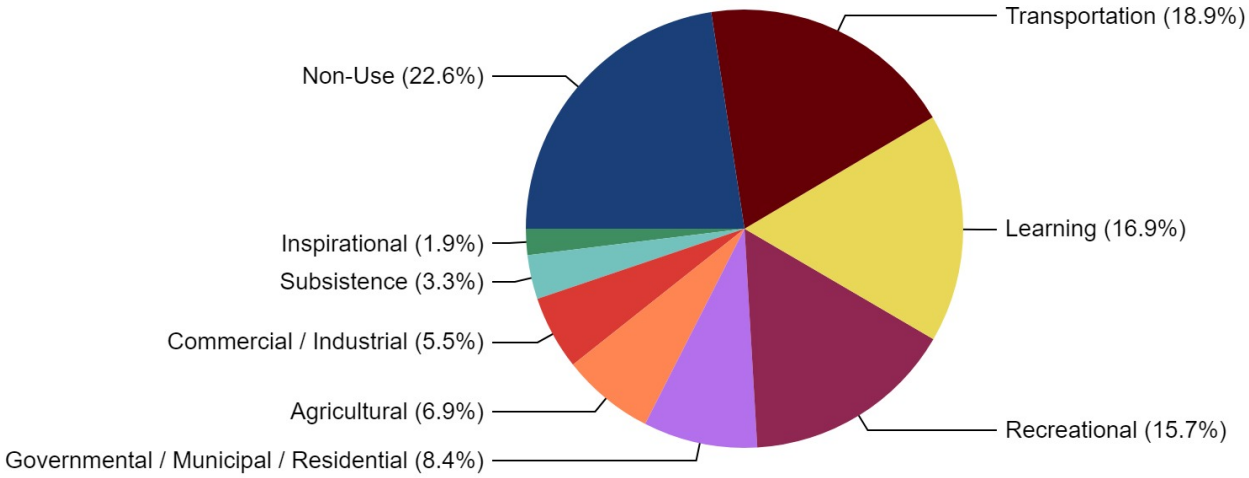


Figure 6. Relative prioritization of beneficiaries by their broader classification.

5. Shared Interests in Environmental Attributes

The final input step for the FST is to identify, by percentage, the environmental attributes that are necessary for each beneficiary to receive the benefits they value in the context of the site and decision (Sharpe et al. 2020). The beneficiary prioritization results in the previous step of the FST are used as the weights to calculate and prioritize environmental attributes. Environmental attributes are the specific aspects of the environment that are used, enjoyed, or consumed by beneficiaries. The environmental attribute categories and subcategories follow EPA's NESCS Plus portfolio of environmental attributes and definitions (in the 3-component system; Newcomer-Johnson et al. 2020).

The environmental attributes segmentation step was approached by thinking of what is needed to sustain beneficiaries' uses at the site specifically, trying to avoid beneficiaries' interests in the abstract or at scales larger than the TRW project site and adjacent lands. While individuals may care about multiple aspects of the environment at a site, when they assume a specific beneficiary role there will be a subset of biophysical attributes that provides the benefit that they directly use, consume, or appreciate (i.e., valued environmental attributes). The number of environmental attributes valued varies among beneficiaries (See Appendix B for full environmental attribute profiles for each beneficiary group). Each beneficiary has 100 points to distribute across all attributes of concern, so these differences can impact the scores given. Some, such as Hunters, primarily value Edible Fauna (and thus give this attribute a high score), while Students and Educators might value multiple subcategories of environmental attributes when studying nature at a site, meaning that there might be many such attributes with relatively smaller scores.

Figure 7 shows how the FST ranked environmental attributes across all beneficiary groups based on the percentage distribution of environmental attributes of interest for each beneficiary (see Appendix B). The nine most valued attributes are described in Table 5, and do not include attributes with a value of 3.00 or lower (see Appendix C, Table C-2 for a full table of environmental attribute results); the higher-scoring environmental attributes may be more focal in driving decision making. The top environmental attribute, Flooding, was valued by seven beneficiary groups and received the greatest score from Transporters of Goods and People. This attribute reflects the composite natural features that reduce the risk of flooding at a site. Edible Fauna was the second most highly ranked environmental attribute, valued by recreational Hunters, recreational Anglers, and People Who Care. Ecological Condition and Water Quality ranked third and fourth, respectively (Figure 7).

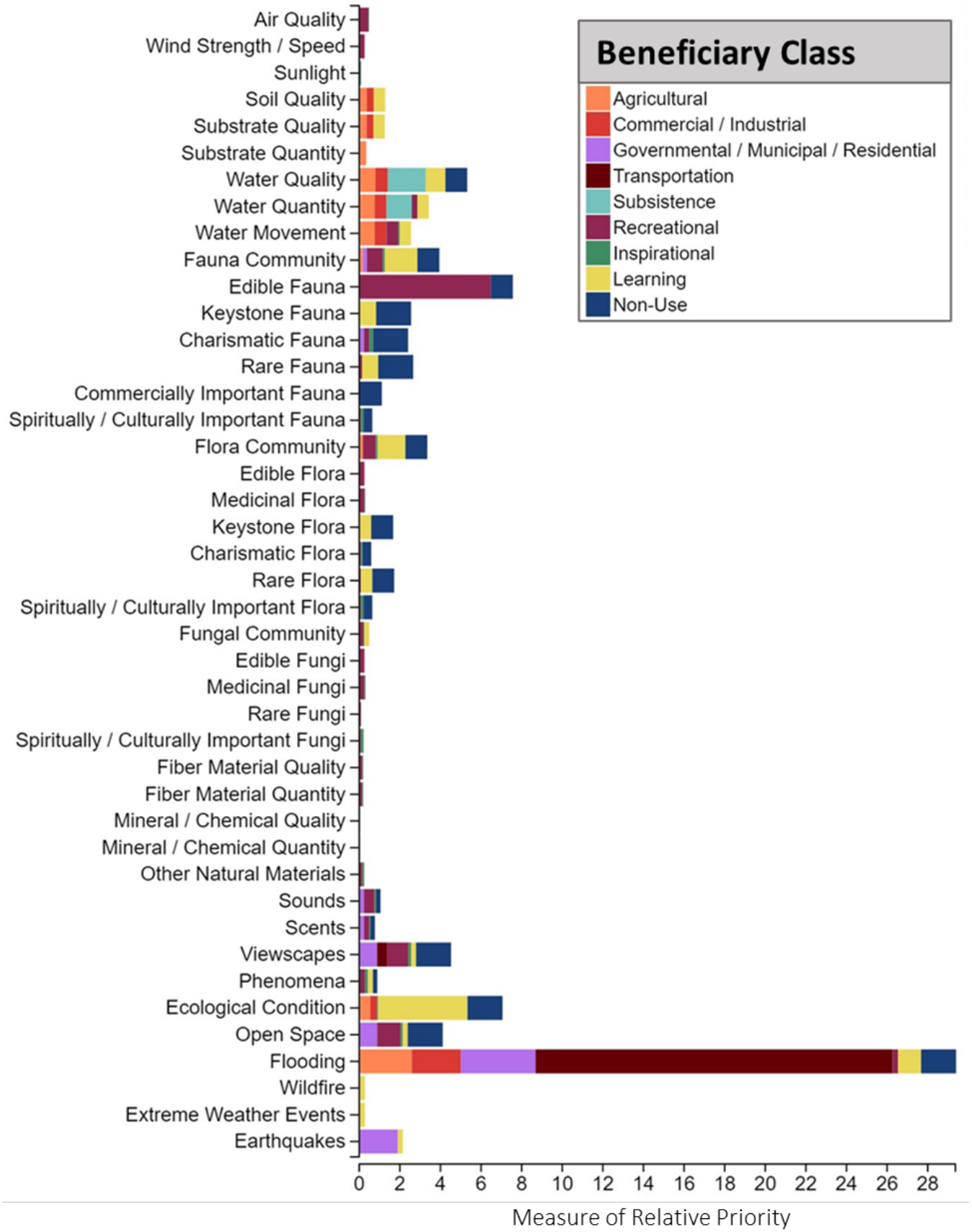


Figure 7. Relative prioritization of environmental attributes.

Table 5. Top 9 individual environmental attributes with a result value of 3.00 or higher in Figure 7.

Attribute	Result
Flooding Flooding is by far the most prioritized attribute in this decision context, as it is a concern to many beneficiaries (Figure 7). The Transporters of Goods and Transporters of People beneficiaries have 100 and 95 of 100 of their points allocated, respectively, toward flooding. The bar in Figure 7 for Flooding shows that a major portion is contributed by the Transporters beneficiary, yet Non-Use beneficiaries (People Who Care), which are the highest ranked beneficiaries, contribute much less because their environmental attribute distribution is much more widely dispersed (dark blue segments in Figure 7) amongst 20 different attributes. Flooding is part of the Composite (and Extreme Events) attribute category (Table A-3).	30.75
Edible Fauna Recreational Hunters and Anglers, and People Who Care make Edible Fauna one of the top 5 attributes (Figure 7). A main reason is that, like Flooding, Edible Fauna has beneficiaries who have close to 100% of their attribute distribution going toward this one attribute. Here, two recreational beneficiaries, Anglers and Hunters, have over 90% of their collective points assigned to Edible Fauna. Edible Fauna is part of the Fauna attribute category (Table A-3).	7.89
Ecological Condition Ecological Condition is a composite attribute that accounts for the overall quality of an ecological system, including the physical, chemical, and biological processes and characteristics. The attribute was given points by various beneficiaries for the holistic view of sustaining healthy local estuarine systems for their existence and to support diverse uses (farming, inspiration, learning and research). About 30% of the total points from the learning beneficiaries (Researchers; Students and Educators) goes to Ecological Condition. Ecological Condition is part of the Composite (and Extreme Events) attribute category (Table A-3).	7.35
Water Quality Water Quality is important to agricultural beneficiaries (Aquaculturalists, Farmers, Livestock Grazers) who benefit from agricultural activities in adjacent properties, but about half of its overall points come from Non-Use (People who Care) and Subsistence beneficiaries (Figure 7). Agricultural beneficiaries care whether the TRW site will affect the quality of water on fields or pastures on adjacent properties or flowing through downstream oyster beds. Other beneficiaries include Learning (Researchers, Students and Educators) who may use the site to study or learn about water quality properties and related ecological processes. It may be important to note that specific properties and thresholds of parameters to characterize adequate/ideal water quality may be different for different beneficiaries who depend on it for agriculture or home potable water use, or just care about its existence. Water Quality is part of the Water attribute category (Table A-3).	5.53
Viewscapes Viewscapes are important for Non-Use (People Who Care) and Recreational and Inspirational beneficiaries, such as Experiencers/Viewers, Artists, and Spiritual and Ceremonial Participants. Viewscapes are also important to Residential beneficiaries, as local residents may be motivated to live in the area for the bucolic setting and views; by Transporters of People, as drive-by sightseers; and by Students and Educators as the synergy of the view with the on-site, outdoor learning opportunities may contribute to making it an ideal location for field-based studies. There are seven beneficiary types that care about this composite attribute and approximately 60% of the resulting priority comes from Experiencers/Viewers and People Who Care (Figure 7). Viewscapes is part of the Composite (and Extreme Events) attribute category (Table A-3).	4.70

Table 5 (continued). Top 9 individual environmental attributes with a result value of 3.00 or higher in Figure 7.

Attribute	Result
Open Space Open Space is a composite attribute that contributes to various beneficiaries in Learning, Inspirational, Recreational, Non-Use, and Government/Municipal/Residential classes. Due to the site being designated for conservation from very initial phases of planning, there is little expectation that beneficiaries will value space for potential urban development here, with the exception of an existing road that may undergo modifications or relocation. Rather, there is value to beneficiaries in the aesthetics and existence of undeveloped open space. Open Space is part of the Composite (and Extreme Events) attribute category (Table A-3).	4.27
Fauna Community Fauna Community is an attribute that is important to Agricultural (Aquaculturalists), Government/Municipal/Residential (Residential Property Owners), Recreational (Experiencers/Viewers), Inspirational (Artists), Learning (Students and Educators, and Researchers), and Non-Use (People Who Care) beneficiaries (Figure 7). The specific benefits of faunal community for an individual beneficiary may vary, as the faunal composition that most benefits Aquaculturalists may be different than the specific attributes of the fauna community that may attract artists for inspiration or be beneficial to those who want to know that a diverse/native animal community exists for people who care. Fauna Community is part of the Fauna attribute category (Table A-3).	4.08
Water Quantity Water Quantity is important to Subsistence (Water Subsisters), Learning (Researchers), Agricultural (Livestock Grazers, Aquaculturalists, Farmers), Recreational (Experiencers/Viewers, Boaters), and Commercial/Industrial (Commercial Property Owners) beneficiaries (Figure 7). The largest portion of the relative rank for this attribute is from Water Subsisters (contribute 40 of their points), who are made up of the neighbors that depend on private well systems. The specific end uses for water quantity most likely are for home use, livestock grazing, forestry, and small craft navigation. Water Quantity is part of the Water attribute category (Table A-3).	3.55
Flora Community Flora Community is valued by Agricultural (Aquaculturalists), Inspirational (Artists), Recreational (Experiencers/Viewers, and Food Pickers and Gatherers), Non-Use (People Who Care) and Learning (Students and Educators, and Researchers) beneficiaries (Figure 7). The specific benefits of Flora Community for an individual beneficiary may vary, as the flora composition that most benefits Aquaculturalists may be different than one that attracts artists for inspiration or that is beneficial to those who care that a diverse, native vegetation composition exists. Flora Community is part of the Flora attribute category (Table A-3).	3.47

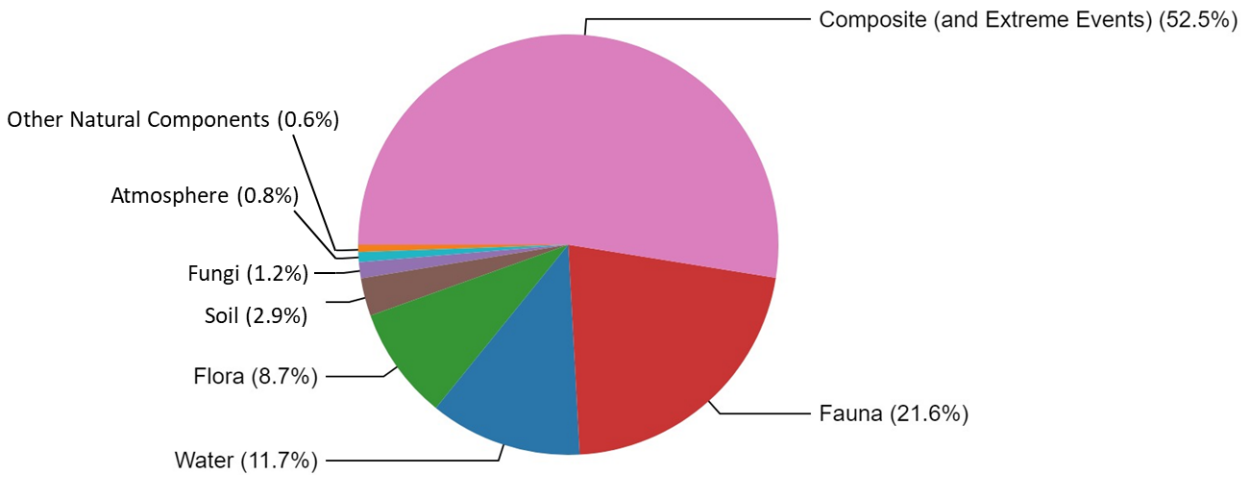


Figure 8. Relative priority of environmental attributes, grouped by their broader categories.

The FST provides a relative percentage result for each of the broader environmental attribute categories following the NESCS Plus organization of environmental attributes (Figure 8; Appendix A - Table A-3; Newcomer-Johnson et al. 2020) and based on the individual environmental attribute results (Figure 7). Composite & Extreme Event attributes make up more than half of the total result for the environmental attributes (Figure 8), led by Flooding, Ecological Condition, Viewscapes, and Open Space (Table 5). Transporters of Goods and Transporters of People were scored as only valuing Flooding and Viewscapes among all environmental attributes (Figure 7). About 49% of the total points from Learning beneficiaries (Researchers, Students & Educators) were distributed among several composite environmental attributes (Ecological Condition, Risk of Flooding, Viewscapes, Open Space, Risk of Earthquakes, Phenomena, Risk of Extreme Weather Events, and Risk of Wildfire).

Fauna attributes are featured in two of the top-ranked environmental attributes (i.e., Edible Fauna and Fauna Community; Table 5). Other fauna categories (i.e., Rare Fauna, Keystone Fauna, Charismatic Fauna, Commercially Important Fauna, and Spiritually Important Fauna) were also valued environmental attributes for several beneficiaries (Figure 7). The Water category includes three attributes (Water Quality, Water Quantity, and Water Movement), of which the first two are among the top nine environmental attributes (Table 5).

The results displayed in Figure 7 and discussed in Table 5 provide valuable insight about which environmental attributes should be the focus of discussion for restoration goals and assessment metrics. It is important to note, however, that although different beneficiary groups may value the same category (or subcategory) of environmental attributes, beneficiaries may disagree on specific manifestations of an attribute held in common. For example, Hunters and Anglers might highly value Edible Fauna, but Hunters are likely thinking about game mammals or birds, whereas Anglers are likely thinking of game fish or shellfish. Nonetheless, this analysis may help prioritize which general environmental attributes discussions should focus on.

6. Stakeholder Interests by Attributes

Another way to analyze how stakeholder groups tie to environmental attributes is by examining the distribution of attributes for each stakeholder group. Table 6 conveys the results of the stakeholder profiles, broken down by the top environmental attributes their beneficiaries care about. There were a total of 43 environmental attributes identified as part of at least one beneficiary's profile and thus were included in the prioritization results (Figure 7), but Table 6 only represents the top nine environmental attributes with a total resulting score of 3.00 or greater (in Figure 7; see full data in Appendix C, Tables C-2 and C-3); thus this is a partial picture of what environmental attributes are of interest to stakeholder groups. This rearrangement to depict how top priority environmental attributes are distributed among stakeholder groups represents a novel approach in using the FST and can be used to illustrate to stakeholders their shared interests and help guide discussions regarding which environmental attributes to prioritize in the restoration design, monitoring and assessment plans.

Table 6. Results of stakeholder interests for each of the top nine environmental attributes ranked in Figure 7; the last column (grey) is the aggregate total for each attribute. For visual ease, individual result values of how much a stakeholder is interested in an attribute are highlighted, high-to-low, with darkest to lightest shading as follows:

Result	>2.00	1.0 to 1.999	0.5 to 0.999	0.1 to 0.499	<0.099

	Stakeholders															
Env. Attributes	County Agencies	Tillamook Shooters Association	Rural Resident Neighbors	NCLC Landowners	TEP & Partners	Industrial Timber Neighbors	Industrial Dairy Neighbors	Funders	Commuters	State Agencies	Federal Agencies	Dairy Community	Utilities	Commercial Community	General Public	Total
Flooding	4.35	2.34	0.97	0.47	0.47	5.58	2.44	0.45	6.97	0.39	0.39	1.10	0.00	4.34	0.51	30.75
Edible Fauna	0.42	0.87	0.25	0.47	0.47	0.00	0.00	0.83	0.00	1.40	1.39	0.31	0.00	0.00	1.48	7.89
Ecological Condition	0.12	1.20	0.03	1.25	1.25	0.18	0.52	0.99	0.00	0.39	0.39	0.50	0.00	0.17	0.37	7.35
Water Quality	0.08	0.17	1.78	0.34	0.34	0.32	0.94	0.28	0.00	0.27	0.28	0.31	0.00	0.15	0.26	5.53
Viewscapes	0.17	0.46	1.09	0.30	0.30	0.00	0.00	0.31	0.37	0.45	0.42	0.50	0.00	0.00	0.33	4.70
Open Space	0.13	0.34	1.01	0.31	0.31	0.00	0.00	0.37	0.00	0.45	0.42	0.50	0.00	0.00	0.42	4.27
Fauna Community	0.13	0.44	0.36	0.55	0.55	0.00	0.00	0.47	0.00	0.42	0.44	0.31	0.00	0.15	0.27	4.08
Water Quantity	0.03	0.01	1.20	0.16	0.16	0.30	0.89	0.17	0.00	0.09	0.11	0.00	0.00	0.15	0.27	3.55
Flora Community	0.10	0.39	0.11	0.49	0.49	0.00	0.00	0.44	0.00	0.34	0.35	0.31	0.00	0.15	0.28	3.47

7. Conclusion

7.1 FST as a Restoration Planning Aide

Early stages of restoration project planning are an ideal time to use the FST to explore the social-ecological interests of people who may be affected by the project (i.e., the stakeholders and beneficiaries). The FST creates opportunities to see how stakeholder group interests interact, and it presents a transparent way of prioritizing the environmental attributes of greatest shared interest among stakeholders. The FST uses MCDA to objectively identify those priorities rather than allowing the most vocal stakeholders to dominate decisions, which is especially valuable when the dynamics of stakeholder groups require an equitable approach to considering their values and needs. Additionally, the FST provides a process to elucidate how stakeholder interests may overlap when those shared interests are not obvious.

The application in this FST analysis was conducted by the restoration team at TEP with assistance and guidance by scientists at EPA, although the tool may be used in different settings with input from diverse actors or stakeholders. The early stages of this FST analysis compelled the restoration team to identify who the stakeholders are in the project and what the environmental interests are of the people represented by each stakeholder. These results can be used by the restoration team to assess whether all of the relevant stakeholders and interests have been included in the planning considerations. The mid-stage results of the FST analysis revealed the environmental uses of the site (including non-use benefits such as appreciation of naturalness) that are of greatest interest among the stakeholders (Fig. 4). Socially valued uses of the site may be useful to consider when setting restoration project goals. The final stage results of the FST analysis reveal the environmental attributes by which those benefits are realized, and those may be used to identify metrics for assessing site condition and progress toward meeting the social-ecological goals.

Additionally, the FST can be used to run scenarios to explore how different decision criteria, sets of stakeholders, beneficiary profile composition, or sets of environmental attributes used by beneficiaries could affect the outcomes just described. The FST could also be used in a participatory, iterative fashion with direct input from stakeholders which would allow stakeholders to make sure their groups and perspectives are represented accurately. Importantly, the FST can be useful for communicating the goals and achievements of the restoration project with a non-expert audience, which can help build trust with the public and community leaders.

9.3 Summary of the FST Analysis Results

This application of the FST for the TRW project was conducted through many virtual conversations between restoration managers at TEP and EPA scientists. The insight from restoration managers was necessary for completing this application, as they are connected to the local communities and the development of the restoration project. Major results of this analysis are:

1. **Decision Criteria**: Level of Influence, Magnitude of and Probability of Impact, Legal Rights, and Proximity were revealed as the most important criteria used by decision makers for prioritizing stakeholder groups.
2. **Stakeholders**: 15 stakeholders were identified as having interest in the TRW restoration project. Based on decision criteria scoring, the most influential stakeholders were revealed to be Tillamook County Agencies, Tillamook Shooters Association, Rural Residential Neighbors, the NCLC Site Landowner, and TEP & Partners. The least influential stakeholders were Utilities, the Commercial Community, and the General Public.

3. **Beneficiaries**: 21 beneficiary groups were identified across the stakeholder groups. The top beneficiaries were People Who Care, Transporters of People, Students and Educators, Transporters of Goods, and Researchers. These top beneficiaries were shared by multiple stakeholder groups. However, other beneficiaries that were not in the top five also have commonly shared interests, such as Hunters and Anglers.

4. **Environmental Attributes**: 43 environmental attributes were identified as necessary for providing the benefits from the TRW site valued by beneficiaries. The attributes that meet shared interests of the most influential beneficiaries were Edible Fauna, Water Quality, composite factors that mitigate Flooding and define Ecological Condition and Viewscapes. Further rearrangement of these results depicted how the top priority environmental attributes were distributed among stakeholder groups, thus revealing which environmental attributes each stakeholder should have greatest concern about restoring, conserving, or developing at the TRW site.

5. **Relevance**: The results can be used to determine whether all stakeholder interests have been included in the planning process, to set and articulate socially relevant goals, and to identify monitoring metrics to assess the site condition and progress toward meeting social-ecological goals. Additionally, the shared interests and language used in the FST may be useful in guiding targeted communications material relevant to stakeholders' benefits during the restoration and monitoring process.

6. **Accuracy**: The results from this application can be used as a preview of potential opportunities in engaging stakeholders if the effort and time to directly obtain their perspectives for input is feasible. The FST can be rerun with data obtained directly from stakeholders (e.g., from meetings with individual or groups of stakeholders) to provide more accurate results. But where limitations do not permit the participatory process, restoration managers can use their knowledge to parameterize FST to identify potential shared interests among stakeholders as preparation for future stakeholder engagement and project planning.

9.4 Key Take-Aways

1. The results of the FST analysis can be used to identify what issues will be of greatest interest and concern to the project stakeholders and the beneficiary interests that comprise stakeholder interests. This can inform the social-ecological goals for the project. The results can also be used to identify which environmental attributes are likely to be useful for monitoring the social-ecological goals associated with site condition.

2. The top six beneficiary classes, each comprised of multiple subclasses, across all stakeholder groups are Non-Use (23%), Transportation (19%), Learning (17%), Recreational (16%), Governmental/Municipal/Residential (8%), and Agriculture (7%). These results can be used to understand who will care about changes to the site and thus who to include in discussions about the restoration plan. Engaging stakeholder groups that include these beneficiaries can help to build trust and interest in the project within the Tillamook basin community. Having these beneficiaries in mind and who they impact can help focus the framing of communication strategies throughout the process.

3. Overall, the restored site could provide the most benefit if the restoration plan focused on Flooding concerns, which would benefit multiple beneficiaries including some of the most influential ones: Transporters of People and Transporters of Goods subclasses and those in the Government/Municipal/Residential beneficiary class.

4. The site would provide benefit to multiple beneficiaries if the restoration plan focused on the Ecological Condition of the site, which would benefit the highest ranked beneficiary, People Who Care. This focus would also benefit Students and Educators and Researchers who fall in the top five ranked beneficiaries.

5. The third environmental attribute to focus on is Edible Fauna, which is of interest to recreational Hunters and Anglers and People Who Care. While the specific fauna of interest will differ among these beneficiaries (i.e., game mammals and birds for Hunters; game fish for Anglers; and all species for People who Care), supporting the needed habitat and uses for one beneficiary may well result in benefits for others. Furthermore, when implementing restoration interventions targeted toward improving habitat conditions for fish, waterfowl, and mammals, the support for one may well result in benefits for others.

6. The FST analysis identifies the environmental attributes that each beneficiary group values (i.e., the attributes of nature that each beneficiary uses, enjoys, or appreciates). Given that each stakeholder is made up of different beneficiary groups, this information can then be used to create a profile outside of the FST of the environmental attributes that are important to each stakeholder. Identifying the shared environmental attributes valued among stakeholders can then become one basis for discussions among stakeholders about the goals of restoration. The FST is a novel approach to solving many of the problems faced by managers making environmental decisions, by helping to identify how those decisions will affect people. As a downloadable online tool, the FST walks users (e.g., managers) through the steps described above to deliver these results and is available to all who are interested in using a structured, multi-criteria approach to explore stakeholder interests, benefits, and the aspects of nature needed to sustain those benefits. While FST relies on the user to specify the stakeholders and their interests, it can be used iteratively to add or remove stakeholders, modify stakeholder interests (i.e., their associated beneficiary groups), or modify other inputs as considerations or perspectives evolve. Ultimately, results from the FST can help guide restoration project design and monitoring and build a stakeholder communication strategy that incorporates stakeholder interests into decision making and planning for the restoration site.

9.5 Data Quality and Limitations

The application of the FST for the Tillamook River wetlands restoration project was conducted under the approved Quality Assurance Project Plan, “Community FEGS (Final Ecosystem Goods and Services) Scoping Tool – Use Case #2 (Tidal Wetlands); J-GEMMD-0031818-QP-1-2”, as part of beta testing of the FST, which was also developed under an approved QAPP, “Community FEGS (Final Ecosystem Goods and Services) Scoping Tool; J-GEMMD-0031818-QP-1-1”. Data input and analyses were conducted per the FST user manual. Data inputs for all criteria weights, and stakeholder, beneficiary, and attribute profiles were provided by TEP restoration managers based on their restoration expertise, knowledge of the site, and knowledge of the stakeholders’ interests at the time. Thus, input data were specific to this site, people providing data (i.e., TEP restoration managers), and the decision context. Consequently, the results of this study are specific to the TRW site and are not directly transferable to another site. If the managers’ priorities or their site-specific knowledge change, as stakeholder-group interests evolve or as issues regarding environmental pressures or disturbances on the site change, the inputs may need to be updated for accuracy, which could affect the results reported above. The structure of the FST is designed to be used in an iterative manner.

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9. Appendix A: Input Tables for the FST

9.1 Stakeholder Scores for Decision Criteria

Table A-1. Stakeholder group scores for the decision criteria. This produces the relative ranking of stakeholder groups (Figure 3 in report).

Stakeholder Group	Magnitude & Probability of Impact	Level of Influence	Level of Interest	Urgency & Temporal Immediacy	Proximity	Economic Interest	Rights	Fairness	Underrepresented & Underserved Representation
NCLC Site Landowners	20	100	100	60	50	100	100	100	50
TEP & Partners	20	100	100	60	75	100	60	100	50
Funders	20	75	100	60	10	100	60	100	50
Rural Resident Neighbors	80	75	100	20	100	100	60	100	100
Tillamook Shooters Association	80	100	100	20	100	100	60	100	0
Industrial Timber Neighbors	50	100	100	20	75	100	20	100	0
Industrial Dairy Neighbors	35	75	100	20	75	100	20	100	0
Commercial Community	5	50	50	20	25	100	20	100	0
Dairy Community	0	75	100	20	50	100	20	100	0
Utilities	20	50	50	20	50	0	60	100	0
Commuters	80	75	100	20	100	0	20	100	0
General Public	5	50	50	20	50	0	20	100	0
County Agencies	80	100	100	40	75	100	100	100	50
State Agencies	0	100	100	40	50	100	20	100	50
Federal Agencies	0	100	100	40	50	100	20	100	50

9.2 Beneficiary Profiles

The representation and relative distribution of beneficiaries for each stakeholder group. Each stakeholder group has their own table with the distribution of beneficiary roles they represent. This information results in the relative beneficiary prioritization (Figure 5 in report).

Table A-2. Beneficiary profile for the NCLC Site Landowners stakeholder group.

Beneficiary Category	Subcategory	Score
Recreational	Experiencers/Viewers	3
	Food Pickers/ Gatherers	3
	Hunters	3
	Anglers	3
	Boaters	2

Beneficiary Category	Subcategory	Score
Inspirational	Spiritual and Ceremonial Participants	3
	Artists	3
Learning	Students and Educators	25
	Researchers	25
Non-Use	People Who Care	30

Table A-3: Beneficiary profile for the TEP & Partners stakeholder group.

Beneficiary Category	Subcategory	Score
Recreational	Experiencers/Viewers	3
	Food Pickers/Gatherers	3
	Hunters	3
	Anglers	3
	Boaters	2
Inspirational	Spiritual and Ceremonial Participants	3
	Artists	3
Learning	Students and Educators	25
	Researchers	25
Non-Use	People Who Care	30

Table A-4. Beneficiary Profile for the Funders stakeholder group.

Beneficiary Category	Subcategory	Score
Recreational	Experiencers/Viewers	6
	Food Pickers/Gatherers	6
	Hunters	6
	Anglers	6
	Boaters	6
Inspirational	Spiritual and Ceremonial Participants	1
	Artists	1
Learning	Students and Educators	19
	Researchers	19
Non-Use	People Who Care	30

Table A-5. Beneficiary profile for the Rural Resident Neighbors stakeholder group.

Beneficiary Category	Subcategory	Score
Agricultural	Livestock Grazers	2
Government/Municipal/Residential	Residential Property Owners	40
Subsistence	Water Subsisters	35
Recreational	Experiencers/Viewers	13
	Food Pickers/Gatherers	2
	Hunters	2
	Anglers	2
Inspirational	Spiritual and Ceremonial Participants	2
Non-Use	People Who Care	2

Table A-6. Beneficiary profile for the Tillamook Shooters Association stakeholder group.

Beneficiary Category	Subcategory	Score
Transportation	Transporters of People	30
Recreational	Experiencers / Viewers	14
	Hunters	13
Learning	Students and Educators	30
Non-Use	People Who Care	13

Table A-7. Beneficiary profile for the Industrial Timber Neighbors stakeholder group.

Beneficiary Category	Subcategory	Score
Agricultural	Foresters	25
Commercial/ Industrial	Timber / Fiber / Ornamental Extractors	25
	Commercial Property Owners	25
Transportation	Transporters of Goods	25

Table A-8. Beneficiary profile for the Industrial Dairy Neighbors stakeholder group.

Beneficiary Category	Subcategory	Score
Agricultural	Livestock Grazers	25
	Farmers	25
Commercial/ Industrial	Commercial Property Owners	25
Transportation	Transporters of Goods	25

Table A-9. Beneficiary profile for the Commercial Community stakeholder group.

Beneficiary Category	Subcategory	Score
Agricultural	Aquaculturalists	30
Transportation	Transporters of Goods	70

Table A-10. Beneficiary profile for the Dairy Community stakeholder group.

Beneficiary Category	Subcategory	Score
Transportation	Transporters of Goods	10
Non-Use	People Who Care	90

Beneficiary profile for the Utilities stakeholder

This stakeholder group does not directly benefit from the ecosystem

Table A-11. Beneficiary profile for the Commuters stakeholder group.

Beneficiary Category	Subcategory	Score
Transportation	Transporters of People	100

Table A-12. Beneficiary profile for the General Public stakeholder group.

Beneficiary Category	Subcategory	Score
Transportation	Transporters of People	4
Subsistence	Water Subsisters	4
Recreational	Experiencers / Viewers	12
	Food Pickers / Gatherers	12
	Hunters	12
	Anglers	12
	Boaters	12

Beneficiary Category	Subcategory	Score
Transportation	Transporters of People	4
Inspirational	Spiritual and Ceremonial Participants	8
	Artists	8
Learning	Students and Educators	8
Non-Use	People Who Care	8

Table A-13. Beneficiary profile for the County Agencies stakeholder group.

Beneficiary Category	Subcategory	Score
Government/Municipal/Residential	Public Property Owners	50
Transportation	Transporters of Goods	10
	Transporters of People	10
Recreational	Experiencers/Viewers	3
	Hunters	3
	Anglers	3
Learning	Researchers	5
Non-Use	People Who Care	16

Table A-14. Beneficiary profile for the State Agencies stakeholder group.

Beneficiary Category	Subcategory	Score
Recreational	Experiencers/Viewers	10
	Hunters	10
	Anglers	10
Learning	Researchers	15
Non-Use	People Who Care	55

Table A-15. Beneficiary profile for the Federal Agencies stakeholder group.

Beneficiary Category	Subcategory	Score
Recreational	Experiencers/Viewers	10
	Hunters	10
	Anglers	10
Learning	Researchers	20
Non-Use	People Who Care	50

9.6 Environmental Attribute Profiles

The representation and relative distribution of environmental attributes for each beneficiary group. Each beneficiary group has their own table with the distribution of environmental attributes they need or care about. This information results in the relative environmental attribute prioritization (Figure 7 in report).

Attribute Profiles for Recreational Beneficiaries

Table A-16: Environmental Attribute profile for the Experiencers/Viewers beneficiary group

Attribute Category	Attribute Subcategory	Score
Atmosphere	Air Quality	8
Water	Water Quantity	1
	Water Movement	1
Fauna	Fauna Community	15
	Charismatic Fauna	5
	Rare Fauna	2
	Spiritually/Culturally Important Fauna	1
Flora	Flora Community	10
	Charismatic Flora	1
	Rare Flora	1
	Spiritually/Culturally Important Flora	1
Fungi	Fungal Community	1
	Rare Fungi	1
	Spiritually/Culturally Important Fungi	1
Composite (and Extreme Events)	Sounds	10
	Scents	5
	Viewscapes	20
	Phenomena	5
	Open Space	10
	Flooding	1

Table A-17: Environmental Attribute profile for the Food Pickers/Gatherers beneficiary group

Attribute Category	Attribute Subcategory	Score
Flora	Flora Community	8
	Edible Flora	15
	Medicinal Flora	15
Fungi	Fungal Community	8
	Edible Fungi	15
	Medicinal Fungi	15
Other Natural Components	Fiber Material Quality	8
	Fiber Material Quantity	8
	Presence of ONC for Artistic Use or Consumption	8

Table A-18: Environmental Attribute profile for the Hunters beneficiary group

Attribute Category	Attribute Subcategory	Score
Fauna	Edible Fauna	90
Composite (and Extreme Events)	Open Space	10

Table A-19: Environmental Attribute profile for the Anglers beneficiary group

Attribute Category	Attribute Subcategory	Score
Water	Water Movement	10
Fauna	Edible Fauna	90

Table A-20. Environmental Attribute profile for the Boaters beneficiary group

Attribute Category	Attribute Subcategory	Score
Atmosphere	Wind Strength/Speed	20
Water	Water Quantity	20
	Water Movement	20
Composite	Open Space	20
(and Extreme Events)	Flooding	20

Attribute Profiles for Inspirational Beneficiaries

Table A-21. Environmental Attribute profile for the Spiritual and Ceremonial Participants beneficiary group

Attribute Category	Attribute Subcategory	Score
Atmosphere	Air Quality	3
	Sunlight	3
Water	Water Movement	4
Fauna	Medicinal Fauna	1
	Charismatic Fauna	10
	Spiritually/Culturally Important Fauna	10
Flora	Medicinal Flora	4
	Charismatic Flora	5
	Spiritually/Culturally Important Flora	10
Fungi	Medicinal Fungi	5
	Spiritually/Culturally Important Fungi	10
Other Natural Components	Presence of Other Natural Components for Artistic Use or Consumption	5
Composite (and Extreme Events)	Sounds	5
	Scents	5
	Viewscapes	5
	Phenomena	5
	Ecological Condition	5
	Open Space	5

Table A-22. Environmental Attribute profile for the Artists beneficiary group

Attribute Category	Attribute Subcategory	Score
Atmosphere	Sunlight	3
Water	Water Movement	3
Fauna	Fauna Community	10
	Charismatic Fauna	10
	Spiritually/Culturally Important Fauna	3
Flora	Flora Community	10
	Charismatic Flora	3
	Spiritually/ Culturally Important Flora	3

Attribute Category	Attribute Subcategory	Score
Fungi	Fungal Community	5
	Spiritually/Culturally Important Fungi	3
Other Natural Components	Fiber Material Quality	5
	Fiber Material Quantity	5
	Mineral/Chemical Quality	1
	Mineral/Chemical Quantity	1
	Presence of Other Natural Components for Artistic Use or Consumption	5
Composite (and Extreme Events)	Sounds	3
	Scents	1
	Viewscapes	10
	Phenomena	10
	Open Space	6

Attribute Profiles for Learning Beneficiaries

Table A-23. Environmental Attribute profile for the Students and Educators beneficiary group

Attribute Category	Attribute Subcategory	Score
Water	Water Quality	5
Fauna	Fauna Community	10
Flora	Flora Community	10
Fungi	Fungal Community	3
Composite (and Extreme Events)	Viewscapes	3
	Phenomena	3
	Ecological Condition	47
	Open Space	3
	Flooding	7
	Wildfire	3
	Extreme Weather Events	3
	Earthquakes	3

Table A-24. Environmental Attribute profile for the Researchers beneficiary group

Attribute Category	Attribute Subcategory	Score
Soil	Soil Quality	7
	Substrate Quality	7
Water	Water Quality	7
	Water Quantity	7
	Water Movement	7
Fauna	Fauna Community	10
	Keystone Fauna	10
	Rare Fauna	10
Flora	Flora Community	7
	Keystone Flora	7
	Rare Flora	7
Composite (and Extreme Events)	Ecological Condition	7
	Flooding	7

Attribute Profiles for Agricultural Beneficiaries

Table A-25. Environmental Attribute profile for the Livestock Grazers beneficiary group

Attribute Category	Attribute Subcategory	Score
Soil	Soil Quality	10
	Substrate Quality	10
Water	Water Quality	18
	Water Quantity	17
	Water Movement	17
Composite (and Extreme Events)	Ecological Condition	10
	Flooding	18

Table A-26. Environmental Attribute profile for the Aquaculturalists beneficiary group

Attribute Category	Attribute Subcategory	Score
Soil	Substrate Quality	11
	Substrate Quantity	11
Water	Water Quality	11
	Water Quantity	11
	Water Movement	11
Fauna	Fauna Community	11
Flora	Flora Community	11
Composite (and Extreme Events)	Ecological Condition	12
	Flooding	11

Table A-27. Environmental Attribute profile for the Farmers beneficiary group

Attribute Category	Attribute Subcategory	Score
Soil	Soil Quality	10
	Substrate Quantity	10
Water	Water Quality	18
	Water Quantity	17
	Water Movement	17
Composite (and Extreme Events)	Ecological Condition	10
	Flooding	18

Table A-28. Environmental Attribute profile for the Foresters beneficiary group

Attribute Category	Attribute Subcategory	Score
Composite (and Extreme Events)	Flooding	100

Attribute Profiles for Government/Municipal/Residential Beneficiaries

Table A-29. Environmental Attribute profile for the Residential Property Owners beneficiary group

Attribute Category	Attribute Subcategory	Score
Fauna	Fauna Community	6
	Charismatic Fauna	6
Composite (and Extreme Events)	Sounds	6
	Scents	6
	Viewscapes	25
	Open Space	25
	Flooding	26

Table A-30. Environmental Attribute profile for the Public Property Owners beneficiary group

Attribute Category	Attribute Subcategory	Score
Composite (and Extreme Events)	Flooding	60
	Earthquakes	40

Attribute Profiles for Subsistence Beneficiaries

Table A-31. Environmental Attribute profile for the Water Subsisters beneficiary group

Attribute Category	Attribute Subcategory	Score
Water	Water Quality	60
	Water Quantity	40

Attribute Profiles for Commercial/Industrial Beneficiaries

Table A-32. Environmental Attribute profile for the Timber/Fiber/Ornamental Extractors beneficiary group

Attribute Category	Attribute Subcategory	Score
Composite (and Extreme Events)	Flooding	100

Table A-33. Environmental Attribute profile for the Commercial Property Owners beneficiary group

Attribute Category	Attribute Subcategory	Score
Soil	Soil Quality	10
	Substrate Quality	10
Water	Water Quality	18
	Water Quantity	17
	Water Movement	17
Composite (and Extreme Events)	Ecological Condition	10
	Flooding	18

Attribute Profiles for Transportation Beneficiaries

Table A-34. Environmental Attribute profile for the Transporters of Goods beneficiary group

Attribute Category	Attribute Subcategory	Score
Composite (and Extreme Events)	Flooding	100

Table A-35. Environmental Attribute profile for the Transporters of People beneficiary group

Attribute Category	Attribute Subcategory	Score
Composite (and Extreme Events)	Viewscapes	5
	Flooding	95

Attribute Profiles for Non-Use Beneficiaries

Table A-36. Environmental Attribute profile for the People Who Care beneficiary group

Attribute Category	Attribute Subcategory	Score
Water	Water Quality	5
Fauna	Fauna Community	5
	Edible Fauna	5
	Keystone Fauna	8
	Charismatic Fauna	8
	Rare Fauna	8
	Commercially Important Fauna	5
	Spiritually / Culturally Important Fauna	2
Flora	Flora Community	5
	Keystone Flora	5
	Charismatic Flora	2
	Rare Flora	5
	Spiritually / Culturally Important Flora	2
Composite (and Extreme Events)	Sounds	1
	Scents	1
	Viewscapes	8
Composite (and Extreme Events)	Phenomena (e.g., Sunsets, Northern Lights, etc.)	1
	Ecological Condition	8
	Open Space	8
	Flooding	8

10. Appendix B: Complete FST output of priority results

Table B-1. BENEFICIARY GROUPS: All beneficiaries that were identified as being a component of any one or more stakeholder groups in relation to the decision alternatives of the TRW site. The beneficiaries that have a result value >3.00 were included in the main report are highlighted orange.

Beneficiary Category	Beneficiary Subcategory	Result
Non-Use	People Who Care	21.55
Transportation	Transporters of People	10.09
Learning	Students and Educators	8.18
Transportation	Transporters of Goods	8.00
Learning	Researchers	7.96
Recreational	Experiencers/Viewers	5.17
Governmental/Municipal/Residential	Public Sector Property Owners	4.67
Recreational	Hunters	4.15
Commercial/Industrial	Commercial Property Owners	3.42
Government/Municipal/Residential	Residential Property Owners	3.39
Subsistence	Water Subsisters	3.11
Recreational	Anglers	3.02
Agricultural	Livestock Grazers	1.80
Agricultural	Foresters	1.79
Commercial/Industrial	Timber/Fiber/Ornamental Extractors	1.79
Agricultural	Farmers	1.63
Recreational	Food Pickers/Gatherers	1.47
Agricultural	Aquaculturalists	1.32
Recreationl	Boaters	1.14
Inspirational	Spiritual and Ceremonial Participants	1.01
Inspirational	Artists	0.84

Table B-2. ENVIRONMENTAL ATTRIBUTES: All environmental attributes that were identified as being a component of any one or more beneficiary groups in relation to the decision alternatives of the TRW site. The attributes that have a result value >3.00 were included in the main report are highlighted orange.

Attribute Category	Attribute Subcategory	Result
Composite (and Extreme Events)	Flooding	30.75
Fauna	Edible Fauna	7.89
Composite (and Extreme Events)	Ecological Condition	7.35
Water	Water Quality	5.53
Composite (and Extreme Events)	Viewscapes	4.70
Composite (and Extreme Events)	Open Space	4.27
Fauna	Fauna Community	4.08
Water	Water Quantity	3.55
Flora	Flora Community	3.47
Fauna	Rare Fauna-	2.75
Fauna	Keystone Fauna	2.64
Water	Water Movement	2.63
Fauna	Charismatic Fauna	2.48
Composite (and Extreme Events)	Earthquakes	2.21
Soil	Rare Flora	1.77
Soil	Keystone Flora	1.71
Fauna	Soil Quality	1.30
Composite (and Extreme Events)	Substrate Quality	1.28
Fauna	Commercially Important Fauna	1.13
Composite (and Extreme Events)	Sounds	1.06
Composite (and Extreme Events)	Phenomena	0.89
Composite (and Extreme Events)	Scents	0.77
Fauna	Spiritually/Culturally Important Fauna	0.64
Flora	Spiritually/Culturally Important Flora	0.64
Flora	Charismatic Flora	0.58
Fungi	Fungal Community	0.48
Atmosphere	Air Quality	0.46
Soil	Substrate Quantity	0.32
Fungi	Medicinal Fungi	0.28
Flora	Medicinal Flora	0.27
Composite (and Extreme Events)	Wildfire	0.26
Composite (and Extreme Events)	Extreme Weather Events	0.26
Atmosphere	Wind Strength/Speed	0.24
Flora	Edible Flora	0.23
Fungi	Edible Fungi	0.23
Other Natural Components	Presence of Other Natural Material for Artistic Use or Consumption	0.22
Fungi	Spiritually/Culturally Important Fungi	0.19
Other Natural Components	Fiber Material Quality	0.17
Other Natural Components	Fiber Material Quantity	0.17
Atmosphere	Sunlight	0.06
Atmosphere	Rare Fungi	0.05
Soil	Medicinal Fauna	0.01
Other Natural Components	Mineral/Chemical Quality	0.01
Other Natural Components	Mineral/Chemical Quantity	0.01

Table C-3. STAKEHOLDER INTERESTS BY ENVIRONMENTAL ATTRIBUTE: Complete results of stakeholder interests for each of the 43 identified environmental attributes; the last column is the aggregate total for each attribute. For ease visualizing the results, the results are highlighted high to low with darkest to lightest shading as follows:

Result	>2.00	1.0 to 1.999	0.5 to 0.999	0.1 to 0.499	<0.099

Stakeholders / Environmental Attributes	County Agencies	Tillamook Shooters Association	Rural Resident Neighbors	NCLC Landowners	TEP & Partners	Industrial Timber Neighbors	Industrial Dairy Neighbors	Funders	Commuters	State Agencies	Federal Agencies	Dairy Community	Utilities	Commercial Community	General Public	Total
Flooding	4.35	2.34	0.97	0.47	0.47	5.58	2.44	0.45	6.97	0.39	0.39	1.10	0.00	4.34	0.51	30.75
Edible Fauna	0.42	0.87	0.25	0.47	0.47	0.00	0.00	0.83	0.00	1.40	1.39	0.31	0.00	0.00	1.48	7.89
Ecological Condition	0.12	1.20	0.03	1.25	1.25	0.18	0.52	0.99	0.00	0.39	0.39	0.50	0.00	0.17	0.37	7.35
Water Quality	0.08	0.17	1.78	0.34	0.34	0.32	0.94	0.28	0.00	0.27	0.28	0.31	0.00	0.15	0.26	5.53
Viewscapes	0.17	0.46	1.09	0.30	0.30	0.00	0.00	0.31	0.37	0.45	0.42	0.50	0.00	0.00	0.33	4.70
Open Space	0.13	0.34	1.01	0.31	0.31	0.00	0.00	0.37	0.00	0.45	0.42	0.50	0.00	0.00	0.42	4.27
Fauna Community	0.13	0.44	0.36	0.55	0.55	0.00	0.00	0.47	0.00	0.42	0.44	0.31	0.00	0.15	0.27	4.08
Water Quantity	0.03	0.01	1.20	0.16	0.16	0.30	0.89	0.17	0.00	0.09	0.11	0.00	0.00	0.15	0.27	3.55
Flora Community	0.10	0.39	0.11	0.49	0.49	0.00	0.00	0.44	0.00	0.34	0.35	0.31	0.00	0.15	0.28	3.47
Rare Fauna	0.13	0.09	0.03	0.36	0.36	0.00	0.00	0.32	0.00	0.44	0.45	0.50	0.00	0.00	0.06	2.75
Keystone Fauna	0.13	0.07	0.01	0.36	0.36	0.00	0.00	0.31	0.00	0.42	0.43	0.50	0.00	0.00	0.04	2.64
Water Movement	0.05	0.01	0.05	0.19	0.19	0.30	0.89	0.21	0.00	0.15	0.18	0.00	0.00	0.15	0.25	2.63
Charismatic Fauna	0.10	0.12	0.28	0.21	0.21	0.00	0.00	0.20	0.00	0.34	0.32	0.50	0.00	0.00	0.18	2.48
Earthquakes	1.96	0.07	0.00	0.06	0.06	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.21
Rare Flora	0.08	0.06	0.02	0.24	0.24	0.00	0.00	0.21	0.00	0.28	0.29	0.31	0.00	0.00	0.04	1.77
Keystone Flora	0.08	0.05	0.01	0.24	0.24	0.00	0.00	0.21	0.00	0.27	0.28	0.31	0.00	0.00	0.03	1.71
Soil Quality	0.03	0.00	0.01	0.13	0.13	0.18	0.52	0.10	0.00	0.08	0.11	0.00	0.00	0.00	0.00	1.30
Substrate Quality	0.03	0.00	0.01	0.13	0.13	0.18	0.35	0.10	0.00	0.08	0.11	0.00	0.00	0.15	0.00	1.28
Sounds	0.03	0.11	0.32	0.06	0.06	0.00	0.00	0.07	0.00	0.11	0.11	0.06	0.00	0.00	0.13	1.06
Commercially Important Fauna	0.06	0.05	0.01	0.10	0.10	0.00	0.00	0.10	0.00	0.19	0.17	0.31	0.00	0.00	0.03	0.95
Phenomena	0.02	0.13	0.06	0.12	0.12	0.00	0.00	0.10	0.00	0.07	0.07	0.06	0.00	0.00	0.14	0.89
Scents	0.02	0.06	0.27	0.04	0.04	0.00	0.00	0.05	0.00	0.07	0.07	0.06	0.00	0.00	0.08	0.77
Spiritually/Culturally Important Fauna	0.02	0.03	0.02	0.07	0.07	0.00	0.00	0.05	0.00	0.08	0.08	0.13	0.00	0.00	0.08	0.64
Spiritually/Culturally Important Flora	0.02	0.03	0.02	0.07	0.07	0.00	0.00	0.05	0.00	0.08	0.08	0.13	0.00	0.00	0.08	0.64
Charismatic Flora	0.02	0.03	0.02	0.06	0.06	0.00	0.00	0.05	0.00	0.08	0.08	0.13	0.00	0.00	0.06	0.58
Fungal Community	0.00	0.08	0.02	0.09	0.09	0.00	0.00	0.08	0.00	0.01	0.01	0.00	0.00	0.00	0.11	0.48
Air quality	0.02	0.08	0.08	0.02	0.02	0.00	0.00	0.04	0.00	0.06	0.06	0.00	0.00	0.00	0.09	0.46

Stakeholders / Environmental Attributes	County Agencies	Tillamook Shooters Association	Rural Resident Neighbors	NCLC Landowners	TEP & Partners	Industrial Timber Neighbors	Industrial Dairy Neighbors	Funders	Commuters	State Agencies	Federal Agencies	Dairy Community	Utilities	Commercial Community	General Public	Total
Substrate Quantity	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.32
Medicinal Fungi	0.00	0.00	0.02	0.04	0.04	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.28
Medicinal Flora	0.00	0.00	0.02	0.03	0.03	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.27
Wildfire	0.00	0.07	0.00	0.06	0.06	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.26
Extreme Weather Events	0.00	0.07	0.00	0.06	0.06	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.26
Wind Strength/Speed	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.24
Edible Flora	0.00	0.00	0.02	0.03	0.03	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.23
Edible Fungi	0.00	0.00	0.02	0.03	0.03	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.23
Presence of Other Natural Material for Artistic Use or Consumption	0.00	0.00	0.02	0.03	0.03	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.22
Spiritually/Culturally Important Fungi	0.00	0.01	0.02	0.03	0.03	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.07	0.19
Fiber Material Quality	0.00	0.00	0.01	0.02	0.02	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.17
Fiber Material Quantity	0.00	0.00	0.01	0.02	0.02	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.17
Sunlight	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.06
Rare Fungi	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.05
Medicinal Fauna	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Mineral/Chemical Quality	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Mineral/Chemical Quantity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Precipitation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Temperature	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Soil Quantity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pollinating Fauna	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pest Predator Fauna	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercially Important Flora	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercially Important Fungi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fuel Quantity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fuel Quality	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

11. Glossary

11.1 Key terms from the FEGS Scoping Tool user manual (Sharpe 2021)

FEGS – FEGS are Final Ecosystem Goods and Services. These are the aspects of the environment that are directly enjoyed, used, or consumed by humans. They are specified as *final* because of the *direct* benefit they provide to humans. For more discussion about FEGS, see Boyd and Banzhaf (2007), Landers and Nahlik (2013) and DeWitt et al. (2020).

Stakeholder groups – Stakeholders are interested and affected parties. Their inclusion has become an important part of the environmental decision-making process and can lead to better-informed and more accepted decisions. Stakeholder groups are groups based on the roles the parties within them play in the community. For example, a tourism industry group representing snorkeling and fishing tours could be considered a stakeholder group or the collection of those businesses could be considered a stakeholder group. Alternatively, if some of those businesses have differing interests or perspectives, it might be more appropriate to treat them as separate stakeholder groups.

Stakeholder prioritization criteria – The stakeholder prioritization criteria were developed specifically for this tool and encompass all aspects of stakeholder groups that decision makers might consider when prioritizing one group over another. Inclusion of diverse stakeholder perspectives can lead to improved decision-making, but for many projects it is not logistically or financially feasible to include every possible stakeholder. These criteria offer a transparent, repeatable, and sharable approach to prioritize stakeholder perspectives. The stakeholder prioritization criteria were designed to cast as wide a net as possible to cover all potential criteria that decision makers currently consider when doing informal or subconscious stakeholder group prioritizations. It is not expected that all the criteria would be meaningful and relevant for all decision makers or decision contexts. Table A-1 contains the full set of criteria used in the tool and their definitions. For more discussion on stakeholder prioritization, see Sharpe et al. (2021).

Beneficiary roles – Beneficiary roles are the ways an individual or group enjoys, uses, or consumes some aspect of the environment. Transitioning from stakeholder groups to beneficiary roles helps decision makers better articulate the ways that stakeholder groups are benefiting from the environment. Beneficiary roles are based on how individuals within them interact with the environment. For example, that snorkeling tour industry stakeholder group would be composed of several beneficiary roles covering the different aspects of their interaction with the environment (i.e., boating, swimming, etc.). The FEGS Classification System (Landers and Nahlik 2013) defined a list of all potential beneficiary roles. The National Ecosystem Services Classification System Plus (Newcomer-Johnson et al. 2020), in its 3-component system, updated that list of beneficiary roles. This updated list, including definitions, is used in the Beneficiary step of the tool. The complete list of beneficiary classes and their definitions can also be found in Table A-2.

Environmental attributes – Environmental attributes are the specific aspects of the environment that are enjoyed, used, or consumed by beneficiaries. For example, edible fauna are environmental attributes valued by anglers, hunters, commercial fishers, and subsistence consumers. An initial list of these attributes was developed as part of the FEGS Classification System (Landers and Nahlik 2013). That list was refined and updated in the National Ecosystem Services Classification System Plus (in its 3-component system, Newcomer-Johnson et al. 2020) and the FEGS Metrics Report (U.S. EPA 2020). The updated list, including definitions, is used in the Attribute step of the tool. The list of attributes and their definitions used in FST as of January 2022, can be found in Table A-3.

11.2 Stakeholder prioritization criteria used in the tool (Sharpe 2021)

Criterion	Definition
Magnitude and Probability of impact	The likelihood and degree of potential impact to the stakeholder group as a result of the decision
Level of influence	The level of influence that the stakeholder group has over the decision-making process
Level of interest	The level of interest that the stakeholder group has over the decision-making process
Urgency/Temporal immediacy	The degree to which the stakeholder group would like to see a decision made or action taken quickly
Proximity	How frequently the stakeholder group comes into contact with the area for which a decision is being made
Economic interest	Whether the stakeholder group has an economic interest in the outcome of the decision-making process (i.e., would their livelihoods or assets be impacted by the decision outcome)
Rights	Whether the stakeholder group has legal, property, consumer, or user rights associated with the decision-making process, the decision outcome, or the area the decision affects
Fairness	Whether the exclusion of the stakeholder group from the decision-making process would lead to the process being viewed as unfair by the community
Underrepresented/Underserved groups	Whether the stakeholder group represents any underrepresented or underserved populations

11.3 Beneficiary classes, subclasses, and their definitions (Sharpe 2021)

Beneficiary Class	Beneficiary Subclass	Definition
Agricultural	Livestock Grazers	Uses the environment to graze livestock
	Agricultural Processors	Cleans edible products
	Aquaculturists	Farms aquatic fauna (e.g., fish, shrimp, oysters)
	Farmers	Farms terrestrial or aquatic flora (e.g., crops, orchards)
	Foresters	Plants and raises trees (i.e., silviculture)
Commercial/ Industrial	Food Extractors	Uses the natural abundance of edible organisms (e.g., hunting, trapping, or fishing for livelihood, job, commercial, or artisanal purposes)
	Timber, Fiber, and Ornamental Extractors	Extracts or harvests timber, fiber, wood, or ornamental extraction or harvest for commercial or business purposes (e.g., logging, shell collection)
	Industrial Processors	Uses natural resources in industrial processing such as manufacturing (e.g., textile or steel industries), mills, or oil and gas extraction and processing)
	Private Energy Generators	Uses the environment for energy production or placement of power generation structures, includes power plants (electric and nuclear), dams, turbines (wind, water, or wave), solar

Beneficiary Class	Beneficiary Subclass	Definition
Commercial/ Industrial	Pharmaceutical and Food Supplement Suppliers	Collects organisms from nature that are used for pharmaceuticals, medicines, food supplements, or vitamins for commercial sale
	Fur / Hide Trappers and Hunters	Hunts or traps fauna for fur or hides for commercial sale
	Private Drinking Water Plant Operators	Provides water for private purposes
	Commercial/Industrial Property Owner	Owners of private land for commercial or industrial purposes
Government, Municipal, and Residential	Municipal Drinking Water Plant Operators	Provides water for the community
	Residential Property Owners	Homeowners of private land
	Military / Coast Guard	Uses the environment for placement of infrastructure or training activities
	Public Energy Generators	Uses the environment for energy production or placement of power generation structures for the community, includes power plants (electric and nuclear), dams, turbines (wind, water, or wave), solar panels, and geothermal systems
	Public Sector Property Owners	Uses or benefits from the environment as an owner of property and in a way not specified in other government, municipal, and residential subclass.
Transportation	Transporters of Goods	Uses the environment to transport goods (e.g., shipping, cargo, commercial navigation, barges, freight, planes, trains)
	Transporters of People	Uses the environment to transport people (e.g., cruises, ferries, airplanes, airports, trains, harbors)
Subsistence	Water Subsisters	Relies on natural sources for water including drinking water and tribal or traditional uses (may use wells, cisterns, rain gardens, rain barrels, etc.)
	Food and Medical Subsisters	Uses natural sources of edible flora, fauna, and fungi as a major source of food; includes hunting, fishing, and gathering as well as other tribal or traditional uses
	Timber, Fiber, and Fur / Hide Subsisters	Relies on timber, fiber, or fauna for survival, including tribal or cultural traditions (e.g., firewood)
	Building Material Subsisters	Relies on natural materials for infrastructure and housing
Recreational	Experiencers and Viewers	Views and experiences the environment as an activity (e.g., bird, wildlife, or fauna watching; nature appreciation; hiking, biking, camping, climbing, outings, sunbathing, sightseeing, beach combing)
	Food Pickers and Gatherers	Recreationally collects or gathers edible flora, fungi, or fauna (does not include hunting or trapping) (e.g., berry picking, mushroom gathering, clam digging)
	Hunters	Hunts for recreation or sport

Beneficiary Class	Beneficiary Subclass	Definition
Recreational	Anglers	Fishes for recreation or sport
	Waders, Swimmers, and Divers	Recreates in or under the water (e.g., snorkeling, SCUBA, swimming, beachgoing, wading, diving, bathing)
	Boaters	Recreates in motorized or unmotorized watercraft (e.g., sailboats, ski boats, jet skis, kayaks, surfboards)
Inspirational	Spiritual and Ceremonial Participants and Participants of Celebration	Uses the environment for spiritual, ceremonial, or celebratory purposes (e.g., harvest festivals, tribal observances, traditional ceremonies, religious rites)
	Artists	Uses the environment to produce art, includes writers, painters, sculptors, cinematographers, and recording artists
Learning	Students and Educators	Includes all educational uses, interests, or opportunities including field trips and outdoor laboratories
	Researchers	Includes opportunities or interest for significant scientific research and improving scientific knowledge
Non-Use	People Who Care	Believes it is important to preserve the environment for moral or ethical reasons, for fear of its loss, or to allow their future selves or future generations to visit or rely upon it

11.4 Environmental attribute categories, subcategories, and their definitions (Sharpe 2021)

Attribute Tier 1	Attribute Tier 2	Definition
Atmosphere	Air Quality	The degree to which air is clean, clear, and pollution-free
	Wind Strength/Speed	The speed and force of the wind
	Precipitation	Weather in which something, including rain, snow, sleet, and/or hail, is falling from the sky
	Sunlight	Light from the sun
	Temperature	A measure of the warmth or coldness of the weather or climate
Soil	Soil Quality	The suitability of soil for use based on physical, chemical, and/or biological characteristics
	Soil Quantity	The amount of soil present, could be measured in terms of volume, depth, and/or extent
	Substrate Quality	The suitability of substrate for use based on physical, chemical, and/or biological characteristics
	Substrate Quantity	The amount of substrate present, could be measured in terms of volume, depth, and/or extent
Water	Water Quality	The suitability of water for use based on physical, chemical, and/or biological characteristics
	Water Quantity	The amount of water present, could be measured in terms of volume, depth, total yield, and/or peak flow

Attribute Tier 1	Attribute Tier 2	Definition
Water	Water Movement	The amount of water flowing per unit of time, includes aspects such as surface water movement through watersheds, wave action, etc.
Fauna	Fauna Community	The interacting animal life present in the area
	Edible Fauna	Fauna fit to be eaten by humans
	Medicinal Fauna	Fauna that have healing properties as is or after processing
	Keystone Fauna	Fauna on which other species depend, whose absence would significantly alter the ecosystem
	Charismatic Fauna	Fauna with symbolic value or widespread popular appeal
	Rare Fauna	Fauna that are uncommon or infrequently encountered
	Pollinating Fauna	Fauna that move pollen from plant to plant
	Pest Predator/Depredator Fauna	Fauna that prey upon pest species
	Commercially Important Fauna	Fauna that are important for commerce
	Spiritually/Culturally Important Fauna	Fauna that are important for spiritual or cultural practices or beliefs
Flora	Flora Community	The interacting plant life present in the area
	Edible Flora	Flora fit to be eaten by humans
	Medicinal Flora	Flora that have healing properties as is or after processing
	Keystone Flora	Flora on which other species depend, whose absence would significantly alter the ecosystem
	Charismatic Flora	Flora with symbolic value or widespread popular appeal
	Rare Flora	Flora that are uncommon or infrequently encountered
	Commercially Important Flora	Flora that have importance for commerce
	Spiritually/Culturally Important Flora	Flora that has importance for spiritual or cultural practices or beliefs
Fungi	Fungal Community	The interacting fungal life present in the area
	Edible Fungi	Fungi fit to be eaten by humans
	Medicinal Fungi	Fungi that have healing properties as is or after processing
	Rare Fungi	Fungi that are uncommon or infrequently encountered
	Commercially Important Fungi	Fungi that are important for commerce
	Spiritually/Culturally Important Fungi	Fungi that are important for spiritual or cultural practices or beliefs
Other Natural Components	Fuel Quality	The suitability of material, based on physical, chemical, and/or biological characteristics, to produce heat or power through burning or other methods
	Fuel Quantity	The amount of fuel present; could be measured in terms of volume, mass, and/or extent
	Fiber Material Quality	The suitability of material, based on physical, chemical, and/or biological characteristics, to be used in production of textiles

Attribute Tier 1	Attribute Tier 2	Definition
Other Natural Components	Fiber Material Quantity	The amount of fiber material present; could be measured in terms of volume, mass, and/or extent
	Mineral / Chemical Quality	The suitability of material for use based on physical, chemical, and/or biological characteristics
	Mineral / Chemical Quantity	The amount of material present; could be measured in terms of volume, mass, and/or extent
	Presence of Other Natural Materials for Artistic Use or Consumption (e.g., Shells, Acorns, Honey)	The presence and/or extent of materials suitable for artistic use or consumption
Composite (and Extreme Events)	Sounds	The sounds or combination of sounds arising from the area
	Scents	The scents or combination of scents arising from the area
	Viewscapes	The views and vistas available in the area
	Phenomena (e.g., Sunsets, Northern Lights, etc.)	Natural phenomena arising from a combination of environmental attributes
	Ecological Condition	The overall quality of the ecological system based on physical, chemical, and biological characteristics
	Open Space	Land that is undeveloped, but may be landscaped or otherwise in use, and is available for use
	Flooding	The likelihood the area will experience flooding and the likely severity of the flooding
	Wildfire	The likelihood the area will experience wildfire and the likely severity of the fire
	Extreme Weather Events	The likelihood the area will experience extreme weather events and the likely severity of the events
	Earthquakes	The likelihood the area will experience earthquakes and the likely severity of the earthquakes

12. Appendix References

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