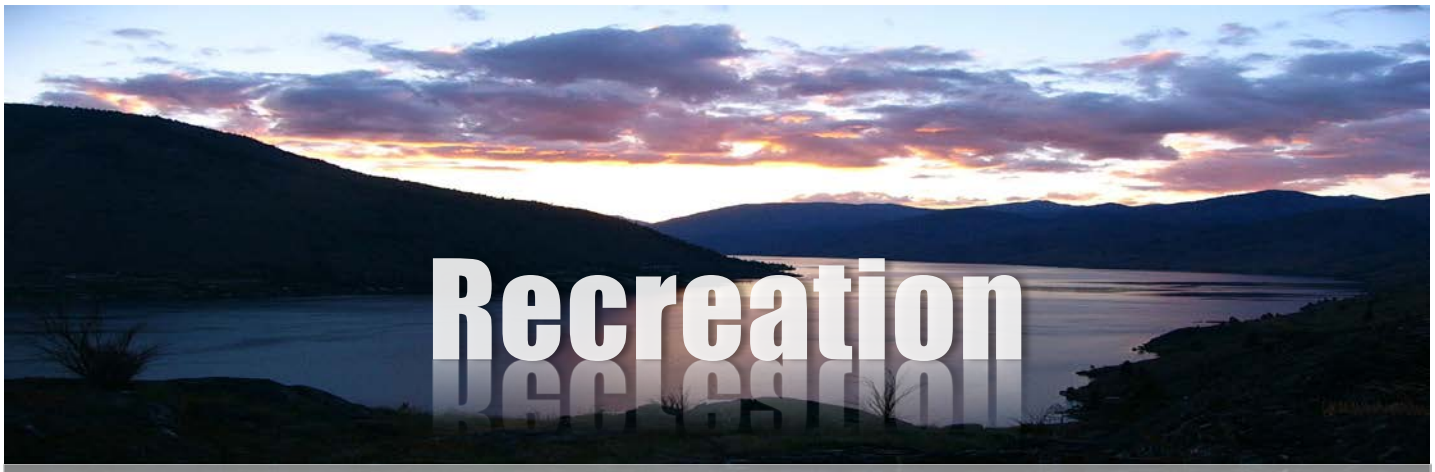

Recreation

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 that are 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 habitat acquisition for recreation 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., 2018) 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

In this discussion, the term "recreation" refers to outdoor recreation or, more specifically, nature-based recreation: leisure activities in which access to and interaction with high quality natural environments are critical to the motivations and satisfaction of participants. Examples include (but are not limited to) hiking, backpacking, mountaineering, camping, bird and wildlife watching, outdoor photography, mountain biking, skiing, hunting, fishing, surfing, canoeing, kayaking and rafting.

Three Washington programs include recreation land acquisition as a primary mandate. The State Parks and Recreation Commission acquires land to expand existing parks and to create new parks, and develops and maintains park facilities. The Washington Wildlife and Recreation Program (WWRP) is the state's largest funding program for local parks and other types of recreation, unique not only in Washington but nationwide, for its variety of funding categories (11) and project evaluation process. The WWRP works to acquire valuable recreation and habitat lands before they are lost to other uses and develop recreation areas for a growing population. The Department of Natural Resources (DNR) funds the acquisition of Natural Resources Conservation Areas (NRCAs) to both protect species habitat and support ecosystem conservation while providing low-impact recreation opportunities to the public. The Department of Fish and Wildlife (DFW) acquires Wildlife Areas and DNR acquires Natural Areas that can provide recreation, but these are included with the species and habitat acquisition indicators. Recreation access and quality, and opportunities for fishing and wildlife viewing are also increased by actions supported by the Puget Sound Acquisition and Restoration Fund.

Outputs

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

- Acres added to existing state parks
- Acres added to WDFW Wildlife Areas
- Acres added to Natural Resource Conservation Areas
- Acres acquired and held for future development as local and state parks and urban wildlife areas
- Acres used for recreation enhanced through environmental restoration
- Number of new WDFW water access sites added
- Area of or number of facilities in which access was enhanced through addition of trails, ADA compliant modifications, boat ramps, etc.

Outcome statements

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

- All socio-demographic groups have equal access to diverse and uncongested recreation opportunities
- Maintain high quality recreation experiences
- Rates of outdoor recreation participation are high and increasing
- Outdoor recreation contributes to health, wellness and environmental learning
- Local and regional economies benefit
- Habitat for native plants and animals is provided and retained over the long term

Literature

By definition, nature-based recreation requires natural settings. Thus, analysis of outcomes from recreation land acquisitions could begin by examining how these acquisitions change the array of recreation experiences available in the area. The Recreation Opportunity Spectrum (ROS) is a well-established tool for classifying and inventorying different types of recreation opportunities, typically via maps generated manually and through digitization by analysts with in-depth knowledge of the region of interest. The ROS allows accurate stratification of outdoor recreation environments by dividing a spectrum of recreation opportunities into broad classes- urban, suburban, rural developed, rural natural, semi-primitive, and primitive (wilderness). Each mapped ROS class is

defined by a particular package of setting attributes, activities, experiences, and benefits. Some managers use seasonal ROS maps where opportunities vary significantly by season. With changes in technology—especially increased availability of remotely sensed data and greater use of GIS—recent studies have focused on better utilization of spatial data to generate ROS maps, e.g., USDA Forest Service 2003a. This is especially true for biophysical setting attributes, although progress has also been made in bringing social recreation data into GIS environments. The ROS and its many variants—including the Water Recreation Opportunity Spectrum (WROS)—have the benefits of being flexible and easy to understand.

Visitation parameters are practical and widely used recreation indicators. Methods for tracking visitor numbers and related factors (group size, activities engaged in, length of stay, etc.) include direct observation via onsite staff or cameras, devices that record and store visits automatically, and counts of visitor registrations or permits. Inferred counts are based on factors such as number of cars at trailheads or parking lots, or amount of visitor impact. An innovative recent methodology employed publicly available social media data (Flickr database of 100 million geo-referenced images) to assess site-specific visitor parameters and values at state parks in Vermont and several popular recreational rivers in Idaho (Hale, 2017).

Commonly-used indicators for recreation experience quality include visitor density (e.g., number of visitors at attraction sites; number of encounters with other visitors on a trail), type of visitors encountered (e.g., hikers encountering mountain bikers), the condition of the natural environment and developed facilities at a site, and overall level of visitor satisfaction. These elements are usually monitored using visitor surveys. Tracking change in experience quality by monitoring satisfaction or acceptability of certain conditions can be complicated by visitor displacement—the tendency of some users to stop using particular sites if conditions there change (e.g., visitation increases) to the point of unacceptability, and be replaced by visitors who are more tolerant of these changed conditions. Use of a numeric standard or reference conditions, e.g., a particular number of persons at one time (PAOT) can help mitigate for this.

The economic outcomes of nature-based outdoor recreation have been examined extensively and are often locally and regionally significant. Economists distinguish between recreation economic *value* and economic *contribution* (Watson et al., 2007). Recreation economic value is a monetary measure of the benefits received by an individual or group directly engaged in an outdoor recreation activity, calculated as the amount they are willing to pay for the activity, minus their costs to engage in it. These direct use values can be used to evaluate change in access or change in quality that might alter types of activities and enjoyment. The US Forest Service Recreation Use Values Database (updated in 2017) can be used to derive average per person, per day values for 14 outdoor recreation activity sets from studies conducted 1958-2015 in numerous locales. These values can be used in combination with local visitation data to derive empirically grounded estimates of recreation economic values for particular recreation areas.

Recreation economic *contribution* measures the gross change in economic activity associated with recreation in an existing regional economy. This measure includes direct spending on lodging, food, fuel, equipment, guide services, etc. and indirect effects via wages and secondary spending supported. To estimate recreation economic contribution, federal land agencies typically aggregate district-level visitor use data with estimates of per capita, per day spending garnered from onsite or phone surveys, e.g., the USFS National Visitor Use Monitoring (NVUM) Program and the US Fish and Wildlife Service USFWS National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. Indirect economic contributions are often assessed with the IMpact analysis for PLANning (IMPLAN) model. Segmenting visitors by trip type— e.g., local-day and local-overnight, and non-local day and non-local overnight trips—allows for better estimates of local economic contribution than segmenting by activity only (White and Stynes, 2008). With some exceptions (e.g., downhill skiing, motorized recreation), the type of recreational activity has much less impact on expenditures than trip type. White et al. (2013, updated version forthcoming) provide key parameters to complete economic contribution analysis for individual national forests. These tools could be adapted for state lands.

Washington's rich endowment of exceptional natural landscapes and the high quality, nature-based recreation they support is widely understood to be a significant factor in attracting new employers and workers to the state. *Amenity migration* is the movement of people based on the draw of natural and/or cultural amenities, and could be

with a benefit of protecting additional natural areas and making them available for nature-based recreation. But quantifying changes in amenity migration, including total employment or wages due to changes to any particular parcel of land or attribute has proven difficult, and is not likely to be separable from the broad suite of factors that collectively attract migrants, including climate, social services and cultural components (Hjerpe et al., 2017).

Public health, wellness, and human quality of life benefits to conserving natural areas have long been recognized. At least some of these benefits fall under the rubric of "recreation" but they also encompass broader issues such as reduced health care costs. Studies assessing health indicators (e.g., obesity) and access to greenspaces commonly find that closer greenspace proximity is correlated with higher rates of outdoor recreation participation and better health. Interest in clarifying and quantifying these benefits continues to grow but establishing causality and linkages to protected areas is challenging due to the many nested and interrelated factors which affect human health. There is a growing evidence base regarding the potential health and well-being benefits of green space and nature-based recreation but the effects are heterogeneous and cannot be summarized as a straightforward exposure-outcome relationship.

Studies examining health outcomes consistently show relationships between recreation opportunities and well-being. Rosenberger et al. (2005), in a study estimating linkages between healthcare expenditures for treatments of circulatory problems, physical inactivity, obesity, and the supply of recreation opportunities in West Virginia, found that counties with more physical activity had higher quantities of recreation opportunities, lower health care expenditures, and lower rates of obesity. Similarly, Rosenberger, Bergerson and Kline (2009), in an analysis of county-level data for Oregon, found a measurable relationship between adult physical activity, overweight, obesity, and recreation supply (trail miles, public land densities, number of recreation facilities) and demand. Biedenweig et al. (2017) empirically demonstrated that a variety of mechanisms for engaging the natural environment, including recreation access, significantly contribute to overall subjective wellbeing, by way of a 13-question survey of 4418 people in the Puget Sound region.

The Florida Communities Trust (FCT) uses 18 public health significant questions out of 60 total—including several specific to outdoor recreation—to assess which land acquisition proposals to fund. Examples include: Will the project provide access to a shoreline or beach and be managed for recreation uses? Will the project enhance or connect local, regional or statewide land-based recreational trail systems by extending an existing trail system or by providing trailhead or trailside facilities? Successful applicants are likely to score higher on these measures, indicating that FCT land acquisitions support public health in Florida (Coutts, 2010). These selection criteria can assess outcomes of completed acquisitions, e.g. the degree to which the acquisition enhances or connects local, regional or statewide trail systems.

In practice

General guidance

- Keep track of visitation – a basic but critical information need. Other recreation outcomes (e.g., health benefits) can be inferred simply by knowing how many people are recreating in an area, and what they are doing. How many people are now using the [newly acquired] area for recreation? How many, and what kinds of recreation experiences does the area support? How are these factors changing over time?
- Actively pursue opportunities to acquire, share and incorporate spatial data for recreation setting attributes and visitation as GIS layers to integrate into an ecosystem service framework for management.
- Key indicators of a parcel's value for nature-based recreation include: proximity to population centers (# of people who will use the area; ease of access, the closer the better), proximity to water, ecological integrity/level of disturbance, degree of ecological and scenic distinctiveness
- When examining economic outcomes, look to USFS research and monitoring for assessment tools and estimators, e.g., the National Visitor Use Monitoring (NVUM) program and spending profiles, and the U.S. Forest Service Recreation Use Values Database.

Outcome measures

Some of the indicators and metrics found in the literature or from identified effective practices are listed in Table 1 (below).

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 outdoor recreation 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.

To understand if acquisition programs are effective at providing additional outdoor recreation opportunities for Washington citizens, it is critical to have a reasonable understanding of the nature, location and amount of outdoor recreation that is occurring. Without this information, it is impossible to understand if acquisitions are making a difference. It can be particularly difficult to obtain this information, especially if there is a focus on underserved communities or creating new opportunities to reduce recreational pressures on very popular areas.

Table 1. Indicators and metrics for recreation outcomes identified in the literature or effective practices

Outcome Measures Category	Indicators and Metrics (units of measurement)	Source(s)
Recreation Supply, Inventory and Access	• # of recreation sites, by type (e.g., campgrounds, picnic areas, attraction sites) • # of miles (e.g., trail or route; coastline of lake, river or ocean) • Amount (e.g., acres, number of campsites) of recreation experience opportunities in each Recreation Opportunity Spectrum (ROS) class, e.g., *semi-primitive, non-motorized* (by ecosystem type, region or planning area) • Amount and kind of ROS experience opportunities added by a particular land acquisition • % total green space (in predefined region) held in public ownership and managed for public access • Median park size in planning area • People served per park acre • % of residents within a 10-minute walk (½- mile) to a park/greenspace OR population unit (e.g., census area) centroid linear distance from park/green space edge • # of new park facilities developed per year, by type of facility • # of existing park facilities improved per year, by type of facility • # of new non-park recreation facilities (boat ramps, trailheads, wildlife viewing platforms, etc.) developed or existing non-park facilities improved per year, by type of facility. • % of visitors and residents rating the access to recreation activities as good or better - total and by activity type • % of recreation sites that meet ADA standards - total and by recreation activity type	More et al., 2003; Aukerman and Haas, 2004; Manning, 2011

Table 1. Indicators and metrics for recreation outcomes identified in the literature or effective practices		
Outcome Measures Category	Indicators and Metrics (units of measurement)	Source(s)
Recreation Participation and Demand	• % of population participating in nature-based recreation. Common outcome measure, assessed via survey, usually broken out by subcategory, e.g. camping, backpacking, boating, wildlife viewing, bird watching; subpopulation (adults, teens, children). • % of participation by population subgroups based on race, ethnicity, gender, socioeconomic status. (A measure for equity of recreation participation.) • % of recreation sites at or above capacity more than X% of the time on high season days - total and by recreation activity type • Park need: Areas farther than 10-minute walk from a park. Prioritize among those areas based on: 1) population density - weighted at 50%; 2) density of children age 19 and younger - weighted at 25%; 3) density of individuals in households with income less than 75% of city median income - weighted at 25%. • # of permits (e.g. fishing, hunting, discover pass/northwest forest pass, wilderness hiking) sold • # of access passes sold per year, per type (Discover Pass, Northwest Forest Pass, etc.) • # of entries in trailhead registers	Manning, 2011
Recreation Experience Quality	*Visitor satisfaction* • % of visitors that report being satisfied or very satisfied with their overall experience • % of visitors that report being satisfied or very satisfied with components of their recreational experience: 1) quality of facilities, 2) quantity of facilities, 3) access, 4) safety, 5) trail condition, 6) signage adequacy, 7) condition of environment, 8) range of recreation activities available. • % of visitors who report seeing wildlife; #of sightings *Visitor density and related measures* • People At One Time (PAOT) at attraction sites: actual number vs. established standard, change over time • Persons Per Viewscape (PPV) • Vehicles Per Viewscape (VPV) • Encounters (per hour, per day) with other groups (e.g., along a trail): actual number vs. established standard • Percent of time/days a site is at full capacity (e.g., parking lot full, campground full, all picnic sites in use.) • Amount of visitor impact (indirect indicator Percent of visitors feeling “very crowded” or “extremely crowded” using 9-point crowding scale: 1 = not at all crowded; 9 = extremely crowded • # or % of reports of visitor conflict • Evidence of visitor displacement *Condition of facilities; visitor impacts* • % of campsite that is bare ground • # of pieces of litter per unit area, or mile of trail	Manning, 2011; Hale, 2017

Economic Outcomes of Recreation	*Recreation economic contribution* • Direct expenditures by participants • Total business sales generated • # of jobs supported – full time, part-time, all year, seasonal *Recreation economic value (benefits received by an individual or group directly engaged in an outdoor recreation activity)* • Consumer surplus value per day, by recreation activity	Watson, et al., 2007; Manning, , 2011; Hjerpe et al., 2017; Rosenberger et al., 2017
Recreation Health and Quality of Life Benefits	• Requires survey to represent indicators for monitoring human wellbeing associated with environmental restoration (e.g., 13 question survey of Biedenweg et al., 2017)	Coutts, 2010; Manning, 2011; Biedenweg et al., 2017
Sustainable Development/Smart Growth	• [Degree to which a] project provides recreational opportunities and open space areas that direct residential and commercial development away from a coastal high hazard area or a 100-year flood plain, or in ways that reduce sprawl • % of lands permanently safe from development	Coutts, C. 2010.

Citations

Baron, J.S., N.L. Poff, P.L. Angermeier, C.N. Dahm, P.H. Gleick, N.G. Hairston, R.B. Jackson, C.A. Johnston, B.D. Richter, and A.D. Steinman. 2002. Meeting ecological and societal needs for freshwater. *Ecological Applications* 12: 1247–1260.

Behan, J., L.J. Gaines, J.S. Kagan, M. Klein, M., and L. Wainger. 2017. Outcome Measures for Habitat and Recreation Land Acquisition and Regulatory Programs: A Science-based Review of the Literature. Institute for Natural Resources, Oregon State University, Corvallis, Oregon.

Bernhardt, E.S., M.A. Palmer, J.D. Allan, G. Alexander, K. Barnas, S. Brooks, J. Carr, S. Clayton, C. Dahm, J. Follstad-Shah, D. Galat, S. Gloss, P. Goodwin, D. Hart, B. Hassett, R. Jenkinson, S. Katz, G.M. Kondolf, P.S. Lake, R. Lave, J.L. Meyer, T.K. O'Donnell, L. Pagano, B. Powell, and E. Sudduth. 2005. Synthesizing US river restoration efforts. *Science* 308:636–637.

Busse, L., Kimball, W., and J. Kiddon. 2012. Using an automated water quality report card system from the east coast on the west coast - a successful implementation. Presentation to the National Water Quality Monitoring Council Conference. May. https://acwi.gov/monitoring/conference/2012/G1/G1Busse20120413.pdf

Dale, V.H. and S.C. Beyeler, 2001. Challenges in the development and use of ecological indicators. *Ecological Indicators* 1: 3-10.

Davies, S.P., and S.K. Jackson. 2006. The biological condition gradient: a descriptive model for interpreting change in aquatic ecosystems. *Ecological Applications* 16:1251–1266.

Diefenderfer, H.L, G.E. Johnson, R. M.Thom, K.E. Buenau, L.A. Weitkamp, C.M. Woodley, A.B. Borde, and R. K. Kropp. 2016. Evidence-based evaluation of the cumulative effects of ecosystem restoration. *Ecosphere* 9(3): e01242. DOI: 10.1002/ecs2.1242.

Doren, R.F., J.C. Trexler, A.D. Gottlieb and M.C. Harwell. 2009. Ecological indicators for system-wide assessment of the greater everglades ecosystem restoration program. *Ecological Indicators* 9s:s2-s16.

Hartema, L., J. Latterell, H. Berge, D. Lantz, and C. Gregersen. 2014. *Lower Boise Creek Channel Restoration Project 2013 Monitoring Report*. King County Department of Natural Resources and Parks Water and Land Resources Division. Seattle, Washington. http://your.kingcounty.gov/dnrp/library/water-and-land/habitat-restoration/lower-boise-creek/boise-creek-monitoring-report-2013.pdf.

Hijuelos, A.C. and D. Reed. 2013. *An Approach to Identifying Environmental and Socio-Economic Performance Measures for Coastal Louisiana*. The Water Institute of the Gulf. Funded by the Coastal Protection and Restoration Authority under Task Order 9 Contract No. 2503-12-58. Baton Rouge, LA.

James, C. A., J. Kershner, J. Samhouri, S. O'Neill, and P.S. Levin. 2012. A methodology for evaluating and ranking water quantity indicators in support of ecosystem-based management. *Environmental Management* 49: 703-719. doi:10.1007/s00267-012-9808-7

Keeler, B.L. S. Polasky, K.A. Brauman, K.A. Johnson, J.C. Finlay, A. O'Neill, K. Kovacs, and B. Dalzell. 2012. Linking water quality and well-being for improved assessment and valuation of ecosystem services. *Proceedings of the National Academy of Sciences* 109(45): 18619-18624. doi:10.1073/pnas.1215991109

Margoluis, R., C. Stem, V. Swaminathan, M. Brown, A. Johnson, G. Placci, N. Salafsky, and I. Tilders. 2013. Results Chains: a Tool for Conservation Action Design, Management, and Evaluation. *Ecology and Society* 18(3): 22.

Niemi, G. and M.E. McDonald. 2004. Application of ecological indicators. *Annu. Rev. Ecol. Evol. Syst*. 35:89–111.

Olander, L.P., R.J. Johnston, H. Tallis, J.S. Kagan, L. Maguire, S. Polasky, D. Urban, J. Boyd, L. Wainger, and M. Palmer. In review. Benefit relevant indicators: Ecosystem services measures that link ecological and social outcomes. *Ecological Indicators*.

Olden, J. D., and R. J. Naiman. 2010. Incorporating thermal regimes into environmental flows assessments: modifying dam operations to restore freshwater ecosystem integrity. *Freshwater Biology* 55: 86–107.

Palmer, R. N., and R. M. Snyder. 1985. Effects of Instream Flow Requirements on Water Supply Reliability. *Water Resources Research* 21: 439–446.

Paulsen, S.G., A. Mayio, D.V. Pecik, J. L. Stoddard, E. Tarquino, S.M. Holdsworth, J. Van Sickle, L.L. Yuan, C.P. Hawkins, A.T. Herlihy, P.R. Kaufmann, M.T. Barbour, D.P. Larsen and A.R. Olson. 2008. Condition of stream ecosystems in the US: an overview of the first national assessment. *Journal of the North American Benthological Society* (27)4: 812-821.

Roni, P., G. Pess, T. Beechi, and S. Morley. 2010. Estimating changes in coho salmon and steelhead abundance from watershed restoration: How much restoration is needed to measurably increase smolt production. *North American Journal of Fisheries Management* 30(6): 1469-1484.

Sawhill, J.C. and D. Williamson. 2003. Mission impossible? Measuring success in nonprofit organizations. *Nonprofit Management and Leadership* 11(3): 371-386.

Stahlnaker, C.B., and E.J.Wick. 2000. "Planning for flow requirements to sustain stream biota." Inland flood hazards: Human, riparian, and aquatic communities, E.E. Wohl, ed., Cambridge University Press, London.

Tallis, H., and P. Kareiva, M. Marvier, and A. Chang. 2008. An ecosystem services framework to support both practical conservation and economic development. *PNAS* 105(28): 9457-9464.

Thom, R. and L.K. O'Rourke. 2005. *Ecosystem Health Indicator Metrics for the Lower Columbia River and Estuary Partnership*. A report by Battelle Marine Sciences Laboratory for the Lower Columbia River and Estuary Partnership. PNWD-3536. Sequim, Washington.

Turnhout, E., M. Hisschemöller, and H. Eijsackers. 2007. Ecological indicators: between the two fires of science and policy. *Ecological Indicators* 7(2): 215-228.

Willis, A.D., A.M. Campbell, A.C. Fowler, C.A. Babcock, J.K. Howard, M.L. Deas and A.L. Nichols. 2016. Instream flows: New Tools to Quantify Water Quality Conditions for Returning Adult Chinook Salmon. *Journal of Water Resources Planning and Management* 142: 04015056.

Wortley, L., J.M. Hero, and M. Howes. 2013. Evaluating ecological restoration success: A review of the literature. *Restorative Ecology* 21(5): 537-543.