

SDM Framework for ENREP Study Results

Draft Decision Problem

Compass was hired by the AMP to demonstrate the application of a Structured Decision Making (SDM) approach to decisions facing TFW Policy. The first step in that process requires clarifying the decision context – i.e., what the core decision is, what boundaries are relevant for that decision, and what the process will be to support that decision. Given the forthcoming results from the ENREP study in the next two to three years, TFW Policy has given us the direction to use riparian Forest Practices rules in Eastside Np basins as a case study.

As we've discussed in earlier Policy meetings, our understanding – gained through reading Program materials and through discussions with Policy, CMER, and program staff – is that the core decision that Policy will be faced with following the completion of the ENREP study is:

What changes (if any) to the riparian Forest Practices Rules for Eastside type Np basins should Policy recommend the Forest Practices Board adopt to better protect important ecosystem functions while mitigating undesirable economic impacts?

Implicit in this decision statement is a recognition that:

- The ENREP study results will provide an essential foundation for this process by demonstrating the degree to which the current WAC rules protect important ecosystem functions;
- In order to inform a decision about whether and how to change the WAC rules, Policy must evaluate the current rules alongside reasonable alternatives to determine whether these alternatives are better able to protect ecosystem functions at acceptable costs.

Draft Decision Objectives and Potential Performance Measures

Based on our discussions to date, Compass has developed a set of draft decision objectives, sub-objectives and associated performance measures to capture key interests and concerns related to the decision described above and how they may or may not be impacted by potential changes to the current Forest Practices rules. As a reminder, decision objectives define the “things that matter” that could be affected by the decision, and they provide the basis for evaluating and comparing alternatives. These draft objectives will be iteratively refined over the course of several rounds of small Working Group and TFW Policy Committee Meetings, with the goal of producing a concise set of decision objectives and PMs that best reflects what matters in decisions related to ENREP study results. Several considerations are guiding the development of the objectives:

- *Complete* – as a set, the objectives capture all the key interests;
- *Concise* – there is nothing unnecessary or ambiguous;
- *Sensitive* – they are differentially influenced by the alternatives under consideration;
- *Understandable* – clearly relate to the things that matter;
- *Independent* – they contribute independently to the performance of alternatives.

Performance measures (PMs) serve to make these values specific to the context and decision at hand. Given their role in informing a decision about how the best path forward, PMs are inherently predictive – which means that they may or may not relate to how one might monitor the outcomes of a decision. Several key considerations – closely related to those used to structure objectives – have been used to guide the development of potential PMs for each sub-objective:

- *Accurate and direct* – there is a clear and well-accepted relationship between the PM and the decision objective;
- *Unambiguous* – it is clearly defined, suitably precise, and will be interpreted by everyone the same way;
- *Understandable* – consequences and value trade-offs made using the PM can be readily understood and communicated;
- *Operational* – information and tools needed to make predictions relative to it (e.g., through modeling) are or can be made available;
- *Complete and concise* – as a set, the PMs report all the essential consequences without duplication.

A summary of draft decision objectives and potential PMs are provided below in Table 1. Arrows represent the preferred direction for the objective.

Table 1. Summary draft decision objectives, sub-objectives and potential performance measures, and preferred direction

Objectives	Sub-objectives	Potential Performance Measures	Pref. Dir.
Riparian Ecosystem Function	Terrestrial		
	Shade	Canopy Cover (%)	↑
		Canopy density (%)	↑
		Windthrow [metric TBD]	↓
	Soil Disturbance	Undisturbed Area (%)	↑
	Large Woody Debris	Index of pieces and volume by size class (unitless)	↑
	Instream		
	Stream Temperature	Change in mean daily summer maximum (deg C)	↓
	Suspended Sediment	Cumulative sediment export	↓
		Sediment export during storm events	↓
	Streamflow	Deviation from pre-harvest streamflow conditions	↓
	Primary Productivity	Change in [metric TBD]	↓
	Aquatic & Riparian dependent species		
	Macroinvertebrate Communities	Biomass per unit area (mg/m ²)	↑
	Amphibian Populations	Suitable habitat availability (m ²)	↑
Economically Viable Timber Industry	Cash flow		
	Operational Cost	Incremental Change in Cost (\$/ha)	↓
	Revenue Potential	Incremental Change in Revenue (\$/ha)	↓
	Land Asset Value		
	Long-term Asset Value	Harvestable acres (# ac.)	↑

Below are brief descriptions of the decision objectives, potential PMs and the ENREP study variables that can be drawn upon for further development. The small groups have provided valuable input to help structure the objectives and PMs described above. Our task during this workshop will be to select or

further develop performance measures that best support decision making. The high-level questions we will explore together include:

1. *What is the most concise manner to describe the relative change between control and treatment site results drawing from the empirical data collected?*
2. *Are there opportunities to develop predictive tools to extend results for alternative treatments (i.e., alternatives to the current WAC rules) that will be explored in the SDM process?*
3. *What is the most appropriate use or combination of ‘selected site’ vs. ‘basin outlet’ variables for different sub-objectives.*

Riparian Ecosystem Function

This objective represents concerns related to the impacts of timber harvesting on the ecological function of riparian non fish-bearing perennial streams in Eastern Washington. This objective also relates to three of the over-arching AMP goals which are: (1) to provide compliance with the Endangered Species Act (ESA) for aquatic and riparian dependent species on non-federal forest lands, (2) to restore and maintain riparian habitat on non-federal forest lands to support a harvestable supply of fish, and (3) to meet the requirements of the Clean Water Act for water quality on non-federal lands.

Table 2. Descriptions for Riparian Ecosystem Function PMs

Sub-objectives	Comments and Questions
Shade	<p>These PMs would measure changes in effective shade across alternative treatments.</p> <p>ENREP is measuring the following: 1) the view to sky at 1m height and at surface level 2) canopy and topographic density and 3) effective shade at 1m height and surface level.</p> <p><i>Q1: Which variable(s) best synthesize changes in effective shade?</i> <i>Q2: Can these variables be aggregated into an index?</i> <i>Q3: How can PMs be developed to predict outcomes of the alternatives?</i> <i>Q4: What other tools or sources of information (outside of ENREP) would support the development of a predictive PM?</i></p>
Undisturbed Soil Area %	<p>This PM would describe the percent area of soil that is undisturbed after harvest.</p> <p><i>Note: this does not seem to be in the ENREP study, however, it seems important under WAC rules.</i></p> <p><i>Q1: Is a PM needed to help compare alternatives?</i></p>
Large Woody Debris	<p>This PM would measure changes in LWD across alternative treatments.</p> <p>ENREP is measuring: for each size class, pieces per unit length, volume per unit length, pieces per unit area, volume per unit area.</p> <p><i>Q1: Which variable(s) best synthesize changes in LWD?</i> <i>Q2: Can these variables be aggregated into an index?</i></p>

	<p><i>Q3: How can PMs be developed to predict outcomes of the alternatives?</i></p> <p><i>Q4: What other tools or sources of information (outside of ENREP) would support the development of a predictive PM?</i></p>
Stream Temperature	<p>This PM would measure changes in stream temperature across alternative treatments.</p> <p>ENREP is measuring stream temperatures at surface and sub-surface levels both seasonally, and every 15 minutes. Data will be summarized by minimum, maximum, mean and diel temperature range.</p> <p><i>Q1: Which variable(s) best synthesize changes in stream temperature?</i></p> <p><i>Q2: How can PMs be developed to predict outcomes of the alternatives?</i></p> <p><i>Q3: What other tools or sources of information (outside of ENREP) would support the development of a predictive PM?</i></p>
Suspended Sediment	<p>These PMs would measure changes in suspended sediment delivery across alternative treatments.</p> <p>ENREP is measuring turbidity and suspended sediment concentrations (monthly and daily) at the basin outlet. The study is also measuring onsite sediment delivery pathways such as gullies and erosional features, as well as the effects of windthrow and road filling</p> <p><i>Q1: Which variable(s) best synthesize changes in suspended sediment delivery?</i></p> <p><i>Q2: Can these variables be aggregated into an index?</i></p> <p><i>Q3: How can PMs be developed to predict outcomes of the alternatives?</i></p> <p><i>Q4: What other tools or sources of information (outside of ENREP) would support the development of a predictive PM?</i></p>
Streamflow	<p>This PM would measure changes in basin streamflow across alternative treatments.</p> <p>ENREP is measuring the spatial extent of flowing water, discrete changes in discharge, and areas of that are in contact with the channel.</p> <p><i>Q1: Should Stream Network Survey and Cross-sectional Survey results also be considered?</i></p> <p><i>Q2: Which variable(s) best synthesize changes in streamflow?</i></p> <p><i>Q3: Can these variables be aggregated into an index?</i></p> <p><i>Q4: How can PMs be developed to predict outcomes of the alternatives?</i></p> <p><i>Q5: What other tools or sources of information (outside of ENREP) would support the development of a predictive PM?</i></p>
Benthic macroinvertebrate communities	<p>This PM would measure changes in the abundance, diversity, and composition of aquatic macroinvertebrates.</p>

	<p>ENREP is analysing 1) samples taken from benthic substrates 2) samples of emerging adult insects and 3) samples of invertebrates drifting in the water column.</p> <p><i>Q1: Which variable(s) best synthesize changes in benthic macroinvertebrate communities?</i> <i>Q2: Can these variables be aggregated into an index?</i> <i>Q3: How can PMs be developed to predict outcomes of the alternatives?</i> <i>Q4: What other tools or sources of information (outside of ENREP) would support the development of a predictive PM?</i></p>
Amphibian Habitats	<p>This PM would measure changes in the composition of amphibian species and their resources.</p> <p>ENREP is collecting eDNA to allow for a fuller description of species composition that occurs in each basin and reach, and identification of taxa to a much lower-level of taxonomic resolution. eDNA samples also have a much higher chance of detecting specific species of interest (i.e. amphibians).</p> <p><i>Q1: Can eDNA results be effectively used to develop a PM?</i> <i>Q2: Could area of suitable habitat be used as a proxy measure?</i></p>

Economically Viable Timber Industry

This objective reflects the interests of industry stakeholders, including both large and small forest landholders. This objective also represents the 4th overarching AMP goal which is to “keep the timber industry economically viable in the state of Washington”. This set of draft PMs aims to capture the potential impacts of changes to forest practice rules on timber industry interests.

Table 3. Descriptions for Viable Timber Industry PMs

Performance Measure	Comments
Operational Costs	<p>This PM would describe the incremental change in operational costs for timber companies associated with alternative rule prescriptions.</p> <p><i>Q: What are the best sources of information to develop this PM?</i></p>
Revenue	<p>This PM would describe the incremental change in revenues for timber companies associated with alternative rule prescriptions.</p> <p><i>Q: What are the best sources of information to develop this PM?</i></p>
Long Term Asset Value	<p>This PM would describe the incremental change in asset value over 20 years for landowners associated with alternative rule prescriptions.</p> <p><i>Q1: What are the best sources of information to develop this PM?</i> <i>Q2: Could harvestable acres be used as a proxy measure for this objective?</i></p>

