Recommended Social Indicators for Puget Sound Partnership: A report summarizing lessons from three local case studies

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Kelly Biedenweg, PhD, Puget Sound Institute, UW Tacoma

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Summary

The Puget Sound Partnership (PSP) is tasked with coordinating restoration of the Puget Sound to enhance healthy human populations and quality of life. One way the partnership monitors the status of these goals is through the Vital Signs, which currently have a placeholder for a quality of life index. This document summarizes research in three local areas using stakeholder processes and scientific literature review to identify common attributes of human wellbeing and quality of life and associated indicators that could serve as effective Vital Signs.

Since 2012, a research team led by the Puget Sound Institute collected data in the Hood Canal watershed, the Puyallup watershed, and Whatcom County. With the support of graduate students and several local and PSP collaborators, we conducted literature reviews and stakeholder interviews to develop potential indicators of human wellbeing related to natural resources relevant to the watershed/county. We then held 2-3 stakeholder workshops in each watershed/county to refine and rank the indicators, recommending indicators for each area categorized into human wellbeing domains:

- physical health
- psychological health
- environmental governance
- social wellbeing
- cultural wellbeing
- economic wellbeing

This document combines the results from these three studies with similar work conducted in Puget Sound tribes to recommend a short list of potential human wellbeing indicators for Puget Sound. These recommendations are intended to support completion of the Partnership's selection of Vital Sign indicators of Healthy Human Populations and Human Quality of Life.

Recommended Indicators of Human Wellbeing

Domain	Attribute	Indicator
Cultural	Cultural Events	Number of opportunities and % of residents who participate in natural resource-inspired cultural activities (such as salmon homecoming, farmers market, outdoor recreation events, etc.)
	Cultural Practices	% of residents who feel they are able to maintain cultural practices associated with natural resources
Social	Trust	% of residents who trust people in their immediate and broader communities (2-3 levels)
	Community Cohesion Index	Frequency of outdoor activities with friends/family
		Frequency of working with other community members to steward environmental resources, prepare cultural events, or solve problems
		Ability to get sufficient natural resources from formal and informal networks
Psychological	Safety	% of residents who feel safe in their neighborhood, open spaces and natural areas
	Sense of Place	% of residents who express a positive connection to the region
		% of residents who express (or nurture) a sense of stewardship for the watershed

	Positive emotions	% of residents who describe experiencing positive feelings/emotions from being in nature, such as awe, inspiration, fulfillment, appreciation, solitude, relaxation, sense of peace and reflection
	Subjective Wellbeing	Average response to overall life satisfaction question
Physical	Outdoor Activity	% of households within 1/2 mile of parks, urban plazas, public courtyards, community gardens or trailheads (10miles rural)
		Average number of hours per week of outdoor activity (by activity: outdoor work, gardening/farming, walking, bicycling, swimming, etc.)
	Air Quality	Number of moderate air quality days in urban and rural areas per year
	Drink water	% of drinking water tests results comply with appropriate standards
	Healthy Foods Index	Average household distance to fresh produce (personal farm, grocery store, farm stand)
		Availability of commonly harvested food species
		# shellfish bed closures per year
Economic	Natural resource-based industry	% of regional economic activity that is from natural resource-based industries: agriculture, commercial shellfish, commercial fishing, timber, non-timber products and tourism
	Natural resource-based jobs	Number of living-wage jobs by resource-based industry categories
		Unemployment rate in natural resource-based jobs
Governance	Trust in Government	% of residents who trust local and regional government to make the right decisions to protect natural resources
	Democratic Engagement	% of residents who feel they have the opportunity to influence natural resource decisions if they wanted to
	Representativeness	Diversity of perspectives and participants in natural resource decision-making (advisory boards, councils, etc.)
		% of residents who feel represented by community and government leaders (see themselves reflected in leadership)
	Stewardship	Percent of participants engaging in a natural resource stewardship activity/year
		# of natural resource development projects

Background

The Puget Sound Partnership (PSP) is a state agency tasked with coordinating the recovery of the Puget Sound basin from "mountain tops to white caps". This geographical area encompasses 14 watershed areas organized into 9 Local Integrating Organizations. Monitoring the status of Puget Sound restoration is done via 21 Vital Signs (Figure 1) grouped by the six legislatively mandated goals (Box 1). For the majority of these Vital Signs, indicators and data sources have already been identified and are monitored on a biannual basis. The Quality of Life Vital Sign, however, is a placeholder which has not been developed. Because quality of life is a broad concept that encompasses aspects of healthy human populations, the development of this Vital Sign may also suggest slight modifications to the structure of the Vital Signs associated with the Healthy Human Population and Quality of Life goals.

Box 1:
Quality of Life and healthy human population Vital Signs specifically address the first two goals of the PSP's mission (Puget Sound Partnership 2014):

- Healthy people are supported by a healthy Puget Sound
- Our quality of life is sustained by a healthy Puget Sound
- Species and the web of life thrive
- Habitat is protected and restored
- Rivers and streams flow at levels that support people, fish, and wildlife
- Marine and fresh waters are clean.

Developing robust indicators for healthy human populations and quality of life not only results in measures of progress toward these goals, it improves overall Puget Sound recovery strategies by identifying the human issues that are relevant and critical for long-term success. A balanced view of recovery that includes human wellbeing and drivers of human behaviors will encourage the consideration of factors that can facilitate or hinder lasting maintenance of ecosystem conditions. Put simply, since the Puget Sound is a social-ecological system with a history of interrelationships between the human and natural world, it is critical to consider both the human and ecological aspects in its recovery. Thus, the human Vital Signs have the dual purpose of monitoring progress toward overall recovery goals and guiding the development of effective recovery strategies.

Figure 1. Puget Sound Partnership Vital Signs. Quality of Life (yellow arrow) is the targeted Vital Sign for this report, although because of it's multi-faceted nature it may suggest modifications to the structure of existing Healthy Human Population and Human Quality of Life Vital Signs in general (blue arrows).

Methods

Study Areas

The study team approached the development of potential Vital Sign indicators by using stakeholder processes in three local areas diverse in their ecology, natural resource industries, and human demographics (Table 1). Stakeholders included both experts in various fields of human wellbeing (i.e., public health and economic development agencies) and community members dedicated to an aspect of human wellbeing related to the environment. Focusing on three areas allowed us to ensure that diverse social-ecological relationships would be taken into consideration while testing whether there were similarities at a local scale that would support basin-scale recommendations. We worked in the Hood Canal, a rural fjord with fisheries, tourism, agricultural and timber industries benefitting three counties and two tribes; the Puyallup Watershed which includes the urban center of Tacoma as well as the agricultural valleys and forests on the western slope of Mt. Ranier; and Whatcom County, a region with a growing urban population and strong rural communities that rely on agriculture, fisheries and timber natural resource economies.

Table 1. Geographical and socio-political comparison of the three areas.

	Hood Canal Watershed	Puyallup Watershed	Whatcom County
Area	68 miles long	1050 sq. miles	2,500 sq. miles
Population	~72,000	~420K	~200K
# incorporated towns	1	17	7
Tribes	-Skokomish -Port Gamble S'Klallam -Jamestown S'Klallam -Lower Elwha Klallam -Suquamish	Puyallup Muckleshoot	Nooksack Lummi
Counties	Jefferson Mason Kitsap	Pierce King (small part)	Whatcom
Primary natural resource industries	Fishing, Shellfishing, Tourism, Agriculture, Forestry	Forestry, Agriculture, Fishing, Tourism	Agriculture, Mining, Industrial, Fishing, Forestry
Collaborating group	Hood Canal Coordinating Council	Puyallup Watershed Initiative	Whatcom County

Case Studies vs. Basin-Wide Study

There are always tradeoffs in choosing methods. Here we highlight the consequences of our having conducted three independent case studies as opposed to one basin-wide process. We chose to focus first in Hood Canal because there was local interest in implementing wellbeing indicators and general agreement within PSP that the development of wellbeing indicators needed to be tested at a smaller scale than the entire basin due to the high demographic and lifestyle variability around Puget Sound. Additionally, best practices in social science suggest that the more interactive the conversation, the more likely we can develop relevant, politically supported indicators. We believe this was true in Hood Canal and thus chose to replicate the same process in the Puyallup Watershed and Whatcom County. Overall, we believe this significantly increased buy-in and relevance of the indicators, but it also resulted in two specific downfalls.

First, the indicators developed at the watershed/county scale were specific to that watershed or county (although participants were aware of the overall project goals). As such, we are making an assumption that the indicators developed for Whatcom, Hood Canal and Puyallup can be scaled in a meaningful way to represent overall relationships within the Puget Sound. We do not believe this is an unreasonable assumption compared to the

benefit of the quality provided by a more local, stakeholder process. Probably more important to consider, however, is that we do not have quantitative ratings for the same indicator in all three regions. As a result, we are relying on qualitative comparisons of the recommended attributes and indicators from each workshop and the conversations surrounding those recommendations to summarize preferences across the regions. While having identical indicators in all eight workshops would clearly have made the final comparisons easier, they may also have limited our ability to provide locally-specific indicators to the collaborating agencies.

Conceptual Framework

To frame the discussion, we first developed a conceptual framework about human wellbeing related to the environment. This is a new and growing field, and thus there is no one correct way to define or organize thoughts around how human wellbeing relates to the natural environment. We developed a framework that incorporated some of our best knowledge in the social sciences as well as the work of others who have looked at human wellbeing in general (Biedenweg et al. *in review*). This framework began with seven domains that have been demonstrated in various fields of the social sciences to influence overall human wellbeing: Physical health, Psychological health, Spirituality, Cultural health, Social cohesion, Governance of natural resources, and Economic health related to natural resources-based industries. In the indicator development process and after further review of other frameworks, we learned that spirituality had too few potential indicators to make its own domain, and that most wellbeing frameworks incorporate spiritual components into psychological and cultural domains. Thus, we stuck with six domains to frame our discussions (Figure 2). Within each domain of the framework, up to six attributes were identified that further describe the domain (see Table 4). For example, Cultural Heritage and Traditional Resource Practices were identified as attributes as Cultural wellbeing. Indicators were then identified to measure the health of each attribute and domain. The development of attributes and indicators is discussed in detail below.

Figure 2. Human Wellbeing Framework diagram used to guide thinking of indicators of human wellbeing in six domains: Psychological, Social, Cultural, Physical, Economic and Governance.

At various times during the project, there were questions about whether we should be developing measures of overall human wellbeing rather than measures of wellbeing that are specific to the environment. We chose the latter for two primary reasons. First, the PSP's mandated goals refer to healthy human populations and their quality of life "supported by a healthy Puget Sound". To develop the most direct measures of this goal, we chose to focus on those predictors of wellbeing specifically related to the natural environment. Second, measuring overall human health and wellbeing are already within the purview of public health agencies. We do not want to duplicate these efforts, although employing their relevant existing data was definitely considered in this process.

Data Collection and Analysis

To test similarities across the three regions, we conducted three independent case studies to develop indicators of human wellbeing relevant to the region. We used essentially the same methods in each of the three regions, attempting to streamline and simplify as possible along the way. In the Hood Canal, we reviewed seven documents summarizing regional research on stakeholder values and interviewed 19 stakeholders, using a snowball sampling technique (Table 2) (Biedenweg et al. 2014). The interviews focused on the question "How does the Hood Canal environment contribute to your wellbeing?" The first two interviewees were recommended by the regional collaborating agency, the Hood Canal Coordinating Council, and subsequent interviewees were identified at the end of each interview by asking for recommendations of people who think differently about their relationship to the environment. A full list of participant demographics is provided in Appendix I. All documents and interviews were coded to identify potential attributes for each of the six domains by two researchers (Biedenweg et al. 2014). We stopped interviews once no new ideas were emerging for the attributes.

Table 2. Data collection statistics from the three regions.

	Hood Canal Watershed	Puyallup Watershed	Whatcom County
# Interviews	19	3	24 +15-person focus group
# Documents reviewed	7	69*	22
#potential indicators provided at workshop	98	103	103
# workshops	3	2	3
# workshop participants	32	26	28

*includes summaries of Communities of Interest meetings where participants shared values associated with the watershed

We then derived the wording for specific indicators for each attribute from a synthesis of social indicators from the Puget Sound region (Hanein and Biedenweg 2012). This resulted in 380 potential indicators relevant to Hood Canal, a number too large to present to stakeholders for feedback. An internal research team made up of the University of Washington researchers and collaborating agency staff ranked this list by Relevance and Importance (see Box 2 for criteria definitions) to come up with a final list of 98 indicators that were presented to local residents in three identical workshops. We held three workshops for two reasons: 1) to achieve better geographic representation by providing locations closer to people's homes and 2) to replicate the workshops to reduce the possibility that group dynamics were the sole factor in final recommendations.

Box 2.
Criteria Used for Rating Indicators

Relevance: An indicator is relevant when it is meaningful to stakeholders and reflective of management priorities.
Importance: An indicator is important when it provides unique added value to the existing list of indicators, rather than being redundant.
Practicality: An indicator is practical when data are readily available or easy to collect.
Robustness: An indicator is robust when it theoretically and practically represents what it is trying to measure.

Thirty-two participants worked in facilitated small groups focused on 1-2 domains to refine and rank a maximum of ten indicators relevant and important to the Hood Canal for their domain. Indicators were organized within domain by up to six attributes identified through the preliminary research. Participants were welcomed to eliminate, combine, or add indicators or attributes. The facilitators took notes of conversations that took place in all groups and this information was taken into consideration when summarizing the similarities across workshops. Finally, we took the indicators recommended in at least two workshops and asked a small group of regional social scientists to rank the list for importance, robustness, and practicality. All indicators that were recommended in all three workshops or received an average score of 4 out of 5 from the social scientists were recommended to the collaborating agency.

In the Puyallup Watershed and Whatcom County, we followed similar procedures with the following modifications. In the Puyallup, we collected locally relevant values from reports rather than interviews. Because our collaborator, the Puyallup Watershed Initiative, had been conducting stakeholder meetings with diverse groups that specifically asked about values and goals for watershed management, we used their careful meeting notes rather than conducting interviews with essentially the same participants. The values were again coded into attributes and translated into 350 indicators that were internally consolidated to 100 indicators for the workshops. While we still referred to the larger Puget Sound Indicators document (Hanein and Biedenweg 2012) to finalize the wording of the 100

indicators, we relied more on regional sources and our experience with what was highly ranked in the Hood Canal workshops to develop the wording. We then held two workshops instead of three to rank and refine the indicators. We did not conduct a social science review. Rather, we considered the overall comments made by social scientists in reference to the Hood Canal attributes and indicators to confirm that the recommended indicators would be viable. We recommended all indicators that were highly rated in both workshops as well as all the governance indicators that were highly rated in either workshop to the collaborating organization. The reason for including all governance indicators was because one workshop workgroup re-wrote all the indicators, thus making it impossible to compare the two sets.

In Whatcom County, we reviewed 22 documents and conducted 24 one-on-one interviews and one focus group with 15 adults. We developed 380 potential indicators from the values described by these sources. This time, we consolidated the indicators prior to sending them for internal ranking. we eliminated indicators that 1) represented values that were *not* mentioned frequently by the different sources and 2) were likely to be difficult to measure through a survey or summarizing existing data. we prioritized keeping indicators that 1) represented values mentioned frequently by Whatcom residents and documents and 2) were similar to those that were highly ranked in Hood Canal and Puyallup. Because the governance indicators were so different between the two Puyallup workshops, we decided to hold three workshops again in Whatcom to facilitate the comparison by increasing the sample size. The final indicators were again not reviewed by social scientists. Rather, this step was reserved for the final scientific review of the indicators that scored highly in all three regions.

Because tribal participation in the workshops was minimal, this report compares the results from the three case studies to a similar process run in several Coast Salish tribes (Donatuto et al. 2011) where tribal members identified attributes of indigenously-defined health. In general, we found that key attributes were very similar between the case studies and the Coast Salish study.

Results

The final products from the three workshops included recommended attributes and indicators from all six domains (Appendix II). Forty-seven attributes and 78 indicators were recommended by at least two workshops in Hood Canal, Puyallup Watershed and Whatcom County, or at least one workshop in the case of governance indicators in Puyallup. The exceptions to this are five indicators recommended during one Whatcom workshop. These made the final county recommendations because, although they were only developed in one workshop, they represented common ideas from interviews with groups that were underrepresented in the workshops. Similarly, nine indicators were added to the final recommendations to more fully represent the Coast salish attributes and increase the representation of tribal values in the list.

The number of recommended attributes and indicators were fairly similar for each region, with the exception of the Governance indicators from the Puyallup Watershed as a result of

having only two workshops (Table 3). In general, more indicators were recommended for the Governance, Economic and Physical domains than the Social, Cultural and Psychological. In fact, no specific Social indicators were recommended in the Puyallup watershed. That said, we emphasize that these domains are not mutually exclusive; many indicators can represent concepts from more than one domain.

Table 3. Number of unique attributes/indicators recommended during each workshop process by human wellbeing domain.

	Hood Canal Watershed	Puyallup Watershed	Whatcom County	Total unique attributes/indicators
Governance	5/6	6/15	6/6	14/25
Social	3/3	0/0	2/6	4/7
Cultural	3/3	2/2	2/2	5/8
Psychological	3/3	3/3	2/3	7/8
Physical	5/6	4/5	5/5	8/12
Economic	2/5	6/7	4/8	9/19
TOTAL	21/26	21/32	21/30	47/79

Some of the originally recommended attributes from the different workshops had essentially the same meaning with slightly different wordings. These were consolidated and are summarized in Table 4. Within each domain, 2-4 attributes representing the same concept were recommended in at least two of the workshops. It is from these attributes that we developed the final recommended list in the next section. In general, there was more agreement on the attributes than the specific indicator wording to represent those attributes. As a result, we made recommendations of indicators based on wording that was either most commonly used or that was clearest for developing a useful metric of that attribute as it had been described during the workshops.

Table 4. Final attributes recommended in each region as compared to attributes defined in Coast Salish process

Domain	Attribute	Hood Canal	Puyallup	Whatcom	Coast Salish*
Psychological	Sense of Place/Place Identity	X	X		X
	Positive emotions	X			X
	Safety		X	X	X
	Subjective Wellbeing	X			X
	Freedom			X	As part of sovereignty
	Pride			X	As part of sovereignty
	Aesthetics	X			
Physical	Access to healthy/local food	X	X	X	X
	Safe Food	X		X	X
	Access to Natural Areas		X	X	X
	Outdoor Activity	X	X	X	
	Air Quality		X	X	As natural resource security
	Drinking Water Quality	X	X	X	As natural resource security
Economic	Natural Resource Industries	X	X	X	As part of sovereignty
	Natural Resource Jobs/Income	X		X	As part of sovereignty
	Livable Communities			X	
	Working lands		X		
	Job Satisfaction		X		
	Equity		X		As part of sovereignty
Governance	Stewardship	X	X		X
	Effective government	X		X	
	Trust in government	X		X	X
	Democratic Engagement/Open Participation		X	X	
	Leadership/Equity		X	X	X
	Access	X			X
	Communication	X			
	Collaboration			X	
	Transparency			X	
	Sustainable Infrastructure/Policy		X		X

Social	Community Cohesion	X		X	X
	Strong Families and Friendships	X			X
	Trust	X		X	X
Cultural	Traditional resource practices	X		X	X
	Cultural events	X	X	X	X
	Cultural heritage		X		X
	Rural character	X			
	Respect/Stewardship				X

* Updated Indigenous Health Indicators can be found at: http://www.swinomish-nsn.gov/ihi/

Recommendations

Human Wellbeing Indicators

Table 5 provides 23 indicators that were either highly rated in at least two areas or are the best representation of the recommended attributes in terms of comprehensive, clear wording that can result in a measurable metric. These are the indicators recommended for consideration as part of the Quality of Life Vital Signs. Additionally, we recommend considering a subjective wellbeing measure (available in the CDC's Behavioral Risk Factor Surveillance System or easy to collect via a survey) as it transcends many of these specific indicators and is comparable to nationally and internationally collected data.

Table 5. 23 recommended indicators for human wellbeing related to the environment

Domain	Attribute	Indicator
Cultural	Cultural Events	Number of opportunities and % of residents who participate in natural resource-inspired cultural activities (such as salmon homecoming, farmers market, outdoor recreation events, etc.)
	Cultural Practices	% of residents who feel they are able to maintain cultural practices associated with natural resources
Social	Trust	% of residents who trust people in their immediate and broader communities (2-3 levels)
	Community Cohesion Index	Frequency of outdoor activities with friends/family
		Frequency of working with other community members to steward environmental resources, prepare cultural events, or solve problems
		Ability to get sufficient natural resources from formal and informal networks
Psychological	Safety	% of residents who feel safe in their neighborhood, open spaces and natural areas
	Sense of Place	% of residents who express a positive connection to the region
		% of residents who express (or nurture) a sense of stewardship for the watershed
	Positive emotions	% of residents who describe experiencing positive feelings/emotions from being in nature, such as awe, inspiration, fulfillment, appreciation, solitude, relaxation, sense of peace and reflection
	Subjective Wellbeing	Average response to overall life satisfaction question
Physical	Outdoor Activity	% of households within 1/2 mile of parks, urban plazas, public courtyards, community gardens or trailheads (10miles rural)
		Average number of hours per week of outdoor activity (by activity: outdoor work, gardening/farming, walking, bicycling, swimming, etc.)
	Air Quality	Number of moderate air quality days in urban and rural areas per year
	Drink water	% of drinking water tests results comply with appropriate standards
	Healthy Foods Index	Average household distance to fresh produce (personal farm, grocery store, farm stand)

		Availability of commonly harvested food species
		# shellfish bed closures per year
Economic	Natural resource-based industry	% of regional economic activity that is from natural resource-based industries: agriculture, commercial shellfish, commercial fishing, timber, non-timber products and tourism
	Natural resource-based jobs	Number of living-wage jobs by resource-based industry categories
		Unemployment rate in natural resource-based jobs
Governance	Trust in Government	% of residents who trust local and regional government to make the right decisions to protect natural resources
	Democratic Engagement	% of residents who feel they have the opportunity to influence natural resource decisions if they wanted to
	Representativeness	Diversity of perspectives and participants in natural resource decision-making (advisory boards, councils, etc.)
		% of residents who feel represented by community and government leaders (see themselves reflected in leadership)
	Stewardship	Percent of participants engaging in a natural resource stewardship activity/year
		# of natural resource development projects

Indices vs. Portfolio

In addition to content, consideration must be given to the structure of the Vital Signs. Should any of these be combined to form an index or indices? Should any of these replace existing Vital Signs or are they already redundant with existing Vital Signs? Several of the recommendations are already indices, such as the Community Cohesion Index and the Healthy Foods Index. Others could be similarly combined, with internal validity to be tested upon collecting more data. In general, however, we caution against indices as they often lack scientific and practical meaning, hiding the real issues we care about monitoring.

Addressing Shifting Baselines

It is possible that some predictors of wellbeing related to the environment may shift over time. For example, we know that engaging in outdoor activities has numerous benefits for humans, but we do not know the duration of activity required to obtain benefits nor the extent to which indoor activities can replace the benefits of outdoor activities. As a result, a drop in overall outdoor activity from year 1 to year 5 may not have a definitive impact on overall human wellbeing. It is partially for this reason that we also recommend regular monitoring of a subjective wellbeing measure. Subjective wellbeing assesses an individual's overall perception of the quality of their life. This metric can be compared to ecological metrics and metrics specifically measuring people's relationship to the environment to explore the relationship between healthy human populations and a healthy Puget Sound. More importantly, however, shifting baselines can be addressed by using spatially-explicit sampling to collect data from areas where we know recovery strategies have taken place or not take place to be able to test for the impact of environmental change on variation in human wellbeing indicators.

Next Steps for Selection

With the regional processes complete, we now present these findings for review by two groups of experts, a small group of social scientists with expertise in social indicators related to the environment and a group of representatives of Puget Sound stakeholder groups. Each of these groups will asked to use a specific set of criteria (see Appendix III) to rate the 23 indicators and will be asked to comment about whether these indicators should be developed at the local or the basin scale, and whether the Vital Sign(s) should be comprised of individual indicators or a portfolio.

Feedback on Case Study Process from Participants

We collected exit surveys from 68 workshop participants to quantify their experience with the indicator development process. We also had conversation with most of the interviewees and workshop participants about their opinion of the process. The majority felt the development of human wellbeing indicators to be an important task. On a scale of 1-10, the average score for the importance of the workshop was 8.4 for Hood Canal, 8.2 for Puyallup and 8.0 for Whatcom County. When asked to select adjectives that described their experience in the workshop, 78% in Hood Canal, 95% in Puyallup and 87% in Whatcom selected interesting (Figure 3). Those who were unsatisfied with the project and process were rural community members from Hood Canal and Whatcom County. They expressed that the workshops were useless and were skeptical of government agencies monitoring human wellbeing.

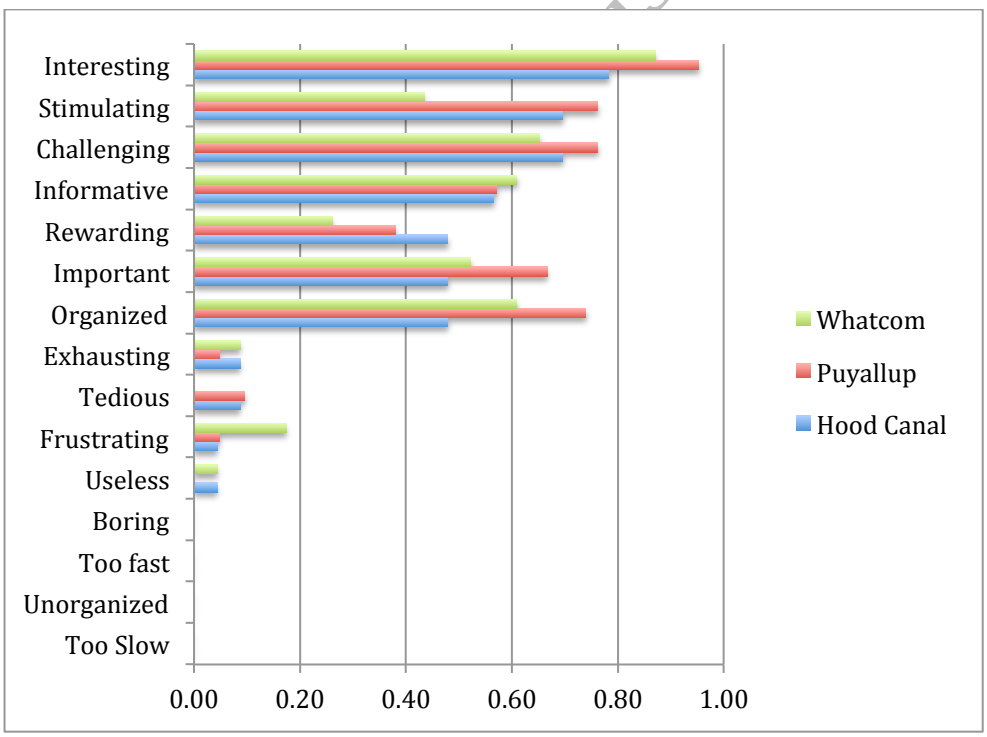

Figure 3. Percent of respondents from each region that selected the above adjectives to describe the workshop experience. N= 68. (21 from Puyallup, 24 from Hood Canal and 23 from Whatcom).

Conclusions

The development of human wellbeing and quality of life indicators is a final step to filling in PSP's Vital Signs for monitoring progress toward recovering ecosystem health and the social systems that depend on it. Identifying and collecting data on these indicators serves several policy-relevant purposes, including monitoring the status of wellbeing, evaluating the effectiveness of recovery strategies, and selecting strategies most likely to contribute to both ecological and human health.

This document summarizes two years of work in three local areas of Puget Sound to develop locally-specific metrics of human wellbeing related to the environment. It recommends 23 indicators across six domains for consideration by both social scientists and regional partner and stakeholder representatives as potential Human Wellbeing Vital Signs . In addition to considering specific indicators, these reviewers should consider whether any or all of the indicators should be combined into an index. A final technical document with recommendations will be presented to the PSP Science Panel and ultimately to the PSP Leadership Council in early 2015.

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Appendix I. Representation of interview and workshop participants for all three regions

	Hood Canal	Puyallup Watershed	Whatcom
Public health representatives	**8**	**1**	**5** (1 tribal)
Community service representatives	**4**	**4**	**1**
Economic development representatives	**4**	**3**	**4**
Academic social scientists	**2**	**2**	**2**
Tribal members/representatives	**3**	**2**	**2**
Extension professionals	**2**	**4**	**2**
Forestry representatives	**0**	**0**	**1**
Agriculture representatives	**1**	**2**	**4**
Fishing/Shellfishing representatives	**2**	**0**	**1**
Local government representatives	**4**	**3**	**6**
Planning representatives	**1**	**2**	**2**
Tourism/Recreation representatives	**3**	**1**	**1**
Historical preservation representative	**1**	**0**	**0**
Environmental organization representatives	**5**	**5**	**0**
Rural citizens (not representing groups above)	**3**	**0**	**20**
Urban citizens (not representing groups above)	**0**	**0**	**6**

Appendix II. Final recommended indicators from all three regions

The number represents the number of workshops in which the indicator was recommended that formed the basis of its recommendation to that region.

Domain	Attribute	Indicator	Hood Canal (N=3)	Puyallup (N=2)	Whatcom (N=3)
Cultural	Cultural events	Percent of residents who participate in natural-resource inspired cultural activities	3		2
		Total attendance to local community/cultural facilities and tours that promote a connection with the watershed+		2	
		Number of opportunities to share and celebrate culture, community, and heritage, such as salmon homecoming, storytelling, and farmers market; Stommish, Pioneer Days, Ski to Sea, etc.)		1	2
	Cultural heritage	Percent of people who feel they understand culture and history of the Puyallup watershed		2	
	Respect/Stewardship	Respect/ stewardship--conferring respect of relations between human, natural and spirit world, protection of cultural resources			
	Rural Character	Distribution and quantity of urban, rural, agriculture, forest, mineral resource, conservation and stewardship lands.	2		
	Traditional resource practices	Proportion of residents who say that they would like to regularly access traditionally/commonly harvested natural resources and are able to do so as much as needed	3		
		Percent of residents who feel they are able to maintain cultural practices associated with natural resources			2
		Ability to honor proper rituals, prayers and thoughtful intentions			
		Healing/ arts programs			
Economic	Equity/Access	Annual tribal salmon catch		2	
	Equity/Business	Ratio of number small/local business owners to		2	

		outside investor owners (Forestry, fisheries, agriculture, eco-agritourism)			
	Equity/Revenue	Ratio of total economic output by industry/ number of jobs in industry		2	
	Industry	Percent of economic activity that is from natural resource-based small business	2		
		Relative Market value of forest, fisheries and agricultural products sold locally, regionally, within the US and exported			2
		Percent of revenue to local economy from agriculture, commercial shellfish, commercial fishing, timber, non-timber products and tourism; Relative contribution of local and non-local natural resource industries to Whatcom County economy (forestry, agriculture, fisheries; by commodity if desired)	3		3
		# of local supporting businesses to industry, by natural resource sector	3		
		#, size and profitability of natural resource-based businesses working within Whatcom County (working farms, timber mills, fishing canneries)			2
		% of farms and rural residents without water rights			2
		# of acres of forest and farmland in active production and # of permitted or locally based boats			2
	Job satisfaction	% of residents who express job satisfaction (disaggregated by annual earnings)		2	
	Jobs	# of jobs and living wages per worker by resource-based employment/industry categories and economic clusters by county, and unemployment rates at subarea level matching state database	2		
		# of new jobs created by natural resource employment sector/year	3		
		% of total wages in county paid by natural resource based industries			2
		Unemployment rate by economic sector			2
	Livable Community	Cost of living index for rural and urban households (septic, water, electric, permit costs, etc.)*			1
	Revenue	Total multiplier effect of working land dollars spent in		2	

		watershed (agriculture, forestry, fisheries, eco-agritourism)			
	Working lands (farm, forest, fisheries)	Acres of working land/water in sustainable management		2	
		Acres of working land/acres of development		2	
Governance	Access	% of shoreline that is publicly accessible or owned	3		
	Collaboration	# of resource management issues in which governments collaborate			2
	Communication	% of Hood Canal residents who have learned about resource management or recreation issues through different media this year: newspaper, radio, website, printed media, mobile app, educational resources for school aged children, word of mouth; include source	3		
	Democratic Engagement	% of residents who report that community participation and decision-making is fun*		1	
		% of residents who feel heard and respected in community decision-making processes*		1	
		# of venues where people from different backgrounds and with different values discuss issues of community importance*		1	
		% of residents who participate in natural resource advocacy groups+		1	
		% of residents who are voting on local elections (for example conservation district)+		1	
	Effective Government	Average and maximum number of days to process a permit by permit type (from submission to decision)			1
	Effectiveness of Public Policies	% of identified PIC failures with corrective action initiated within "x" weeks	2		
	Equity	% of residents who feel represented by community and government leaders (see themselves reflected in leadership)*		1	
	Leadership	% of residents who think government and community leaders are effective*		1	
	Open Participation	% of residents who feel they have the opportunity to influence natural resource decisions if they wanted to			3
	Stewardship	% of participants engaging in a natural resource	3	1	1

		stewardship activity/year; # of students involved in stewardship activities			
		# natural resource development projects		1	
		% of residents who have volunteered in their community in the last quarter (in whatever capacity)		1	
		% of residents who take individual actions to protect the Puget Sound		1	
		% of residents who feel that efforts of local government to encourage and practice stewardship are diverse and supported by a wide range of interest groups			1
	Sustainable Infrastructure	% of residents who live within 1/2 mile of a bus stop or other alternative transportation*		1	
		# of residents living within 1/2 mile of neighborhood components (public transit, grocery store, library, school, park, etc.)+		1	
	Sustainable Policy	% of critical areas (floodplain, unstable slopes, lahar hazard areas) that are protected from development+		1	
		# of people participating in programs that provide incentives for sustainable practices (whatever they are from carpooling to recycling to keep land in farm and forest)+		1	
		% or acres of natural areas, resource lands and environmentally-sensitive areas protected/maintained/restored/created through innovative (TDR and conservation easements) and other means+		1	
	Transparency	% of residents who feel that local resource management decision-making is transparent			2
	Trust in government	# of Hood Canal residents who report trust in experts and local and state government and collaborative government efforts; % of residents who trust local government to make the right decisions to protect natural resources	2		2
Physical	Access to healthy Food	Average household distance to fresh produce (personal farm, grocery store, farm stand)			2
		# Shellfish Bed Closures per year			2

	Access to Local Food	Availability of commonly harvested species (e.g. hardshell clams, crabs, shrimp, salmon, deer, elk, mushrooms, rose hips, willow, cedar, other plants or animals)	3		
		Food resources produced in the communities where they are consumed (include fishing, local farms, gardens, etc.)		2	
	Access to natural areas/public spaces	% of households within a half mile of parks, urban plazas, public courtyards, community gardens or trailheads (10miles rural)		2	2
	Air Quality	# of moderate air quality days in urban and rural areas per year; # of days during the calendar year that air quality was good, moderate, unhealthful, very healthful or hazardous (must include pollutants from smoke)	3	2	2
	Outdoor Activity	Approximate number of hours residents engage in outdoor activities (divided into work that involves outdoor physical activity, swimming, hiking, walking, running, mountain biking, human-powered watercraft, skiing, scuba, home care (garden, yard), & other motorcraft) per week; % of people and frequency of outdoor activity (by activity: outdoor work, gardening/farming, walking, bicycling, swimming, etc.)	3		2
		# of people using natural areas		2	
		% of swimming beaches that meet safe swimming standards at all times during the summer	2		
	Overall Environmental Health Index	Environmental health impact index (fine air particulate matter, drinking water quality, waste management, etc. by jurisdiction)		2	
	Safe Drinking Water/Water Quality	Drinking water testing results from Community Groups and wells; % of drinking water systems that comply with relevant water quality standards	2	2	2
	Safe Food	Toxin levels in shellfish harvest areas, commercial and recreational: PSP, crypto, giardiasis, vibriosis, notoviris	3		
Psychological	Aesthetics	% of residents who are able to experience the beauty		2	

		of nature on a daily basis			
	Freedom	% of residents who feel they have sufficient personal freedom and choices. Later divided into: % of residents, by demographic, who feel they have sufficient choices in accessing and experiencing the natural environment; % of residents, by demographic, who feel that environmental protection regulations are impairing their quality of life			3
	General subjective wellbeing	% of residents who express high life satisfaction or happiness and percent who express living in Hood Canal as a contributor to this	2		
	Place Identity/Sense of Place	% of residents who express a positive connection to the region			
		% of residents who express (or nurture) a sense of stewardship for the watershed		2	
		% of residents who feel connected to their local food system		2	
	Positive emotions	% of residents who describe experiencing positive feelings/emotions from being in nature in Hood Canal, such as awe, inspiration, fulfillment, appreciation, solitude, relaxation, sense of peace and reflection	3		
	Pride	% of residents, by demographic, who feel a sense of pride in stewarding natural resources			2
	Safety	% of residents who feel safe in their neighborhood and in open spaces and natural areas.		2	2
		Feeling of safety--trust that water, natural resources are safe to eat, drink, work and play there without worry			
		Confidence that environment is stable/ resilient, will be here for next 7 generations			
Social	Community Cohesion	% of residents who have worked with other residents to manage resources, prepare cultural events, solve community challenges, or share harvested goods in	2		

		the past year			
		% community members have a job or role in community and/or with local natural resources			
		Sharing –people able to get sufficient natural resources thru informal or formal community networks			
		% of residents who feel that others in the region value the contribution of natural resource industries (e.g. logging, farming, fishing, mining)			2
		% of residents who feel they have a voice in their community*			1
		% of residents who feel that they understand the differences of both city and rural lifestyle choices			3
	Future generations	% of residents, by demographic, who feel that the next generation will have a better/worse quality of life than current generation			2
	Strong Families and Friendships	Average number of days/year participate in outdoor activities with family members and/or friends	3		
		Family--supportive, cohesive			
	Trust	% of residents who trust people in their surrounding community	3		2