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**Social Science, Economics, and Making Science Relevant:
The Puget Sound Social-Ecological System**

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Abstract: The Pacific Northwest region faces urgent and large-scale social-ecological challenges – such as declining forest and Puget Sound health. Such concerns were once addressed primarily as biophysical conditions and dynamics. Yet the urbanized condition of much of the region demands co-implementation of human dimensions and social science knowledge to address ecosystem health, conservation, and recovery. The various disciplines of the biophysical sciences aid our understanding of ecological health and function at different scales, ranging from the individual organism, to populations, to inter-species interactions, then to biome based associations of species. The social sciences likewise include an array of disciplines that address human and social systems at different scales. Psychology, sociology, anthropology, economics, and political science are but a few of the social science disciplines that offer insight about human systems ranging in scale from the individual, to small groups, to organizations, to entire cultural societies, and the interactions and interdependencies across these entities. Social science disciplines offer traditions of research and theory that are both directly and indirectly associated with environment and natural systems. Three general topics were shared in the presentation and are described more fully in this article: **1) Research Applications:** It is important to clarify two major contributions of social science in ecosystem recovery. Social science can be applied as a set of indicators in order to monitor the human consequences of an ecosystem. A system of measures can then be used to periodically assess the health and well being of a certain human population. Social science can also address the social change that is needed to address human effects on ecosystems. Altering the current trajectories of human behaviors and systems are often necessary for substantial ecosystem change, and social science can contribute to this large-scale process, **2) Research Precedents:** There are key theories and knowledge sets that can be applied to achieve social change for ecosystem recovery. Evidence-based principles have been derived from experimental, case study, and other analytic assessments. A review of strategic applications will be provided, and **3) Social Scales:** Theory and applications of social change for the environment will be reviewed across the scales of human systems. How might social science be applied for ecosystem recovery in ways that range across the social scales of household behaviors to institutional policy making? The three topics will be presented with a focus on the context of Puget Sound recovery, while recognizing that other large water ecosystem situations can provide insights.

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The Puget Sound Science Update was published on-line in April 2011 and represents the state-of-the-science supporting the work of the Puget Sound Partnership (PSP) to restore and protect the Puget Sound ecosystem. The Puget Sound Science Update represents advancement in the development and use of science to support Puget Sound recovery, as its content will be periodically revised to reflect the latest research, then shared widely.

The initial Update was a starting point, envisioned as an ongoing process to synthesize scientific information about the lands, waters, and human social systems within the Puget Sound basin. The Puget Sound Partnership has committed to using the Update as a ‘one stop shopping’ location for scientific information—thus, it will be key to ensuring that credible science is used transparently to guide strategic policy decisions. As the document matures, it will become a comprehensive reporting and analysis of science related to the ecosystem-scale protection and restoration of Puget Sound.

The biophysical aspects of the Puget Sound ecosystem are addressed in Chapter 2A of the Puget Sound Science Update, as well as Chapters 4, 5, and 6 in the Puget Sound Science Review. The social dimensions are addressed in Chapters 1B and 2B.

Chapter 2B – The Socio-Economic Condition of Puget Sound, was not completed and is now available as a brief outline. A new writing effort is underway to complete the chapter. This article provides background information on a new focus for the chapter, and includes preliminary content. Section I contains initial ideas for an organizing framework about the role of social science in Puget Sound recovery. Sections II and III then offer preliminary outlines of the research that has, and could be done to better understand how human systems both contribute and benefit from ecosystem recovery.

I. Framework for the Role of Social Science Knowledge in Puget Sound Recovery

A. Puget Sound - A Social-Ecological System

The escalating pace of environmental change suggests that new scientific approaches are needed to both assess effects and evaluate potential solutions (Ender-Wada et al. 1998). Mainstream ecology has often intentionally detached biophysical processes from human systems, and many social science disciplines have resisted the influences of environment and limited research scope to human activity and systems. A broader integration of what were once thought to be separable scholarly domains is now needed. An interdisciplinary approach to the problems of environmental management and sustainable development is becoming increasingly obvious. Figure 1 depicts the interactions of social-ecological systems. Recent concepts about coupled human and natural systems will guide development of the PSP Science Update chapter on human

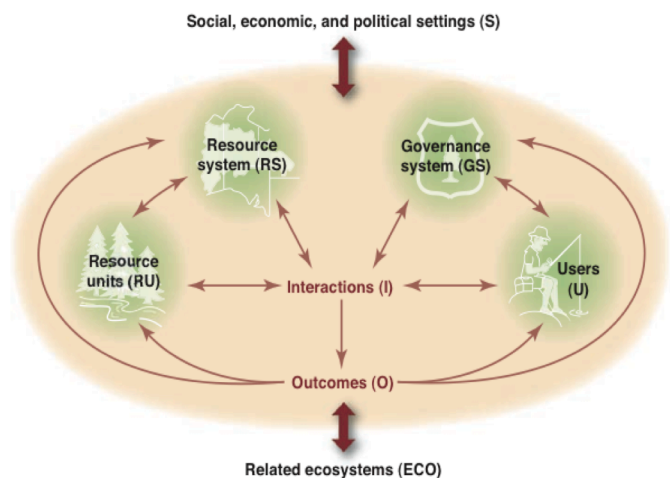


Figure 1: Social-ecological systems (Ostrom 2009)

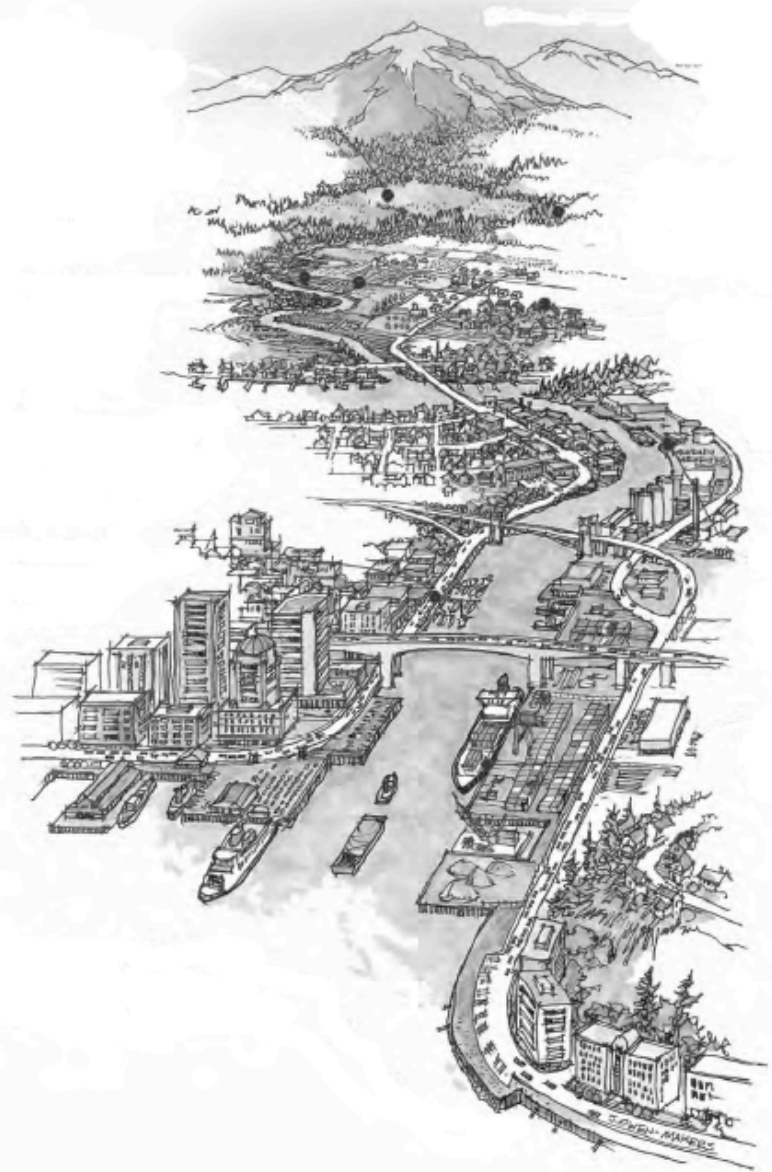
dimensions. The summary and synthesis of prior social science studies will be presented in reference to recent theories about *social-ecological systems*.

B. Place-Based Knowledge and Action for Recovery

The identity, values, and quality of life in the Puget Sound region are deeply connected to the environment. The region's abundant natural resources have been used for industry and employment, and land, water, and forests have been developed to provide the region's cities, homes, and businesses.

Growth and development in recent decades has created a heterogeneous landscape system in terms of 1) endemic ecology and biodiversity, 2) settlement patterns, 3) socio-political jurisdictions and governance, and 4) resident human populations in terms of culture, demographics, and dependence on the Puget Sound. Figure 2 is an illustration of the complexity of land use, land cover, settlement, and Puget Sound health influences across a typical landscape gradient within the basin (adapted from Puget Sound Regional Council 2009, p. 9).

Regional changes have caused a wide range of environmental impacts, many having influence on Puget Sound health. Changes in land cover have led to damaged habitat and ecosystems, contaminated lands and waterways, and contributed to polluted air. The increase in pavement and other impervious surfaces has intensified flooding and erosion. Polluted sediment has affected a host of plants and animals with toxins moving through the food chain.



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Biophysical sciences have contributed better knowledge about the effects of various land use conditions on ecosystems and how natural systems function. Meanwhile, there is a general public appreciation of the role the environment plays in personal well-being, water quality, economic prosperity, food production, recreational opportunities, visual and aesthetic features, sense of place,

and overall quality of life. Social science offers two major opportunities to integrate biophysical and social research. First, theory and methods can support targeted investigations about how human systems processes can contribute to ecosystem recovery, generating studies that range in scale from individual behaviors to institutional analysis. A second major category of study is to understand baseline conditions of human health and well-being associated with Puget Sound health, and devise monitoring indicators that provide feedback concerning recovery efforts.

C. Human Dimensions Systems and Scales

The biophysical studies of the Puget Sound have addressed the ecosystem at variable scales – from organism to species population to ecological associations to large-scale ecosystem modeling. Studies of the social dynamics also consider human populations and their respective influences at a variety of scales – from individuals and households, to communities (geographic and activity-based), to jurisdictions, and ranging up to institutions. In a general way, a ‘food web’ metaphor also portrays the various scales and inter-relationships of human actors within the Puget Sound basin.

Identification of such systems is important in order to first assess the extent of current social science, then to consider how future science might be framed and conducted to effect Puget Sound recovery. The success of policy and programs concerning environmental health and restoration are dependent not only on governmental authorities and policy but are also reliant on commitments of individuals, communities, and informal and formal institutions. Table 1 is an initial effort to specify the various roles and governance systems that influence Puget Sound health. Once this interplay of human activity and effects are assessed within the current research literature, then attributes and indicators can be proposed (the now empty third column) to monitor human dimensions as both cause and effect in ecosystem recovery.

II. Research Outline on the Social Processes of Puget Sound Recovery

Several reports propose social science research frameworks for marine protected areas or coastal zones (Hanna et al. 2009; Luton and Cluck 2000). Below is a sweeping outline of social science research themes and topics that address human agency and directed activity concerning Puget Sound ecosystem recovery (adapted from Wahle et al. 2003).

This outline is a preliminary framework serving to aid the sorting and classification of published research. Each line item statement represents a potential assessment or analysis. As Chapter 2B is being written publications about studies that were specific to the Puget Sound will be included, as well as studies from other large water systems that are relevant to Puget Sound recovery.

A. Governance, Institutions and Processes

1. interactions of state & federal agencies - including regulatory and non-regulatory authorities and capacities
2. tribes – acting as local communities, local governments, and sovereign nations
3. jurisdictional structure – examination of intra- and interagency, tribal, and intergovernmental interactions and relationships to Puget Sound; examination of governmental and administrative domains including incompatibilities, inconsistencies, and potential conflict
4. environmental protection and ecosystem recovery policy – programs and resources; perhaps include regulatory analysis

Table 1: Roles, Governance, and Effects at Various Human Scales

	Roles	Activities/ Effects	Attributes/ Indicators
state & federal agencies	legislators policy makers scientists	governance incentives/regulations knowledge building	
multi-jurisdiction landscape unit	watershed councils tribes conservation NGOs	planning local benchmarks 'brokering'	
local government city/county	elected champions infrastructure professionals land use planners	political feasibility 'grounding' best practices development technical solutions	
communities of practice business sector	design firms commercial/industrial resource dependent communities	best practices goods and services production sustainability programs	
neighborhood	schools civic organizations associations	civic engagement social networking	
households/ individuals	residents visitors homeowners	awareness behavior adoption stewardship	
social unit of analysis			

5. institutional analysis – governmental and major non-governmental institutional cultures and how they influence or constrain needed actions
6. political ecology – legislative, social, environmental, and economic dimensions of decision-making; legal and historic frameworks that define the ‘rights and responsibilities’ of stakeholders concerning Puget Sound

B. Cultural Heritage and Resources

1. general cultural, heritage, and significant resources (such as places, artifacts, built structures, historic events)
2. understanding population-specific resources (addressing legacy and/or place attachment)
3. entities that steward and/or celebrate both tangible and intangible resources
4. traditional and local ecological knowledge about biophysical elements (species, habitats, places)

5. validation and incorporation of traditional and local knowledge into formal management frameworks

C. Historic and Future Land and Resource Use Patterns

1. patterns of human use and resource management from prehistoric to present time
2. development and land use guidance – Growth Management Act, development code and ordinances that acknowledge Puget Sound
3. vernacular land uses in sensitive areas such as shorelines
4. recreational uses and impacts
5. human ecology and geography of resource dependent industries – extractive and non-extractive

D. Organizations, Associations, and Firms

1. non-governmental organizations committed to Puget Sound (e.g. communities of practice, including business sectors & networks, foundations, NGOs); leadership, economic condition and program mission
2. multi-jurisdiction units, including watershed groups, local integrating organizations, PSRC, and NW Straits Commission (merit a separate section?)
3. capacity, interaction, and influence concerning recovery goals; membership representation, political
4. design and testing of recovery and sustainability innovations – structural (e.g. LEED), legal strategies for land and water, resource practices (e.g. fishing bycatch)
5. economic flows that support (or diminish) Puget Sound resource units and systems
6. assessing public and private investments in protection and restoration of functions and services — source of funding, amounts expended, use/benefit of funds, distribution issues

E. Economics of Ecosystem Recovery

1. baseline information – baseline and ongoing monitoring of resource use (such as commercial and recreational fisheries), shoreside support industries, coastal communities and associated infrastructure, coastal development, Puget Sound related tourism and recreation, other non-consumptive uses
2. cost-benefit analysis – considerations of basic groups (recreation, tourism, industry); alternative scenarios, cultural values
3. non-market values – use and non-use, ecosystem services; bequest, existence, and option values
4. trade-offs – goal development and decisions, stakeholders
5. environmental and context variability – incorporation of ecological and land use variability into economic analysis and monitoring

F. Communities and Local Jurisdictions

1. characteristics of geographic and stakeholder communities having variable functions and relationships with Puget Sound (e.g. Poulsbo vs Issaquah)
2. management structure and processes; including regulatory and non-regulatory authorities and capacities
3. degree of resource dependence, use, and management practices
4. socioeconomic, social, and cultural profiles of communities concerning Puget Sound recovery; community size and economic base

5. capacity and skills to develop and implement best practices; program resiliency; compliance; innovation and adaptation
6. information flow and use (resource availability, technical knowledge) within and among communities; network analysis
7. influence of Puget Sound system wide policy and management ‘edicts’ on local communities
8. lessons learned; successes and failures; case studies
9. systems view of social capital (focus of the Social Capital Index)

G. Stewardship Capacity and Participation

1. individuals/households (focus of the Sound Behavior index) – sustainability behaviors, benefits and barriers of lifestyle and civic environmental stewardship
2. neighborhoods and local, self-organizing groups – social commitment and cohesion associated with recovery needs
3. motivations for land care – biophysical, social, sense of place
4. environmental ethics – individuals’ and communities’ principles and norms regarding the environment

H. Knowledge, Attitudes, Perceptions, and Beliefs

1. baseline data – Puget Sound condition knowledge, human responses to habitats, species, places, ecological processes
2. underlying motivations that influence human preferences, choices and actions
3. factors that shape human behavior
4. relationships of how behaviors affect and are affected by Puget Sound quality
5. uncertainty and attribution – extent to which people take responsibility for actions; perceptions of causes and effects of such actions, including understandings of Puget Sound impacts
6. role of aesthetic ideals in shaping human-environment interactions

III. Research Summary on Social, Community, and Economic Outcomes

The first outline of Chapter 2B largely focused on socio-economic indicators that serve as outcomes measures; they represent consequences for populations of citizens that benefit from Puget Sound health and recovery. The central question underlying this potential collection of studies is, ‘what do people gain or how do they benefit from the Puget Sound, and how might that change with ecosystem recovery?’ There are two possible (and likely intertwined) ways to provide measures, and thus indicators, for this question.

Ecosystem services is a concept that is gaining greater attention as a strategy to integrate considerations of ecosystem function and associated benefits for human populations. Since the publication of the Millennium Ecosystem Assessment (2005) there has been increased effort to develop more knowledge about ecosystem services across landscape gradients that span from wildland to rural to urbanized settings. While there are several precedents for socio-economic assessments in the Puget Sound basin to date, a focus on ecosystem services (particularly *cultural services*) could provide a coherent set of priorities to guide social indicator development (such as Quality of Life).

Another approach is to pursue sets of social indicators of human well-being. Schneider and Plummer (2009) conducted an extensive review of the concept of human well-being within the context of the Puget Sound basin. At this time, across the well-being literature, there is a range of frameworks concerning how well-being benefits are assessed and who assesses them – experts or stakeholders. In addition indicator measures for humans (unlike many other species) may be objective (gathered by observation or other forms of impersonal measurement) or subjective (seeking information from individual responses, often using surveys or interviews).

This article describes preliminary thoughts and efforts about Chapter 2B of the Puget Sound Science Update. Two major domains of social science are being assessed for the science review: 1) better understanding of how human and social systems can be or are engaged in the process of ecosystem recovery, and 2) the positive consequences for individuals and communities of improved ecosystem condition. The completed work will be a starting point for dynamic discussions and revisions about the important contributions of social science to Puget Sound ecosystems recovery.

IV. References

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