The Washington State Joint Legislative Audit and Review Committee (JLARC) conducted a review of the state's efforts to conserve habitat and expand outdoor recreation. This work included a review of existing or potential objective outcome measures that could be used to evaluate the success of 13 land acquisition and regulatory programs intended to protect and conserve habitat and expand outdoor recreation. Based on the effective outcome measures found in the peer-reviewed and gray literature, communications with managers from similar programs in the U.S., and the project team's professional opinion, it was found that there is very little literature that focuses specifically on outcome measures as they relate to land acquisition intended to protect and conserve species, habitats or to expand outdoor recreation; however a number of states and regions have implemented outcome measures for acquisition, and guidance is available from the extensive literature on restoration program and project effectiveness.

Introduction

Developing strategies to effectively measure ecological outcomes linked to specific programs and projects is an essential, but not simple, task that remains generally elusive in practice (Dale and Beyeler, 2001; Sawhill and Williamson, 2003; Niemi and McDonald, 2004; Doren et al., 2009; Margoluis et al., 2013). There are many examples of project-level effectiveness and projects that have laid out clear outcome measures linked to the project goals, such as Hartema et al. (2014). At the programmatic and regional levels, examples of these outcome measures are more difficult to find. For an example of a regional evaluation of the cumulative effectiveness of multiple projects see Diefenderfer et al. (2016). For a model-based evaluation of restoration project impacts at a watershed scale see Roni et al. (2010).

Some researchers note that the increased demand for outcome measurement, particularly ecological outcomes, does not imply that they are useful for decision making or that they are frequently used (Turnhout et al., 2007). Others argue that aligning outcome measures (indicators and metrics) with the mission and goals of an organization, program, or project can change it profoundly.

Margoluis et al. (2013) argue that to measure success in conservation three questions must be answered: (1) are we achieving our desired impact?; (2) have we selected the best interventions to achieve our desired impact?; and (3) are we executing our interventions in the best possible manner? Another question to add to this list is (4) who is the audience and who will care about the effectiveness of our program and our actions?

Outcome measurement processes are based on the selection of indicators and metrics, and the choice of indicators and metrics will directly impact the results of the process (Behan et al., 2017). To understand which indicators and metrics have been shown to effectively measure the performance of land acquisition and regulatory actions, we focused our efforts on peer-reviewed literature, agency publications, and on programs that would help provide information about 'best practices' for outcome measures that were not found in peer-reviewed or agency publications. By best practices we were looking for *outcome measures* (i.e., indicators and metrics) and programs that were effective, innovative, or promising.

Due to the complexity and nuances related to the protection of forest resources and benefits in Washington, this section is not intended to be a comprehensive compendium of the indicators and metrics used to create effective outcome measures. Rather it is a compilation of effective outcome measures and practices based on our literature search, conversations with program managers, and the opinions of the project team within the timeframe of the project. The complete report (Behan et al., 2017) provides many more details concerning the development of outcome-based indicators from the literature, along with information on all of the other related programs and subject areas evaluated in the JLARC study.

Background

The state of Washington has a number of programs addressing forest habitats and forestry issues related to habitat protection or restoration. The Washington Forest Practices program regulates forest practices on private lands to maintain a viable forest products industry while protecting forest soils, fisheries, wildlife, water quality and quantity, air quality, recreation and scenic beauty. Because of their importance, a number of specific habitat protection measures were identified in Habitat Conservation Plans adopted by the Forest Practices Board to address salmon protection. These include correcting fish passage barriers, bringing forest roads up to standards or building new roads using new standards, and increasing riparian zone protection from 25 feet to between 90 and 200 feet.

A number of the land use and growth management programs have a goal of protecting forests by requiring jurisdictions to designate forest resource lands and adopt development regulations to protect them. Some of the acquisition activities undertaken by the Department of Natural Resources and the Department of Fish and Wildlife protect important forest ecosystems.

Literature

The maintenance of productive forestlands or sustainable forestry is one of the areas for which very extensive indicator development has occurred, and is one of the few areas in which the best practices matches recommendations from the literature. Measures of forest indicators are widely used to assess sustainable forestry (Cubbage et al., 2003), particularly of interest to the public for describing "green" forest products, generally through the Sustainable Forest Indicators (SFI) or the Forest Stewardship Council (FSC) certification processes; each of which identify a number of indicators. However, the indicators are designed primarily to support certification, so do not generally provide information on the overall success of various regulatory protection measures or voluntary protection or acquisition activities. The most widespread measures and indicators used in North America were identified in a United Nations effort to support sustainable temperate forests undertaken in 1995, and updated regularly, called the "Montreal Process criteria and indicators". Mendosa and Prabhu (2003) evaluate different forest indicators based on their uses globally, including some European programs (Baycheva, et al., 2013). Other U.S. based publications recommend specific forest health indicators, including those based on Ecological Integrity (Tierney et al., 2009; Perles et al., 2014). However, no papers appear to be more useful than the updated information provided as part of the Montreal Process online publications in creating information useful to Washington DNR.

Outputs

A short list of outputs identified in agency materials, or provided by JLARC, about the programs relevant to forestry:

- Populations of fish, wildlife and plants maintained on state and private forestlands.
- Forest soils maintained on forest lands.
- Water quality and quantity provided by forest lands.
- Timber generated from forest lands.

Outcome statements

The primary outcomes the project team identified from the objectives in the enabling legislation of the program:

- Protect forest species, habitats and ecosystems
- Store soil and carbon in working forest lands
- Provide water to support fish or other aquatic species, and downstream water users.
- Provide both recreation and education opportunities
- Assure the long-term production of timber products and maintenance of related jobs

In practice

Common and Effective Practice. Montreal Process Indicators. The Montreal Process indicators are widely used across the country, although the effort undertaken varies in different states and provinces. In Oregon, these were a major focus for the Oregon Department of Forestry until 2014, when changes in staffing and leadership combined with the legislature defunding the Oregon Progress Board caused the state to stop tracking them. In

many states in the southeastern U.S., widely distributed but declining forested ecosystem types, such as longleaf pine forests, have been intensively studied, with monitoring protocols developed to report on recovery indicators (Oswalt et al., 2012). In general, since the Montreal Process Indicators are so widely used, are being constantly updated and evaluated, and are outcome based, they represent the best practice.

The indicators are varied, but are organized into themes within the Montreal Process (see Table 1 below). It is important to note that while these indicators and metrics represent a best practice, they are generalized sufficiently to be usable throughout the globe in areas with temperate forests. They are designed to be modified to be relevant in each county or jurisdiction. As a result, a more generalized indicator for protecting water resources included in Table 1, such as the last one in the list referring to the streams meeting best management practices or protected, night be made to be more Washington-specific by rewriting it as "area of riparian forest preserved in conservation easements", if this represents a best management practice in the state.

Conclusions

Methods for developing meaningful outcome-based indicators are clearly identified in the literature. They are being put into practice successfully in a few states, but generally very sparsely across the country, and rarely for species and habitat focused land acquisition programs. When evaluating program success, most agencies tend to focus on gathering information they need for adaptive management – either data needed to determine if their actions are achieving their goals, or the information needed to develop plans or strategies. These focus on their need to understand the effectiveness of their actions to restore habitats or to address threats to species and habitats on property they manage – both important issues for agencies wanting to understand the priorities for their work. However, understanding priorities for action or the effectiveness of actions may not inform if the overall program is achieving the desired outcomes.

The most effective programs for evaluating program success in land acquisition, water quality protection, and restoration had a few commonalities. First, the legislation that created these programs was relatively specific in describing the types of outcomes desired, so designing an outcome based set of indicators was more straightforward for agencies. Second, the legislation required that indicators of program success be developed and reported on some regular schedule, and at a minimum funded the development of the indicators and their implementation, often requiring interagency cooperation, which is essential as many agencies and local or regional governments may be involved in program implementation. And lastly, they required statewide (or jurisdiction wide for regional governments such as Tahoe) evaluation of outcomes – which helps to assure the development and measurement of the indicators are not focused on plans or projects.

Unlike many of the other acquisition and regulatory programs lacking indicators, outcome based forestry indicators are well developed, well studied, and used throughout the world. They have not been widely implemented in the Pacific Northwest primarily because governments have been unable to decide which of the many forest benefits are most important to report on.

Table 1. Montreal Process forest categories, Indicators and metrics

Category	Indicators and Metrics
Conservation of Biological Diversity *(ecosystem, species and genetic diversity)*	• Area and percent of forest by forest ecosystem type, successional stage, age class, and forest ownership • Area and percent of forest in protected areas by forest ecosystem type, and by age class or successional stage • Fragmentation of forests • Number of native forest associated species • Number and status of native forest associated species at risk, determined by law or scientific assessment • Status of on-site and off-site efforts focused on conservation of species diversity • Number and geographic distribution of forest associated species at risk of losing genetic variation and locally adapted genotypes • Population levels of selected representative forest associated species to describe genetic diversity • Status of on-site and off-site efforts focused on conservation of genetic diversity

Table 1. Montreal Process forest categories, Indicators and metrics (continued)	
Measures Category	Indicators and Metrics
Maintenance of Productive Capacity of Forests	• Area and percent of forest land and net area of forest land available for wood production • Total growing stock and annual increment of both merchantable and non-merchantable tree species in forests available for wood production • Area, percent, and growing stock of plantations of native and exotic species • Annual harvest of wood products by volume and as a percentage of net growth or sustained yield • Annual harvest of non-wood forest products
Maintenance and Enhancement of Long-term Multiple Socio-Economic Benefits to Society	• Value and volume of wood and wood products production, including primary and secondary processing • Value of non-wood forest products produced or collected • Revenue from forest based ecosystem services • Total and per capita consumption of wood and wood products in round wood equivalents • Total and per capita consumption of non-wood forest products • Value and volume in round wood equivalents of exports and imports of wood products • Value of exports and imports of non-wood forest products • Exports as a share of wood and wood products production and imports as a share of wood and wood products consumption • Recovery or recycling of forest products as a percent of total forest products consumption
Conservation and Maintenance of Soil and Water Resources	• Proportion of forest management activities that meet best management practices or other relevant legislation to protect soil resources • Area and percent of forest land with significant soil degradation (soil erosion, diminished soil organic matter, soil compaction, or chemical changes) • Area and percent of water bodies, or stream length, in forest areas with significant change in physical, chemical or biological properties from reference conditions • Proportion of forest management activities that meet best management practices, or other relevant legislation, to protect water related resources

Citations

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