Developing Human Wellbeing Indicators for the Puyallup Watershed

July 2014

Kelly Biedenweg, Ph.D., Puget Sound Institute
Haley Harguth, M.P.A./M.M.A., WA Sea Grant Hershman Fellow to the Puget Sound Partnership

PUGET SOUND INSTITUTE

Acknowledgements
We thank the Puyallup Watershed stakeholders for their participation in the indicator rating and refining process. Kalon Thomas assisted with initial indicator refinement. We also thank Kari Stiles (Puget Sound Partnership) and Brenda Le-May, Jennifer Arnold and Robert Warren (Puyallup Watershed Initiative, Bonneville Environmental Fund) for their active participation throughout the process, including refining initial indicators and facilitating the stakeholder workshop groups.

Funding for this research was provided by the Puyallup Watershed Initiative through The Russell Family Foundation, NSF Grant #1215886, and the Puget Sound Partnership.

TABLE OF CONTENTS

Executive Summary:

The Puget Sound Institute (PSI) collaborated with the Puyallup Watershed Initiative (PWI) to develop a process for selecting human wellbeing indicators relevant to natural resource management in the Puyallup Watershed. The purpose of these indicators will be to monitor the state of Puyallup Watershed communities and to inform and evaluate integrated watershed strategies for key social impacts.

The process involved several steps of compiling, creating, rating and refining potential human wellbeing indicators that related the values of Puyallup Watershed residents to the health of Puyallup Watershed ecosystems (Figure 1). These steps included 1) an analysis of values of Puyallup Watershed residents related to the environment from interviews and literature review, 2) a merging of existing Puget Sound indicators with Puyallup Watershed values, and 3) two ranking processes with the project team and Puyallup Watershed stakeholders.

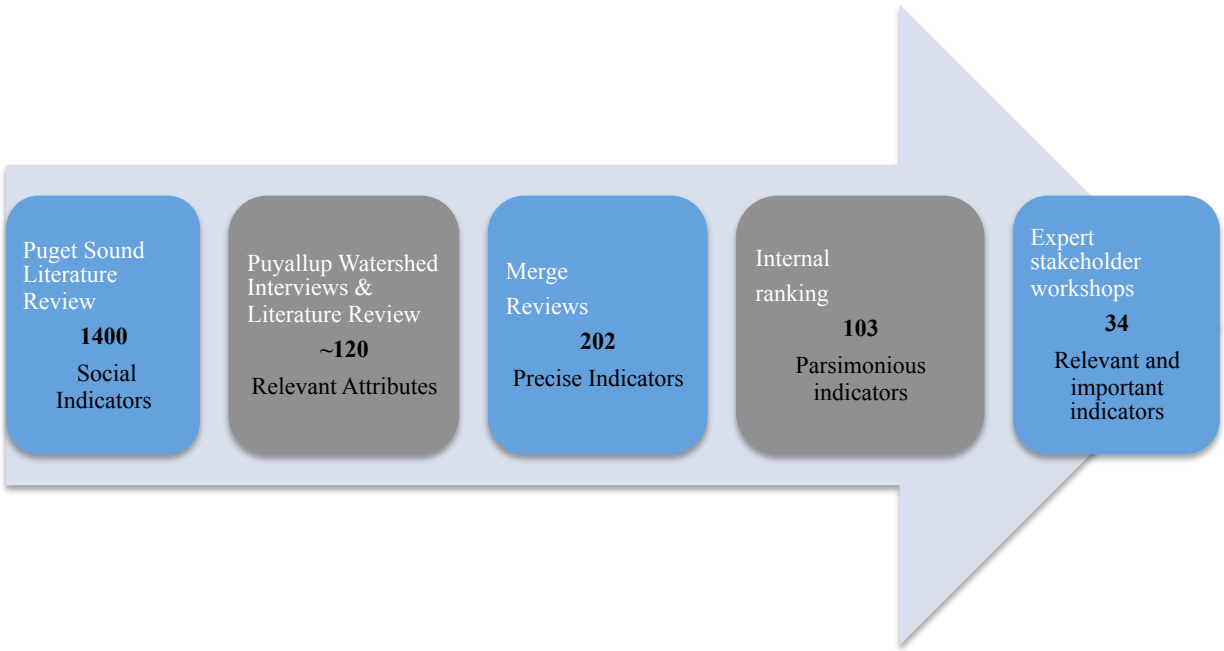


Figure 1. Primary phases of the Puyallup Watershed human wellbeing indicator development process. Each phase builds off the outcomes of the prior.

Indicators were developed to represent six domains of Human Wellbeing related to the environment: Psychological, Physical, Cultural, Social, Economic and Governance. In the stakeholder workshop phase, 103 indicators were presented to 26 workshop participants in two workshops (Tacoma and Puyallup). From this initial list of 103, 34 were highly rated for relevance and importance.

Data for some of these indicators are available from regional and national sources. Many, however, will require a regular household survey of Puyallup Watershed residents or independent analyses of existing data. If the PWI would like to monitor any of these indicators in consultation with partners and member governments, it will need to make decisions about how often these indicators are measured and how the information will be collected.

It is important to remember that:

- All indicators must be disaggregated by demographic variables to understand equity issues, one of the most important aspects of human wellbeing:
    - Socioeconomic status
    - Age
    - Gender
    - Time living in Hood Canal
    - Ethnicity or Tribal/Non-tribal

- Indicators are not targets. They are a measure of the status of a specific aspect relevant to human wellbeing associated with the environment

- Consequently, it is not necessarily desirable that the unit of measure of an indicator increases. The measure *only* demonstrates the status of the indicator. It is still up to people to analyze the implications of that measure.

Table 1. Human Wellbeing indicators highly ranked by Puyallup watershed workshop participants

Domain	Attribute	Indicator	Highly rated in both workshops	New indicator created to respond to overall comments
Physical	Access to natural areas	Percent of households within a half mile of parks, urban plazas, public courtyards, community gardens or trailheads	X	
	Access to healthy food	Food resources produced in the communities where they are consumed (include fishing, local farms, gardens, etc.)	X	
	Outdoor activity	Number of people using natural areas	X	
	Clean water	Populations served by public water systems that do not meet drinking water standards	X	
	Overall environmental health	Environmental health impact index (fine air particulate matter, drinking water quality, waste management, etc. by jurisdiction)	X	
Psychological	Safety	Percent of residents who feel safe in their neighborhood and in open spaces and natural areas.	X	
	Sense of place	Percent of residents who express (or nurture) a sense of stewardship for the watershed	X	
		Percent of residents who feel connected to their local food system		X
	Aesthetic	Percent of residents who are able to experience the beauty of nature on a daily basis		X
Governance	Sustainable infrastructure	Percent of residents who live within 1/2 mile of a bus stop or other alternative transportation*		
		Number of residents living within 1/2 mile of neighborhood components (public transit, grocery store, library, school, park, etc.)+		
	Democratic engagement	Percent of residents who report that community participation and decision-making is fun*		
		Percentage of residents who feel heard and respected in community decision-making processes*		
		Number of venues where people from different backgrounds and with different values discuss issues of community importance*		
		Percent of residents who participate in natural resource advocacy groups+		
		Percent of residents who are voting on local elections (for example conservation district)+		
	Stewardship	Percentage of residents who have volunteered in their community in the last quarter (in whatever capacity) *		
		Percent of residents who take individual actions to protect the Puget Sound +		
		Number of students involved in stewardship activities +		

	Sustainable policy	Percent of critical areas (floodplain, unstable slopes, lahar hazard areas) that are protected from development+		
		Number 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)+		
		Percent or acres of natural areas, resource lands and environmentally-sensitive areas protected/maintained/restored/created through innovative (TDR and conservation easements) and other means+		
	Leadership	Percent of residents who think government and community leaders are effective*		
	Equity	Percent of residents who feel represented by community and government leaders (see themselves reflected in leadership)*		
Cultural	Cultural heritage	Number of opportunities to share and celebrate culture, community, and heritage, such as salmon homecoming, storytelling, and farmers market*		X
		Total attendance to local community/cultural facilities and tours that promote a connection with the watershed+		X
	Cultural events	Percent of people who feel they understand culture and history of the Puyallup watershed		X
Economic	Working lands (farm, forest, fisheries)	Acres of working land/water in sustainable management		X
		Acres of working land/acres of development		X
	Revenue	Total multiplier effect of working land dollars spent in watershed (agriculture, forestry, fisheries, eco-agritourism)		X
	Equity/Businesses	Ratio of number small/local business owners to outside investor owners (Forestry, fisheries, agriculture, eco-agritourism)		X
	Equity/Revenue	Ratio of total economic output by industry/ number of jobs in industry		X
	Equity/Access	Annual tribal salmon catch		X
	Job satisfaction	Percent of residents who express job satisfaction (disaggregated by annual earnings)		X

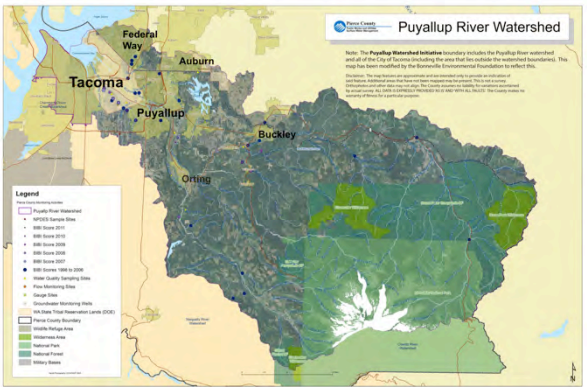
* Recommended in Tacoma workshop
+ Recommended in Puyallup workshop

Background

Human wellbeing (HWB) is multi-faceted and can be enhanced, or negatively affected, by our daily experiences, such as the quality of our work life and personal relationships, our engagement in physical activity and adherence to a healthy diet, and opportunities to participate in cultural activities. Many facets of wellbeing are directly related to the health of the natural environment such as the ability to release stress in a peaceful forest or a thriving local economy derived from sustainable shellfish harvesting. The status of our wellbeing can influence the way we make decisions that affect the environment and the status of those resources, in turn, can affect our wellbeing. In many cases, this perspective is left out of ecosystem recovery.

Because of a growing understanding of the relationship between HWB and the status of natural resources, planning for and monitoring human wellbeing as a component of ecosystem recovery is a growing trend. Within the Puget Sound specifically, the Puget Sound Partnership has a placeholder for quality of life indicators. The actual incorporation of human wellbeing into these types of policies has been limited, however, because of a lack of guidance for developing indicators to begin addressing HWB in practice.

The Puyallup Watershed encompasses approximately 1050 sq miles in South-Central Puget Sound, with a population of about 280,000 people primarily within Pierce County. Since 2012, the Puyallup Watershed Initiative (PWI), funded by The Russell Family Foundation, has been supporting community-based processes for watershed development based on communities of interest. Their goal is to create a foundation over the next ten years for empowered citizens and a healthy watershed.



The Puget Sound Institute collaborated with the PWI to develop a process for selecting HWB indicators related to the health of Puyallup Watershed natural resources. This report summarizes the methods and results. The resulting indicators may be helpful for identifying indicators to monitor the 10-year impact of the PWI. Additionally, the indicators will be compared to similar processes in the Hood Canal and Whatcom County to determine if any are applicable to the entire Puget Sound to become part of the PSP Quality of Life indicators.

Methods

We adapted methods from several international efforts to incorporate social, economic and cultural indicators into coastal and watershed planning processes (e.g., Tipa 2009; Day and Prins 2013). The process involved iterative phases of gathering and refining potential attributes and indicators with soliciting feedback from local experts in participatory one-on-one formats.

Preparing Potential Indicators

To begin the process, we conducted a review of social indicators that were being measured or intended to be measured by government and non-government organizations in the Puget Sound

region (Hanein & Biedenweg 2012) (Figure below). This resulted in 1400 indicators that were coded into one of seven common HWB domains (Social, Cultural, Spiritual, Psychological, Physical, Economic and Governance), as well as relevant attributes within those domains.

We then compiled existing data about Puyallup watershed resident values. These data came in various formats from diverse projects, including notes from the PWI's community of interest meetings, and documents from the Pierce County Conservation District, Pierce County Department of Parks and Recreation, Tacoma-Pierce County Health Department, Puyallup River Watershed Council, University of Washington, Tacoma sustainability research, a variety of local news and media sources, and others.

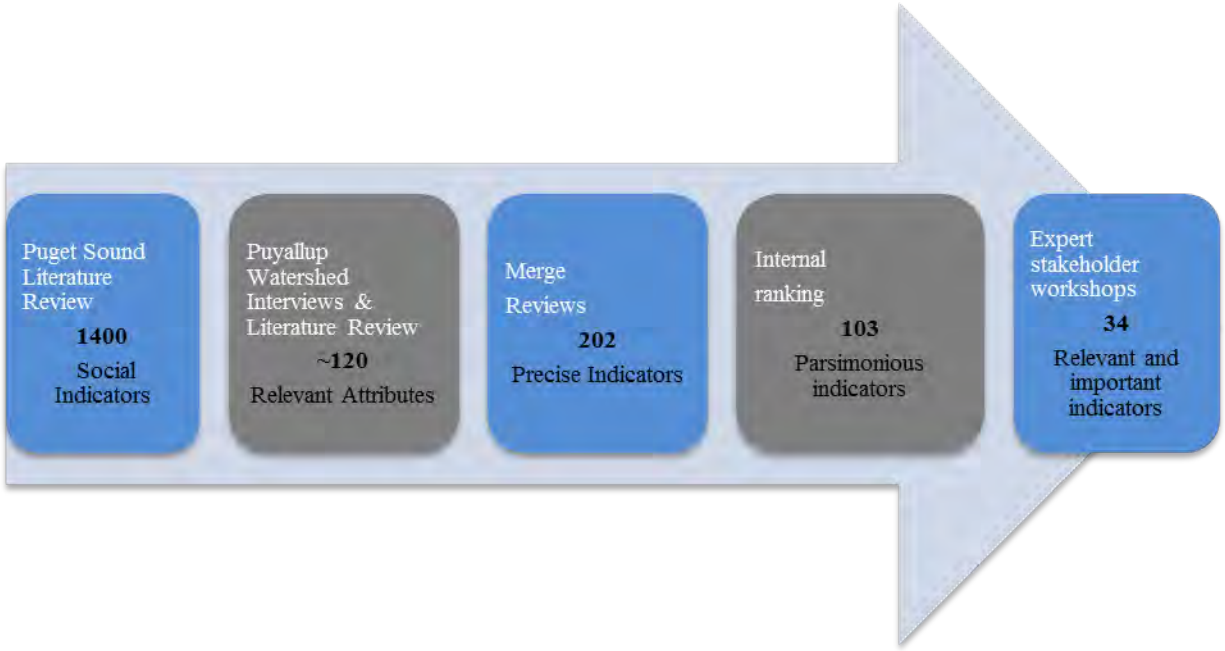


Figure 1. Primary phases of the Puyallup Watershed human wellbeing indicator development process. Each phase builds off the outcomes of the prior.

We coded the existing data into the human wellbeing domains. As we did so, we created attributes (a more specific category to the domain, but not yet a measurable indicator) that best represented the concept and potential indicators that would measure the specific aspects of the attributes. Example attributes included "exercise" and "safe food" for the physical domain, which could be measured by the indicators "number of hours spent in outdoor activity per week" or "level of toxins in commonly harvested species," respectively. Two of the authors worked on this process, resulting in 120 potential attributes spread across the six domains.

To come up with specific indicator wording for the 120 attributes, and ideally indicators for which data was already regularly collected, we filtered the initial Puget Sound social indicator database (Hanein & Biedenweg 2012). First, we removed all indicators and attributes that were not related to natural resources or were duplicated in the data set. In order to merge these indicators with the list of 120 derived Hood Canal attributes, we searched the set of existing indictors for each of the 120 attributes. Based on this merge, a total of 202 potential indicators were selected.

Refining and Ranking Indicators

To reduce this list to a more manageable set of indicators we used two processes to refine and rank the potential indicator list based on:

Relevance	Importance
How well the indicator represents the issues of the Puyallup Watershed	How important the indicator is in relation to the other indicators to provide a complete representation of the domain

Criteria used in the indicator selection process.

These criteria were selected to enhance the robustness of the selection process and are a subset of criteria used in other indicator ranking processes (i.e., Kurtz et al. 2001; Kershner et. al 2011; and Day and Prins 2013). The first ranking phase was an internal review of the potential indicators. Our research team ranked each indicator on a scale of 1-5, resulting in a list of 103 potential indicators with a mean rating of 4 or higher.

The second phase included two stakeholder workshops with participants who had regional expertise in measurement or first-hand-knowledge of one of the domains. A list of potential participants was put together based on recommendations from PWI and the literature review. A total of 26 participants from the 73 invited attended the workshops. Nineteen of the invitees expressed interest in participating but were not available on the designated days (7 needing to cancel last minute due to professional or personal reasons), 2 expressed interest but felt they were not the most appropriate participants, and 26 simply did not reply to the email invitation. . Fourteen participants attended the workshop in the town of Puyallup and 12 in the city of Tacoma. While we acknowledge the small group size, this is a common size for specialized working groups comprised of people with the most regional understanding of a topic. These 26 participants represented diverse perspectives as tribal members, public health scientists, economic development representatives, and active citizens in economic and cultural activities.

Workshop at the Center for Urban Waters, Tacoma

Each participant was assigned to one of four small groups focused on 1 to 3 of the domains. They were informed of their group placement and provided the indicator list prior to their attendance at the workshop (Appendix III). Examples of Economic group participants

included representatives from economic development, extension services, and private businesses; the Social/Cultural/Spiritual/Psychological group had representatives from tribal nations, the regional public health department, an urban community house, and local active groups; the Governance group included representatives from tribal nations, the conservation district, and the watershed council; and the Physical group had representatives from county health departments and recreation groups. Each group was provided 22-27 indicators from which they were asked to refine and prioritize to less than ten to facilitate the narrowing of indicators to the most relevant.

We asked workshop participants to complete two steps to refine and rank potential indicators.

Step 1

The first step was to independently rate each indicator for relevance to the region, placing green (good indicator), yellow (potentially good but needs modification), and red (not relevant) sticker dots on poster-sized printouts of the indicators for their domain. This first step allowed participants to see where they had some agreement and allowed the second step to proceed more efficiently.

Step 2

In the second step, each group worked with a facilitator to refine their list of indicators to less than ten based on relevance and importance. In this step they were also welcomed to add any indicator or attribute that they perceived as critical. Although we recommended methods for doing this, each group chose a different path to accomplish this task. Some approached this step by discussing the potential indicators (yellow stickers), trying to refine these so they better filled a gap or choosing to eliminate them altogether. Other groups looked primarily at the good indicators (green stickers) and asked participants to rank those. Each group was facilitated by a member of the research team who kept detailed notes of the conversations either in an Excel spreadsheet or directly on the printouts of indicators. Results from both workshops were compiled; indicators that were prioritized in both workshops were automatically retained and new indicators were created based on stakeholder comments if the concepts were discussed in both workshops. This resulted in 34 indicators that reflected stakeholder input on the most relevant and important measures for each domain.

Recommended Indicators

We present a list of 34 HWB indicators that Puyallup watershed residents believed to be relevant and important. Eight of these indicators were highly ranked as they were in both workshops. Eleven were reworded to match the ideas expressed at both workshops. These represented the Social/Cultural/Psychological, Economic, and Physical domains. The Governance domain was treated differently in each workshop; as such the resulting 15 recommended indicators are a combination of those recommended in each workshop.

The indicators are specific to the way residents interact with natural resources in the Puyallup watershed; including upland, freshwater and estuarine ecosystems.

It is important to remember that:

- All indicators must be disaggregated by demographic variables to understand equity issues, one of the most important aspects of HWB:
    - Socioeconomic status
    - Age
    - Gender
    - Time living in watershed
    - Ethnicity or Tribal/Non-tribal

- Indicators are not targets. They are a measure of the status of a specific aspect relevant to HWB associated with natural resources

- Consequently, it is not necessarily desirable that the unit of measure of an indicator increases. The measure *only* demonstrates the status of the indicator. It is still up to people to analyze the implications of that measure.

Highly Ranked Indicators of Human Wellbeing related to Natural Resource Health by Puyallup Watershed Stakeholders

Domain	Attribute	Indicator	Highly rated in both workshops	New indicator created to respond to overall comments
Physical	Access to natural areas	Percent of households within a half mile of parks, urban plazas, public courtyards, community gardens or trailheads	X	
	Access to healthy food	Food resources produced in the communities where they are consumed (include fishing, local farms, gardens, etc.)	X	
	Outdoor activity	Number of people using natural areas	X	
	Clean water	Populations served by public water systems that do not meet drinking water standards	X	
	Overall environmental health	Environmental health impact index (fine air particulate matter, drinking water quality, waste management, etc. by jurisdiction)	X	
Psychological	Safety	Percent of residents who feel safe in their neighborhood and in open spaces and natural areas.	X	
	Sense of place	Percent of residents who express (or nurture) a sense of stewardship for the watershed	X	
		Percent of residents who feel connected to their local food system		X
	Aesthetic	Percent of residents who are able to experience the beauty of nature on a daily basis		X
Governance	Sustainable infrastructure	Percent of residents who live within 1/2 mile of a bus stop or other alternative transportation*		
		Number of residents living within 1/2 mile of neighborhood components (public transit, grocery store, library, school, park, etc.)+		
	Democratic engagement	Percent of residents who report that community participation and decision-making is fun*		
		Percentage of residents who feel heard and respected in community decision-making processes*		
		Number of venues where people from different backgrounds and with different values discuss issues of community importance*		
		Percent of residents who participate in natural resource advocacy groups+		
		Percent of residents who are voting on local elections (for example conservation district)+		
	Stewardship	Percentage of residents who have volunteered in their community in the last quarter (in whatever capacity) *		

		Percent of residents who take individual actions to protect the Puget Sound +		
		Number of students involved in stewardship activities +		
	Sustainable policy	Percent of critical areas (floodplain, unstable slopes, lahar hazard areas) that are protected from development+		
		Number 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)+		
		Percent or acres of natural areas, resource lands and environmentally-sensitive areas protected/maintained/restored/created through innovative (TDR and conservation easements) and other means+		
	Leadership	Percent of residents who think government and community leaders are effective*		
	Equity	Percent of residents who feel represented by community and government leaders (see themselves reflected in leadership)*		
Cultural	Cultural heritage	Number of opportunities to share and celebrate culture, community, and heritage, such as salmon homecoming, storytelling, and farmers market*		X
		Total attendance to local community/cultural facilities and tours that promote a connection with the watershed+		X
	Cultural events	Percent of people who feel they understand culture and history of the Puyallup watershed		X
Economic	Working lands (farm, forest, fisheries)	Acres of working land/water in sustainable management		X
		Acres of working land/acres of development		X
	Revenue	Total multiplier effect of working land dollars spent in watershed (agriculture, forestry, fisheries, eco-agritourism)		X
	Equity/Businesses	Ratio of number small/local business owners to outside investor owners (Forestry, fisheries, agriculture, eco-agritourism)		X
	Equity/Revenue	Ratio of total economic output by industry/ number of jobs in industry		X
	Equity/Access	Annual tribal salmon catch		X
	Job satisfaction	Percent of residents who express job satisfaction (disaggregated by annual earnings)		X

* Recommended in Tacoma workshop
+ Recommended in Puyallup workshop

Collecting Data on Indicators

Many of the indicators selected during the process require direct data collection from Puyallup Watershed residents. The easiest way to collect such data is with a randomized phone, mail, or Internet survey. We can ensure that the data represent the overall population by comparing respondent demographics with overall demographics of the region. Any demographics with low representation can be weighted, if desired, to better represent the Puyallup Watershed population.

Other indicators, however, already have data being collected for them by other agencies. In the table below, we have noted whether a new survey would be required ("Survey") or the name of a specific data source that could provide such data if Puyallup Watershed responses are disaggregated or aggregated.

Domain	Attribute	Indicator	Data Source
Physical	Access to natural areas	Percent of households within a half mile of parks, urban plazas, public courtyards, community gardens or trailheads	Tacoma-Pierce County Health Dept.
	Access to healthy food	Food resources produced in the communities where they are consumed (include fishing, local farms, gardens, etc.)	PCC Farmland Trust (Orting-only survey), Pierce County Economic Development, Pierce Conservation District
	Outdoor activity	Number of people using natural areas	Pierce County-Parks and Recreation
	Clean water	Populations served by public water systems that do not meet drinking water standards	Tacoma-Pierce County Health Dept.
	Overall environmental health	Environmental health impact index (fine air particulate matter, drinking water quality, waste management, etc. by jurisdiction)	Needs to be compiled from existing data (mostly Tacoma-Pierce County Health)
Psychological	Safety	Percent of residents who feel safe in their neighborhood and in open spaces and natural areas.	Tacoma-Pierce County Health Dept.
	Sense of place	Percent of residents who express (or nurture) a sense of stewardship for the watershed	Survey
		Percent of residents who feel connected to their local food system	Survey
	Aesthetic	Percent of residents who are able to experience the beauty of nature on a daily basis	Survey
Governance	Sustainable infrastructure	Percent of residents who live within 1/2 mile of a bus stop or other alternative transportation*	Tacoma-Pierce County Health Dept.
		Number of residents living within 1/2 mile of neighborhood components (public transit, grocery store, library, school, park, etc.)+	Tacoma-Pierce County Health Dept.
	Democratic engagement	Percent of residents who report that community participation and decision-making is fun*	Survey
		Percentage of residents who feel heard and respected in community decision-making processes*	Survey
		Number of venues where people from different backgrounds and with different values discuss issues of community importance*	Unsure, probably a survey

		Percent of residents who participate in natural resource advocacy groups+	Survey, & possibly natural resource advocacy groups
		Percent of residents who are voting on local elections (for example conservation district)+	WA Secretary of State
	Stewardship	Percentage of residents who have volunteered in their community in the last quarter (in whatever capacity) *	Survey, & possibly Pierce Conservation District, Puyallup River Watershed Council, others
		Percent of residents who take individual actions to protect the Puget Sound +	Survey
		Number of students involved in stewardship activities +	Survey, & possibly Pierce Conservation District, Puyallup River Watershed Council, Harbor Wild Watch
	Sustainable policy	Percent of critical areas (floodplain, unstable slopes, lahar hazard areas) that are protected from development+	Puyallup-White Watershed Open Space Strategy
		Number 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)+	PCC Farmland Trust (Orting-only Survey), Pierce Conservation District, Pierce Transit, Pierce County Public Works & Utilities
		Percent or acres of natural areas, resource lands and environmentally-sensitive areas protected/maintained/restored/created through innovative (TDR and conservation easements) and other means+	Puyallup-White Watershed Open Space Strategy
	Leadership	Percent of residents who think government and community leaders are effective*	Puget Sound Partnership
	Equity	Percent of residents who feel represented by community and government leaders (see themselves reflected in leadership)*	Survey
Cultural	Cultural heritage	Number of opportunities to share and celebrate culture, community, and heritage, such as salmon homecoming, storytelling, and farmers market*	Survey
		Total attendance to local community/cultural facilities and tours that promote a connection with the watershed+	Survey
	Cultural events	Percent of people who feel they understand culture and history of the Puyallup watershed	Survey
Economic	Working lands (farm, forest, fisheries)	Acres of working land/water in sustainable management	Pierce Conservation District, Puyallup-White Watershed Open Space Strategy, PCC Farmland Trust-(Orting-only survey),
		Acres of working land/acres of development	Tacoma-Pierce County Health Dept., Puyallup-White Watershed Open Space Strategy

	Revenue	Total multiplier effect of working land dollars spent in watershed (agriculture, forestry, fisheries, eco-agritourism)	Sustainable Seattle for regional estimation and methods
	Equity/ Businesses	Ratio of number small/local business owners to outside investor owners (agriculture, forestry, fisheries, , eco-agritourism)	City Departments of Economic Development
	Equity/ Revenue	Ratio of total economic output by industry/ number of jobs in industry	Pierce County Economic Development Dept., PCC Farmland Trust (Orting-only survey)
	Equity/Access	Annual tribal salmon catch	Northwest Indian Fisheries Commission
	Job satisfaction	Percent of residents who express job satisfaction (disaggregated by annual earnings)	Survey, National Institute for Occupational Safety and Health

Next Steps and Potential Uses of Indicators

These recommended indicators are presented to the Puyallup Watershed Initiative for their consideration. Depending on the final objective for using these indicators, the PWI will want to undergo their own process to select the indicators most relevant to the objective. They can then be used in a variety of ways. Some examples include:

1) **Assessing the state of HWB related to the environment in the Puyallup Watershed**. This can be done at a single instance or compared over time. Numerical measures for each indicator can be presented at time "x" and change over time can also be explored to demonstrate increasing or decreasing trends in HWB.

2) **Monitoring the impacts of recovery strategies**. Once we calculate if any indicators are changing over time, we can collect qualitative data or run statistical models to explore whether any changes in indicator status (increases or decreases) are likely results of Puyallup Watershed Initiative activities. For example, we may find that the local income from timber harvests has increased over six years. We can test if this could be due to a strategy that reduced regulations on timber harvest, or if it is more likely due to other factors.

3) **Assisting the selection of initiative strategies that are most appropriate to enhance or at least not harm the current status of HWB.** When we are considering potential watershed strategies, we want to consider the potential impacts on HWB. This is because we want to enhance HWB while we enhance ecosystem health. It is also because we want to implement strategies that will address, and not exacerbate, human pressures on ecosystems. To do so, we will need to model these potential relationships between HWB and the environment. For example, we may learn through our research that people are more likely to engage in outdoor family activities in public parks closer to towns than further away, all other factors being equal. If we are faced with budget cuts and must close a certain number of public parks, then, we may choose to close those further from town centers. There are at least three details to consider when trying to prioritize strategies that enhance both ecological and human wellbeing:

    a. **Prioritizing regions or demographics of Puyallup Watershed in order to address specific HWB needs.** Selecting activities that benefit HWB might include prioritizing regions based on their specific HWB status. Disaggregated data by region and demographics can be used to aid decision-making about where to prioritize strategies that might benefit specific regions or demographics. For example, if governance of natural resources is considered strong in one county but weaker in another, we may choose to prioritize strengthening governance in the weaker county.

    b. **Prioritizing strategies that most likely influence multiple domains of HWB.** Another aspect of selecting activities that benefit both ecology and human wellbeing is to use research data about the relationship of HWB

indicators to specific ecological components to choose strategies that are most likely to enhance a variety of HWB domains. For example, enhancing the population of salmon is likely to enhance all aspects of human wellbeing, from cultural practices to natural resource-based income.

c. **Understanding HWB tradeoffs**. A critical piece to selecting strategies that benefit ecosystems and HWB is to understand any potential tradeoffs among HWB domains. For example, while natural resource based jobs and income might go up, family outdoor time might decrease. We would need to use scientific data or expert-driven decision-making processes to consider how to handle this tradeoff when selecting an activity.

Conclusions & Lessons Learned

This multi-step process for developing HWB indicators for the Puyallup Watershed provides an example of how to combine scientific evidence with local knowledge to develop indicators. We believe that the potential success of the project will be due to the iterative steps that included compiling existing indicators, matching them to local values, and refining them based on stakeholder input. This was greatly enabled by the partnership of scientists, planners, and staff from the PWI to develop a process that was both scientifically robust and locally supported. This process took about four months; having one 50% FTE dedicated to indicator preparation and workshop organization was important for maintaining continuity and flow.

Most of our lessons, as usual, were learned during the stakeholder workshop process. Key aspects that enabled success at the workshops included significant preparation of materials in advance, having diverse people at the table, providing a small number of indicators, starting with an individual ranking exercise, and facilitating small-group decision-making. During the workshops, we first asked participants to individually rank the indicators on poster-sized sheets. This was a critical piece to getting people on the same page; the indicators were fresh on everyone's mind, they had personal time to process the meaning, and group members could visually assess their initial agreement or disagreement with the indicators. This step greatly facilitated the following discussion. We also found that the number of indicators we provided each group (22-27) for ranking and discussion was sufficient enough to represent the diversity of the domains but not so large as to result in fatigue.

Refining and ranking indicators is not an easy task no matter how it is presented, but it appears that this deliberate process was helpful in making the process reasonable. In fact, from a list of 15 potential positive and negative adjectives to describe the workshops, participants most often selected interesting (95% of respondents) and organized (74%) (Appendix IV). They also selected challenging (76%) and rated the ease of completing the ranking tasks a 6.9 out of 10 (N=21). Thus, although the ranking and rating tasks were cognitively difficult, when organized and facilitated, they can become a positive experience.

For those considering conducting a similar process at a similar scale, we recommend the following:

- Carefully select a small team (3-5 people) of scientists, policymakers and/or active citizens that is willing to champion the project and work together throughout the process.
- Work with the agency/organization that will adopt the indicators to learn what type of product is most useful or adaptable to them.
- Look carefully for existing data about why residents value your watershed and use this data to inform the initial set of potential indicators.
- Start early in identifying potential workshop participants – look for these in county, state and federal agencies as well as academic institutions and research-based non-profit and for-profit organizations.
- When inviting workshop participants, look for a balance in representation across the six domains.
- You will need to repeatedly email and call potential participants. Plan for this amount of time.
- Carefully prepare information for workshop participants and scientific reviewers. A 1-2 page handout is helpful, and clear, detailed emails are important.

References

Day, A. and M. Prins. 2013. Developing Human Wellbeing Indicators for Canada's Pacific Marine Ecosystems: Steps and Methods. Uuma Consulting Ltd., Nanaimo, British Columbia.

Hanein, A. and K. Biedenweg. 2012. Wellbeing Indicators in the Puget Sound Basin: A summary and categorization of types of social indicators and metrics used by government and non-government agencies in the Puget Sound Basin. Puget Sound Institute. Available at: http://www.eopugetsound.org/articles/well-being-indicators-puget-sound-basin.

Kershner, J., J. Samhouri, C.A. James, P. Levin. 2011. Selecting Indicator Portfolios for Marine Species and Food Webs: A Puget Sound Case Study. PLoS ONE 6(10):e25248.
Kurtz, J., L. Jackson, and W. Fisher. 2001. Strategies for evaluating indicators based on guidelines from the Environmental Protection Agency's Office of Research and Development. Ecological Indicators 1:49-60.

Tipa, G. 2009. Exploring Indigenous Understanding of River Dynamics and River Flows: A Case from New Zealand. Environmental Communication: A Journal of Nature and Culture 3(1): 95-120.

Appendix I: Sources for Puyallup Watershed Values Review

Author(s)	Title	Year
Central Puget Sound Regional Open Space Strategy	Preliminary Comprehensive Strategy	2012
City of Puyallup Chamber of Commerce Video	Comcast Neighborhoods: Puyallup, Part 1, 2	
Earth Economics	The Puyallup River Watershed: An Ecological Economic Characterization	2011
Forterra	"Puyallup Land Conservation a Boon for Endangered Turtles, City Residents"	2012
Forterra	The Cascade Agenda	2005
Harbor WildWatch	Programs (online)	2012
Northwest Leadership Foundation	Guide to Programs	
Pacific Northwest Journal of Community-based Environmental Literacy Education	"I am Clark's Creek - Puyallup School District"	2012
PCC Farmland Trust/The Trust for Public Land	Puyallup Valley Farmland: Metrics and Economic Analysis for Organic and Sustainable Agriculture in the Orting Study Area	2013
Pierce Conservation District	Green Partnership Fund (online)	Accessed 2014
Pierce Conservation District	The Tahoma View	Spring 2013
Pierce Conservation District	The Tahoma View	Fall 2013
Pierce Conservation District	The Tahoma View	Winter 2012/13
Pierce Conservation District	The Tahoma View	Summer 2013
Pierce Conservation District	The Tahoma View	Winter 2013/14
Pierce Conservation District	Pierce Conservation Service: Dedicated Service Since 1949 (brochure)	
Pierce County Council	Ordinance No. 2012-82s (re: Conservation Futures Program)	2013
Pierce County Parks & Recreation	Conservation Futures Property Nomination Information Packet	2013
Pierce County Parks & Recreation	Parks, Recreation & Open Space Plan	2008
Pierce County Planning & Land Services: Pierce County Farming	"Growing Your Farm" Fact sheet	
Pierce County Planning & Land Services: Pierce County Farming	Meet the Farmer (PC TV video series)	2013-14
Pierce County Public Works and Utilities, Surface Water Management	2012 Homeowners Association (HOA) Workshop (presentation)	2012
Pierce County Public Works and Utilities, Surface Water Management	Northwest Salmon (brochure)	
Pierce County Public Works and Utilities, Surface Water Management	Stormwater Runoff: Pierce County Public Attitudes, Awareness, and Behavior	2009
Pierce County Public Works and Utilities, Surface Water Management Division	Five Steps to Natural Yard Care	

Pierce County Public Works and Utilities, Water Programs Division	Naches Trail Preserve Stewardship Plan	2006
Pierce County, Economic Development Division	Preserving Farmland and Farmers - Pierce County Agriculture Strategic Plan	2006
Puget Sound Regional Council	Measuring Urban Agriculture in the City of Seattle	2013
Puyallup Herald	"Parks dept. welcomes public comment on open space plan"	2013
Puyallup Herald	"Residents embrace planting project along Meeker and Clarks creeks"	2013
Puyallup Herald	"Rogers High science teacher improves trail to school for paralyzed gymnast"	2014
Puyallup River Executive Task Force	Draft Meeting Summary Notes (May 20, 2011)	2011
Puyallup River Watershed Council	Annual Report 2012	2012
Puyallup River Watershed Council	Salmon Homecoming Celebration (flyer)	2013
Puyallup River Watershed Council	History, Reinvigoration, and Board (presentation)	2012
Puyallup School District	I am Clark's Creek - "How to Care" A Creative Guide by Puyallup School Children	2012
Puyallup Tribal News	"Community event brings Tribe, local interests together to support Puyallup Watershed"	2013
Puyallup Tribe of Indians	Historical Overview (online)	2014
Puyallup Watershed Initiative	Agriculture COI "PCAR Minutes May 2013"	2013
Puyallup Watershed Initiative	Just and Healthy Food System Draft Proposal Notes	2013
Puyallup Watershed Initiative	Salmon COI "Strengths and Weaknesses"	2013
Puyallup Watershed Initiative	Environmental Education COI "Postcards" Docs	2013
Puyallup Watershed Initiative	Environmental Education COI "Puyallup Watershed Vision Planning Map"	2013
Puyallup Watershed Initiative	Forest COI Notes 10.15.2013	2013
Puyallup Watershed Initiative	Just and Healthy Foods COI "Root Causes"	2013
Puyallup Watershed Initiative	Just and Healthy Foods COI "Vision summary"	2013
Puyallup Watershed Initiative	Just and Healthy Foods COI "Values"	2013
Puyallup Watershed Initiative	Trails COI "Notes 2013 10 31"	2013
Puyallup Watershed Initiative	Trails/Active Transportation COI "Notes 2013 11 21"	2013
Puyallup-White Watershed Open Space Strategy	Background and Opportunities Report	2013
South Puget Sound Action Area Workgroup	Puyallup/Commencement Bay Watershed Action Agenda Basis	2008
Tacoma-Pierce County Health Department	Living Well in PC: Happiness, Economy, and Environment (flyer)	2013
Tacoma-Pierce County Health Department	Pierce County Environmental Trends 2010	2012
Tacoma-Pierce County Health Department	Strategic Plan - Natural and Built Environment Performance Measures	2012
Tacoma-Pierce County Health Department	Built Environment Outcome Measures	

Tacoma-Pierce County Health Department	Strategic Plan - Natural Environment Outcomes	2012
Tacoma-Pierce County Health Department	Strategic Plan - Placemaking Outcomes	2013
Tacoma-Pierce County Health Department	2011-2015 Strategic Plan	2011
Tacoma-Pierce County Health Department	Pierce County Community Health Improvement Plan: Sharing Key Findings (presentation)	2014
Tacoma-Pierce County Health Department	Pierce County Community Health Status Assessment	2013
The Examiner	"The University of Washington raises awareness for the Puyallup River watershed "	2013
The Nature Conservancy	Managing Floods and Floodplains in Puget Sound: A synthesis of Flood Manager and Decision-maker Interviews and Research	2013
The News Tribune	"Sea Scouts brave cold, show off seamanship in Tacoma"	2014
The Olympian	"Puyallup tribe creating logjams to protect young fish"	2013
U.S. E.P.A.	Surf Your Watershed 17110014 - Puyallup Watershed Profile	2014
UW Tacoma Urban Studies Program	"Measuring Sustainability at the Municipal Level in Pierce County"	2014
UW Tacoma/Russell Family Foundation	Water Undone: The Efforts to Save the Puyallup River Watershed	2010
Washington State Department of Health	Pierce County Commercial Shellfish Growing Areas, Shoreline to -70 Feet (map)	2012
Water Resource Inventory Area (WRIA) 10	Puyallup-White Watershed Initial Assessment	1995

Appendix II: Initial Indicator Sets Provided at Stakeholder Workshops

Group 1: Physical Domain

#	Domain	Attribute	Indicator wording	Sources for Indicator wording
	Physical			
1		Access to healthy food	Number of community gardens/farms growing produce for food banks	
2			Percent of residences served by a full grocery store selling fresh fruits and vegetables or a farmers market within 1/2 mile walking distance (that accepts EBT & WIC)	TPCHD
3			Percent of residents who express a sense of food security	
4			Amount of fresh food donated to food banks	
5			Food resources produced in the communities where they are consumed	
6			Number of community gardens and local farms, including usage and output	
7		Access to natural areas	Number of urban gardens and farms	PSRC
8			Percent of residents who feel that park/open space is accessible for recreation and exercise	
9			Total miles of bike, walking and hiking trails	TPCHD

10			Linkages between area trail systems/distance of linked trails	
11			Percent of residents who feel that trails provide an alternative transportation option/route	
12			Percent of households within a half mile of parks, urban plazas, public courtyards, community gardens or trailheads	TPCHD
13			Percent of parks accessible by foot and bike; or percent of parks with off-street trails connected to on-street trails	TPCHD
14			Ratio of miles of bike facilities per miles of roadway	TPCHD
15			Percent distribution of multimodal transportation	TPCHD
16		Clean air	Number of days per year over federal fine particulate matter standard	TPCHD
17		Clean water	Populations served by Group A and Group B public water systems that do not meet drinking water standards	TPCHD
18			Percent of streams and lakes with improved/passing surface water grades	TPCHD
19			Total paved road miles/total square-miles of area	
20		Climate Control	Percent tree cover by city/town	TPCHD
21		Exercise	Walkability index (a function of net residential density, retail floor area ratio, land use mix, and intersection density)	
22			Percent of residents who utilize trails as form of alternative transportation	

23			Percent of residents by transportation mode for commute to work (SOV, carpool, transit, walk, other)	
24		Overall environmental health	Environmental health impact index (air and water quality, waste management, etc. by jurisdiction)	
25		Safety	Natural flood protection/Reduction of flood risk from natural floodplains	
26			Percent of residents who feel safe for family and children while in the natural environment	Puget Sound Partnership

Group 2: Governance

#	Domain	Attribute	Indicator wording	Sources for Indicator wording
1	Governance	Access to natural areas	Connectivity between parks, trails, open space	
2			Acres of farmland protected from development	
3			Acres of protected forested green space	
4		Democratic Engagement	Percent of residents who feel they are able to influence resource management decisions	
5		Informed Citizens	Percent of residents who are aware of the condition of water bodies in their neighborhood	
6			Percent of residents with exposure to environmental education	
7			Percent of citizens who understand importance of natural resource conservation	
8			Percent of residents who recognize the system-wide effects of their actions	
9			Percent of citizens who understand the role of agriculture in relation to economy, environment, health, community, and culture	
10			Percent of residents who are aware of where food comes from	
11			Percent of residents who understand the connection of salmon recovery to greater ecological values & human wellbeing	
12			Percent of residents who understand sustainable agriculture practices	
13		Neighborhoods	Walkability index (a function of net residential density, retail floor area ratio, land use mix, and intersection density)	

14			Number of residents living within 1/2 mile of neighborhood components (public transit, grocery store, library, school, park, etc.)	
15		Safety	Percent of mapped floodplain that is undeveloped	
16			% of total population engaged in food production	
17			Percent of residents who feel that individual actions to protect the Puget Sound make a difference	
18			Percent of residents who feel a responsibility to protect the environment	
19			Number of gardens and gardeners participating in or on the wait list for city/county community garden program	PSRC
20		Stewardship	Percentage of private landowners' willing to participate in county restoration programs	
21			Number of students involved in stewardship activities through school-govt. partnerships	
22			Number of City/County sponsored LID/green infrastructure projects	
23			Access to transportation (% who live within 1/2 mile of a bus stop)	
24		Sustainable Infrastructure	Percent or acres of natural areas, resource lands and environmentally-sensitive areas protected/maintained/restored/created through innovative means, such as TDR and conservation easements	TPCHD
25			Amount of agriculture industry tax credits & percent use of funds in local watershed	
26		Sustainable Policy	Number of programs that support local farming industry (incentives, outreach, etc.	

Group 3: Cultural, Psychological and Social

#	Domain	Attribute	Indicator wording	Sources for Indicator wording
	Cultural			
1		Cultural Events	Annual number of farmers markets and fairs	
2			Total attendance at salmon-related events per year	
3		Cultural Heritage	Percent of residents who express feeling a connection to the legacy of living in this place	
4			Percent of residents who value the watershed's history (Native American populations, pioneers & settlers)	
5			Percent of residents who feel responsibility to preserve land to honor heritage	
6			Percentage of residents who feel pride in local agricultural products	
7			Percent of residents who know the watershed's history (Native American populations, pioneers & settlers)	
8			Percent of residents who desire to preserve a rural landscape	
9			Number of multigenerational farms	
10		Spiritual	Percent of residents who feel that farming connects them to the environment	

Psychological				
11		Aesthetic	Percent canopy cover for watershed	
12			Percent of residents who feel that existing park spaces provide a desirable aesthetic	
13			Percent of residents who are able to experience natural aesthetic beauty on a daily basis	
14		Positive emotions	Percent of residents who express a sense of adventure, discovery, & freedom in the environment	
15			Average life satisfaction of residents	PSI, HIP & BRFSS
16			Percent of residents who have felt relaxed as a result of being in natural environments	PSI
17		Sense of Place	Percent of residents who feel connected to the Puyallup watershed	
28			Percent of residents who express a sense of ownership or stewardship for natural areas	
29			Percent of residents who express a strong connection to nature	
20			Percent of residents who feel connected to their food supply	
	Social			
21		Community Cohesion	Percent of residents who express a sense of community connectedness	

22			Percent of residents who trust people in their surrounding community	PSP
23			Percent of residents who feel that interconnected parks and trails facilitate community connectedness	
24			Number of community gardens in Pierce County	PSRC
25			Percent of residents that feel a sense of community about the environment	
26		Safety	Percent of residens who feel safe in their neighborhood, countywide average and by race/ethnicity, income, and geography	

Group 4: Economic

#	Domain	Attribute	Indicator wording	Sources for Indicator wording
1	Economic	Agriculture	Acres of open space converted to development uses	
2			Total protected/preserved farmland acres; total farmland loss (acres)	
3			Total annual sales from farming	
4			Price per acre of agriculture land in Puyallup Valley	
5			Number of farmers and workers in farm-related industries in the Puyallup	WA state
6			Number of commercial farms and nurseries in Pierce County	
7			Percent of farmland in Puyallup Valley UGA	
8			Percent of businesses in watershed that are agriculture dependent	
9			Acres of farms in certified organic production Puyallup Watershed	For Orting
10			Average farm size (acreage)	
11			Wage structures from agriculture industry jobs	
12			Total multiplier effect of agricultural dollars spent in Puyallup Watershed	
13			Food production per acre	
14			Proportion of agricultural jobs in rural communities	
15			Number of local government support programs for agriculture	For Orting
16		Forestry	Rate of conversion of forest land (area converted; type of conversion)	
17			Acres of working forest lands in watershed	

18			Total forest product contribution to regional economy	
19			Number of small forest landowners and outside investor owners	
20			Average small forest landowner income	
21			Amount of forestland managed for even flow or sustainable yield	
22			Change in forest area ownership (% forest area/number of properties)	
23			Number of commercial forestry jobs	
24		Tourism/ Recreation	Total value of recreation-based tourism in Puyallup	
25			Number of visitors/year engaging in agritourism	

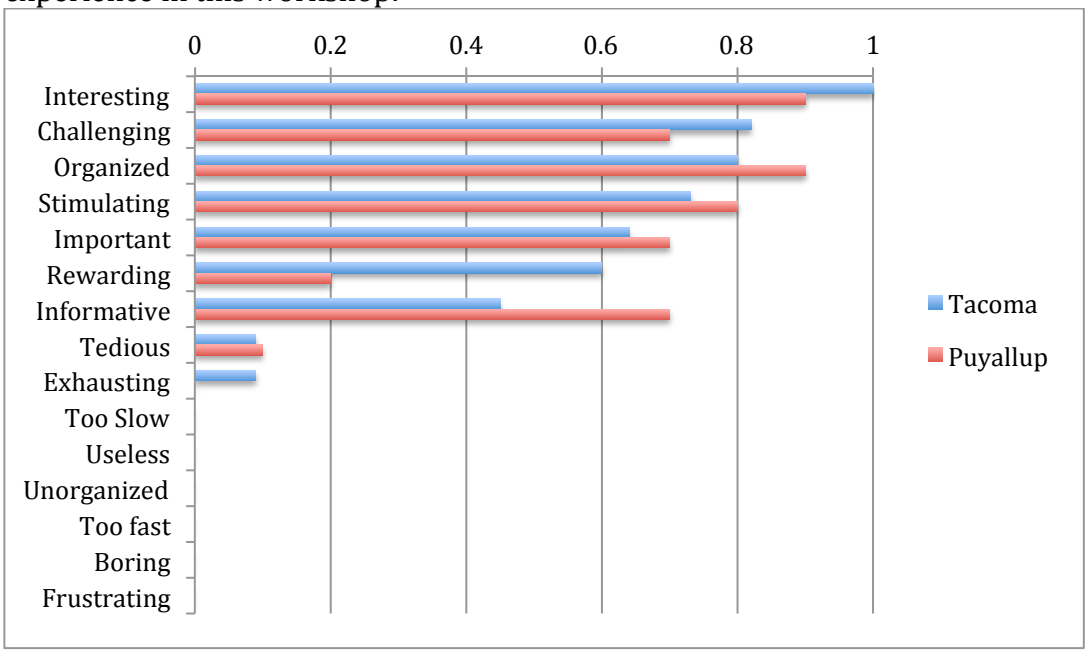
Appendix III: Workshop Evaluations

We requested workshop participants to provide feedback about the indicator rating process. Below are the tallied results.

1) On a scale of 1-10 (10 is high), please rate… (mean responses), N=21

	Tacoma	Puyallup	Average
Importance of workshop	8.70	7.70	8.20
Ease of completing activities	7.00	6.75	6.88
Ability of workshop to help refine indicators	8.00	7.72	7.86
Quality of background Information	7.91	7.95	7.93
How well the workshop met expectations	8.36	8.85	8.61

2) From a list of 15 descriptors, please circle the ones that most describe your experience in this workshop:



Percent of respondents who circled descriptor by workshop