

Sound Health for Sound Tribes:
Developing a Tribal/Salmonids Social-Ecological Systems Model

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A thesis

submitted in partial fulfillment of the
requirements for degree of

Master of Marine Affairs

University of Washington

2015

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Marine and Environmental Affairs

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Abstract

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This study examines the parameters involved when risk assessments of salmon recovery actions consider the impacts that may occur upon the culture and well-being of local Puget Sound tribes. The problems involved with using insufficient information, disregarding eco-cultural preferences, downplaying tribal preferences during decision-making, and dismissing the links connecting local salmon stock fitness to tribal community well-being are specifically recognized. Thematic synthesis is used to analyze data from journal articles using the authors as informants. Results underscore the need to empower the tribal community, nurture decision outcomes, pursue high-quality resource conditions, and prioritize high-quality salmon fitness results. The Community Sustainance Dynamics model is offered to focus attention upon local natural resources needing to be accessible and in the high-quality conditions needed to support tribal livelihoods and fulfill the other eco-cultural well-being needs of the tribal community. The model spotlights the importance of fulfilling community health and resilience targets as well.

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ACKNOWLEDGMENTS

My thanks to my advisor, David L. Fluharty, for his personal interest, contributions and unwavering support throughout this research work. I also wish to thank each the members of my committee for all of their valuable input as well as unmitigated faith that I could accomplish this work. Thanks must be given to the members of the Washington State Timber/Fish/Wildlife Cultural Resources Roundtable for indulging the many scheduling demands that were required for me to complete this work. A very special thanks must be given to Allyson Brooks (DAHP) and Dan Sherman (UPS) for their very gracious and ongoing recognition of my work, as well as to Judy Wright (Tribal Historian) and Joseph Anderson (Fisheries Manager) of the Puyallup Tribe for their never-ending friendship and contributions to my work. Finally, I sincerely thank the Muckleshoot Tribal Scholarship Committee, and especially the Puyallup Tribe for directly funding and/or sponsoring the time that was needed for me to undertake the Master’s degree training and to complete my Master’s Thesis work.



Historic Indian Agency Campus of the Puyallup Tribe – ca. 1980

DEDICATION

I dedicate this thesis to my older brother Joseph Loren Teeias Halliday, my mother Frances Jeanne Thomas, and my grandmother June Rose Courville, whom have each served as my personal role models throughout my life - and who continue to give me strength and guidance from the Spirit World. I also dedicate this thesis to my father James Arthur Halliday, my aunt Jacqueline Swanson, and my children Joseph, Sealth, Amenda, Lydia, Romajeane, Rhea, Curtiss and Jason and loving tribe of grandchildren as well. Finally, I dedicate every single word, idea and meaningful aspect of this work to my very dedicated and loving wife, Lauren Jo Butler, who has always supported and inspired me, as was certainly asked to sacrifice the most. It is with great pride that I now thank the Creator for providing me with each and every one of you as the center of my world, and my life-long will always be that that the Creator blesses each of you with personal strength, happiness, and togetherness throughout every moment of your lives.



With Loving Honor to My Ancestors and to All of My Future Generations

Jeffrey Paul Thomas (Muckleshoot & Wasco Tribes)

Chapter 1 INTRODUCTION

1.1 ISSUES and ORGANIZATION OF THESIS

1.1.1 ISSUES

1.1.1.1 Lack of High-Quality Salmon Fitness Results

The federally-recognized tribes of the Puget Sound region are co-managers of the salmon resource and each tribe has its own preferences regarding what their local areas' natural resource managers should be doing to pursue and maintain high-quality local salmon fitness results. The ability to spotlight the salmon-related aspects of local tribal social-ecological systems during land use risk assessments is vitally important to every Puget Sound tribe, but frameworks and models that are being used for assessments now do not usually critique the full range of tribal cultural impacts that can actually arise as a result of local land use - and especially salmon recovery - proposals. As such, the quality of the tribal cultural resource protection programs of the Washington state Puget Sound Partnership (<http://psp.wa.gov/>) - and the Washington state Timber/Fish/Wildlife Agreement (http://file.dnr.wa.gov/publications/fp_hcp_29appl.pdf) - salmon recovery processes are of a special concern here.

1.1.1.2 Disregard of Risk Assessment Gaps and Tribal Community Health and Resilience

Objectives

The frameworks and models being used to assess the risks of salmon recovery within the Puget Sound region have significant shortcomings. These shortcomings translate into key gaps that are compromising the quality of tribally-focused local risk assessment work. Some of the most important shortcomings to overcome are the insufficient approaches being used to collect tribal natural resource information, and/or those being used to accommodate tribal community eco-

cultural preferences, and/or to address local tribal environmental justice and sovereignty concerns.

Given the extensive geographic area that is affected by all of the Puget Sound salmon recovery proposals, there is a need to evaluate both the significance of the gaps within the approaches that are currently being used to collect or respond to natural resource values information, as well as evaluate the quality of the local environmental risk (e.g. land use) assessment approaches that are currently being used. One possible strategy to use to overcome this is to highlight the social-ecological systems significance of the gaps affiliated with the models being used now to structure local tribal risk assessments, and to demonstrate how these gap factors could be re-contextualized and/or reassessed.

The precision, accuracy and overall quality of tribal risk assessment information is an especially vital issue. Present standards do not promote using the most accurate and precise information that is available to analyze risk assessment data. As such, new approaches for improving the quality of the information that is being collected, and providing a framework that focuses upon collecting and analyzing natural resource values information is actually very sorely needed. Any new general approaches may have to target the procuring of precise, accurate data detailing natural variability and general changes to local natural resource conditions, along with expanding the breadth and depth of tribal eco-cultural preference information, and pinpointing the factors, relationships and metrics that are associated with tribal community sustenance dynamics. It is possible that a new model which spotlights tribal community health and resilience targets, tribal cultural values and tribal well-being indicators, tribal natural resources stewardship, and promotes the sustainment of the tribal community really should be developed as well.

1.1.1.3 Barriers to Tribal Salmonid Preferences

Puget Sound salmon recovery risk assessments are ripe for enrichment using new tools and approaches. Instituting new strategies for overcoming the forces contributing to the long-standing local salmon recovery problems of Puget Sound may now rely upon whether mainstream importance is assigned to incorporating tribal cultural resources into local risk assessment work, and/or evaluating the relative qualities of site-specific environmental risk assessment efforts, or multi-scalar cultural resources protection and management programs - and/or committing to recognizing and fulfilling the eco-cultural needs of local tribes.

New approaches focusing upon sustaining the eco-cultural needs of local tribes, and negating the ambivalence, disregard and barriers that inhibit accommodating tribal eco-cultural preferences are vitally needed. Potential new strategies for enriching current Puget Sound salmon recovery approaches might include: a) optimizing the discourse procedures being used to collect and respond to information, b) ensuring tribal community or cultural preferences are fulfilled, c) addressing issues relating to risk, power, and empowerment, and d) neutralizing the forces that stymie and inhibit the tribal communities' targets for local biophysical processes from actually being attained.

1.1.2 ORGANIZATION OF THESIS

This thesis examines whether or not “local eco-cultural preferences can be identified and accommodated” because portrayals of environmental change impacts upon local tribal cultural systems are lacking, and because tribal eco-cultural systems and community well-being factors are being disregarded during local salmon recovery decisions in general. This thesis hypothesizes that the ecocultural preferences (ECPs) of local Puget Sound tribes can and should be identified and accommodated, and as such uses the method of systematic review to collect key concepts

from relevant scientific journal articles. These concepts are used as qualitative data that is sorted into new categories and themes that are inductively-created and are both grounded in, as well as able to represent, the original key concept data.

This document is structured to describe how the original problems along with existing gaps were identified and investigative plan developed, how the methods were picked for collecting and analyzing the research data, and how a new theoretical model was synthesized using “systematic patterns” that were identified across existing models. The study findings then describe how the current gap factors were transformed into key concepts capable of operating the new model, and how the new model could be used to broaden the scope of current risk assessments (as well as reverse the disregard that always seems to stymie actually realizing the end results of local tribal ECPs). The study closes by concluding that the blockades inhibiting tribal ECPs could be neutralized (and even obliterated) through applying the new theoretical model. The final recommendations of the study highlight that the new model needs to be used to address tribal community resilience as well as eco-cultural risk concerns, and that the model should be used to upgrade local salmon recovery risk assessment and public (especially professional) training approaches.

1.2 PROBLEM STATEMENT

1.2.1 THESIS: “ECO-CULTURAL PREFERENCES CAN BE IDENTIFIED AND ACCOMMODATED”.

1.2.2 PROBLEM ANALYSIS: “CAN LOCAL ECO-CULTURAL PREFERENCES BE IDENTIFIED OR ACCOMMODATED?”

1.2.2.1 Tribal Eco-Cultural System and Well-Being Factors Are Disregarded During Local Salmon Recovery

Every federally-recognized Puget Sound tribe is bombarded with endless streams of land use proposals that all need to be evaluated for the potential impacts they might have upon local salmonid fitness factors, and the possible risks that they might impose upon the Tribes’ local community as well. Practically every land use proposal has some potential to impose risks to the natural or the cultural resources of importance to a local tribe, but the cultural dimensions of local land conditions are nearly always dismissed as being just superfluous to local risk assessment work. The need to pinpoint how eco-cultural resources are being impacted is however, becoming an increasingly pertinent topic which arises every time a tribal community assesses the risks that a natural resource management proposal could impose upon its tribal community, especially in regards to the personal level well-being or other eco-cultural concerns. Conversely, tribal assessment goals are actually most likely to focus upon identifying relevant tribal cultural values and/or human well-being indicators, and the need to institute innovative ways in which their communities’ natural resource condition preferences can be realized as local salmon recovery outcomes.

Each salmon stock of the Puget Sound arises from the ancestral lands of a federally-recognized co-managing Tribe who then has a duty to understand and characterize the risks and impacts that each salmon recovery action and its’ expected environmental changes is likely to

have upon the tribal community. Current risk assessments do not however, prioritize local natural resources really being accessible, let alone being in the high-quality conditions that are needed to support tribal community livelihoods, or meet the psychological well-being, deep-seated spirituality, and/or other locally-based eco-cultural well-being needs of a local tribe.

Most risk assessments never do really recognize any of the components and dynamics of the local social-ecological system that have always connected the relative fitness of local salmon stocks to the relative well-being of the members and communities of the Puget Sound Tribes. As such, the quality of the information obtained for analysis during assessments is actually critical for ensuring natural resource condition and/or tribal well-being trends sufficiently are being detailed sufficiently – especially in terms of the factors that are needed for sustaining each tribe’s community well-being and/or tribal eco-cultural needs.

One insidious problem facing Puget Sound tribes is that their tribal communities’ preferences for local salmon recovery (and salmon habitat conditions in particular) are severely downplayed during local salmon resource management decision-making. The general bulk of local natural resource risk assessments never do recognize or accommodate local tribal eco-cultural concerns. This suggests then that the current quality of the existing multi-scalar salmon recovery risk assessment programs need to be evaluated and then upgraded to target truly high-quality salmonid fitness results.

1.2.2.2 High Quality Data must be Acquired

Accurately identifying tribal cultural values and the factors needed to sustain tribal well-being and eco-cultural needs throughout the Puget Sound region requires sophisticated approaches being used to seek out tribal natural resource preference information including tribal risk and

empowerment concerns. As such, the quality of the preference information that is obtained will quite likely depend upon the discourse procedures that are used to:

- convey basic ecosystem services concepts;
- link tribal community preferences to local biophysical targets;
- detail how individuals are being empowered to make choices that actually affect the condition of the biophysical template of local social-ecological systems;
- ensure that local communities are being equitably served through natural resource decisions;
- address local ecological variability, tribal environmental justice, and/or the decisions needed to manage the future conditions of tribal natural resources and lands; and
- demonstrate how using tribal cultural preferences could lead to decisions that produce higher-quality salmon recovery outcomes.

1.2.3 OVERALL CHALLENGES TO SOLVING PROBLEMS

1.2.3.1 Current Frameworks and Models Have Shortcomings

Prevailing risk assessment frameworks or models have significant shortcomings which limit their ability to address the key components or dynamics that have been affiliated with the problem situations being targeted by this study. Common shortcomings of existing frameworks and models include the following:

- The social or cultural values attributed to local natural resources are poorly represented;
- Human ecosystems, socio-ecological systems, and/or tribal eco-cultural health-specific conceptual frameworks (and their potential indicators) are not incorporated;
- Links between human socio-psychological impacts and environmental degradation are not spotlighted;

- Risks are not characterized at a variety of spatial, temporal, and especially social scales;
- Scale-specific tribal natural resource and human well-being indicators are not used;
- Mechanisms to fulfill local tribal community preferences and collective eco-cultural well-being needs are not pinpointed;
- Socio-cultural drivers of local natural resource health and benefits to future tribal populations are not evaluated;
- Collaboration with local community organizations and responding to their desired changes is lacking or disregarded; and
- The approaches used to upgrade model shortcomings are either in need of improvement or still need development altogether.

1.2.3.2 Portrayals of Environmental Change Impacts upon Local Cultural Systems Are Lacking

A social-ecological systems model representing the impact of environmental change on cultural systems is not available. Therefore a new model needs to be created that portrays:

- 1) the impacts of local environmental change;
- 2) the impacts environmental degradation has upon individuals or families;
- 3) the local environmental elements that are critical for sustaining a healthy tribal community; and
- 4) that fulfilling community sustenance needs includes addressing local environmental change, social and cultural stability, tribal well-being, and/or basic tribal sovereignty concerns.

1.3 BACKGROUND LITERATURE AND INFORMATION GAPS

1.3.1 CURRENT THEORIES AND FINDINGS

The incorporation of cultural resource assessments into local risk assessment or cultural resource protection and management approaches is disregarded in most cases. The significance of tribal cultural information was highlighted in 1986 within an article entitled The Search for an Environmental Ethic (J. Baird Callicott, 1986, p. 415) where it was stated that “the general ideal provided by American Indian cultures of respectful, restrained, mutually beneficial human use of the environment is certainly applicable in today’s context.” Twenty-five years later, the importance of risk assessments and their need to incorporate power and empowerment (including “who is in charge and who is liable”), especially in tribally-focused risk assessments, was underscored within the article, Poisoning the Body to Nourish the Soul (Donatuto, Satterfield, & Gregory, 2011, p. 121).

The Callicott (1986) article underscores that local tribal natural resource management information should be sought out and respected, while the Donatuto (2011) article counsels natural resource professionals to be certain to include issues relating to risk, power, and empowerment (and who is in charge, and who is liable) when working on environmental issues within a tribal community. Some of the most important links between the goals of seeking out tribal natural resource information and addressing tribal risk and empowerment concerns have been connected to the topics of local risk assessment, decision-making power, indigenous well-being, cultural dimensions, social values, indigenous health-based risk evaluations, ecosystem services, and even eco-cultural concepts.

1.3.1.1 Early Connections

It is likely that recent work on these topics is actually founded in earlier work and conceptual developments. For example, ecological risk assessments needing to address tribal empowerment concerns (Donatuto et al., 2011) could be considered as being a newer iteration of earlier appeals to respect local tribal cultural information and use an “ecocentric environmental ethic” (J. Baird Callicott, 1986) as well as recognize that “Indian land wisdom” provides a legacy of ideas that could have practical benefits for contemporary society (J. Baird Callicott, 1989).

Advice to detail who the interested parties are, how they interact, and who has the power to influence what happens (Reed et al., 2009) could be an extension of previous recommendations to “use concepts such as actor, role, network, power, institutions, values, and ethics” (Folke & Kaberger, 1991). Specifying that planning should be conducted as the local identification of what matters, who knows, and what rules are guiding the framing of questions and evidence (Satterfield, Gregory, Klein, Roberts, & Chan, 2013) possibly furthers earlier prompts to use the “Indian vision of land healing” to guide local ecological and cultural restoration work (Rogers-Martinez, 1992).

Promoting representations which frame “cultural services” (with respect to relative contributions of relevant structures and functions) and also demonstrate how they can be “operationally defined” (Daniel et al., 2012) could be a realization of earlier advice to learn from traditional social-ecological systems “how degraded ecosystems could be restored” (Berkes & Folke, 1994). Quantifying and illustrating the connections between social values, the attitudes and preferences that manifest these values, and the environmental characteristics, locations and associated ecosystems that elicit such values (Sherrouse, Clement, & Semmens, 2011) could be a refinement of previous advice to focus upon the “social construction of preferences, the

treatment of distributional issues, the identification of universal underlying needs, and the relationship between the satisfaction of these needs and perceived well-being” (Dodds, 1997).

Evaluating risks to natural resources based upon the priorities, values, and decision-making requirements of affected groups (Donatuto et al., 2011) is potentially founded in the need to foster a resource-based perspective that could “form the basis of” an environmental risk assessment methodology (Harris & Harper, 1999). Highlighting how ecosystem services should be managed, including specific services and management actions being targeted by the community (Bryan, Raymond, Crossman, & MacDonald, 2010) is a possible expression of the need to “identify ecosystem services using multiple methods” (Kaplowitz, 2000).

Finally, needing to integrate nature and culture within an eco-cultural system and attend to the cultural dimensions of ecosystem health and dysfunction - including using an eco-cultural health perspective to address linkages between human activities, ecological and cultural disruption, and public health (Rapport & Maffi, 2011), is potentially rooted within other original appeals to utilize “eco-culturalism” (Slack & Whitt, 1992) and/or to adopt “Eco-cultural Systems Management Model” concepts (J. P. Thomas, 1995a).

1.3.1.2 Recent Proposals to Enrich the Basic Themes and Key Topics

Recent proposals to enrich the above basic themes and key topics have included the following ideas:

1.3.1.2(A) Local Risk Assessment

Recognize that risk assessment occurs whenever natural resource-related projects or proposals are reviewed and that risk assessments need to address intangible values – and ensure that power, loss of power, and empowerment are central within the discourse (Donatuto et al., 2011).

1.3.1.2(B) Decision Making Power

Focus upon local actor-networks and value articulation dynamics - and ensure analyses detail which ecosystems are being prioritized, and who benefits (Ernstson, 2013).

1.3.1.2(C) Indigenous Well-Being

Recognize the precepts that: 1) the natural environment plays an integral role in achieving and maintaining health; 2) indigenous cultures perceive the natural environment as linking traditional cultural practices, social connectedness, identity and health; 3) health includes physical, mental, cultural, spiritual and social components; and that 4) these components are interrelated with each other and with the health of the natural environment - particularly as it relates to traditional gathered foods (Schure et al., 2011). Also, recognize the need to involve indigenous constituents and policies, and to “consult with constituents” to create new and meaningful scales for important cultural values (Satterfield et al., 2013).

1.3.1.2(D) Cultural Dimensions

Highlight conceptual frameworks that integrate cultural heritage and identity into policy-making (Tengberg et al., 2012), and frameworks to understand the potential range of cultural values and dynamics between these values (Stephenson, 2007). Ensure cultural dimension representations focus upon how cultural knowledge and practices and scientific approaches can be communicated and integrated (Tipa, 2009), and ensure appropriate methods are used to assess

compensations of cultural losses (Gregory & Trousdale, 2011).

1.3.1.2(E) Social Values

Strengthen the connections between community engagement and policy decisions (MacDonald et al., 2013), highlight community suggestions on how ecosystem services should be managed (Bryan et al., 2010) and address non-material values through methods from diverse social sciences (K. M. A. Chan, Satterfield, & Goldstein, 2012a). Identify specific ecosystem services and management actions being targeted by the community, and identify indices for the spatial distribution of social values (Bryan et al., 2010). Provide assistance articulating values to feature within a framework able to inform existing programs (MacDonald et al., 2013). Provide systematic treatment for both fact-based and value-based knowledge claims (Failing, Gregory, & Harstone, 2007), and optimize decision-making that is both ecologically appropriate and socially just (K. M. A. Chan et al., 2012a).

1.3.1.2(F) Indigenous Health Based Risk Evaluations

Involve local expertise at the local level (Fagerholm, Kayhko, Ndumbaro, & Khamis, 2011), optimize community involvement and participatory mapping (Fagerholm et al., 2011), and design framing to spotlight a tribal communities held values - underscoring why these values define and prioritize health, especially health risks and impacts (Donatuto et al., 2011).

1.3.1.2(G) Ecosystem Services

Focus the management of ecosystem services upon social values (Kaplowitz, 2000). Adopt the ecosystem services concept (Daily, 1997) – e.g., recognizing ‘environmental services’ was introduced in 1970 - and ‘ecosystem services’ became the standard in scientific literature by 1981 (Ehrlich & Ehrlich, 1981), and that the concept includes socio-economic and conservation

objectives.

1.3.1.2(H) Eco-Cultural Concepts

Recognize and promote research advancing the concept of “eco-culturalism” (Slack & Whitt, 1992), and/or the original eco-cultural” concepts which were initially advanced as the “Eco-Cultural Systems Management Model” (J. P. Thomas, 1995a), and/ or as “eco-cultural restoration” (J. P. Thomas, 1995b) and (Martinez, 1995).

1.3.1.3 Critical Main Points

- Local risk assessments do need to address intangible values, and prevailing decision-making regimes.
- Indigenous well-being and stewardship has to be recognized as well as nurtured.
- Social values of ecosystem services need to be accommodated.
- The cultural dimensions of ecosystem services should always be included.
- Risk evaluations need founding within the health requirements of the affected groups using the wider definition of “health” presented above.
- Deriving ecological benefits and having equal power over decisions should be in balance.

1.3.2 CURRENT TOPICS NEEDING BROADER SCOPE OR DEEPER COMPREHENSION

The above and related research indicates that all of these basic themes need to be broadened in scope and/or increased in comprehension as follows:

LOCAL RISK ASSESSMENT

- **Broaden Scope: Risk Assessment Purposes**
 - examine who is in charge and who is liable,
 - include intangible values
 - provide a means for evaluating how these dimensions are impacted (Donatuto et al 2011).

DECISION MAKING POWER

- **Broaden Scope: Data Parameters**
 - include which ecosystems are being prioritized
 - include who benefits (Ernstson 2013).

INDIGENOUS WELL-BEING

- **Broaden Scope: Indigenous Policies and Consultation**
 - involve indigenous constituents and policies
 - consult with constituents to create new and meaningful scales for important cultural values (Satterfield et al 2013).
- **Deepen Comprehension: Human Health**
 - view health in a holistic and dynamic manner - including physical, mental, cultural, spiritual and social components with components interrelated to each other, as well as with the health of the natural environment (Schure et al 2011).

CULTURAL DIMENSIONS

- **Broaden Scope: Cultural Information and Losses**
 - facilitate the communication of cultural knowledge and practices and their integration with relevant scientific approaches (Tipa 2009).
 - underscore cultural losses and compensation (Gregory and Trousdale 2011).
- **Deepen Comprehension: Decision Making Mechanisms**
 - employ conceptual frameworks to integrate cultural heritage and identity assessments into policy-making (Tengberg et al 2012).
- **Deepen Comprehension: Cultural Values**
 - employ conceptual frameworks to understand the potential range of cultural values, and the potential dynamics between these values (Stephenson 2007).

SOCIAL VALUES

- **Broaden Scope: Community Values and Preferences**
 - solicit community suggestions on how ecosystem services should be managed
 - formulate spatial indices of social values for ecosystem services (Bryan et al 2010)
 - examine non-material values through diverse methods of social sciences (Chan et al 2012).
- **Deepen Comprehension: Community Engagement**
 - strengthen connections between community engagement and policy decisions (MacDonald et al 2013).
- **Deepen Comprehension: Targeted Actions**
 - identify specific ecosystem services and management actions targeted by local communities (Bryan et al 2010).
- **Deepen Comprehension: Program Improvements**
 - assist the articulation of values to inform existing programs (MacDonald et al 2013).
- **Deepen Comprehension: Incorporating Knowledge**
 - treat both fact-based and value-based knowledge claims systematically (Failing et al 2007).
- **Deepen Comprehension: Social Justice**
 - empower decision-making to be ecologically appropriate and socially just (Chan et al 2012).

INDIGENOUS HEALTH BASED RISK EVALUATIONS

- **Broaden Scope: Risk and Exposure of Affected Groups**
 - evaluate ecological risks based upon the priorities, values, and decision-making requirements of affected groups (Donatuto et al 2011).
 - involve local expertise at the local level, and employ community involvement and participatory mapping during risk assessment (Fagerholm et al 2011).
 - prioritize examining the held values of exposure groups - and why these define and prioritize health, and health risks and impacts (Donatuto et al 2011).

ECO-CULTURAL CONCEPTS

- **Broaden Scope: Eco-cultural Perspectives**
 - prioritize the cultural dimensions of ecosystem health and dysfunction
 - employ eco-cultural health perspectives highlighting the linkages between human activities, ecological and cultural disruptions, and public health (Rapport and Maffi 2011).

1.4 SPECIFIC PROBLEMS and QUESTIONS TO RESOLVE

1.4.1 PRIMARY PROBLEMS

A. Ambivalence to cultural systems – undermines relevance of “Eco-Cultural Preferences” (ECPs).

B. Disregard of natural resource qualities and opportunities which negates accommodating ECPs.

C. Blockades to tribal decision preferences which thwarts high-quality natural resource conditions.

1.4.1.1 Problem A: Ambivalence Undermines ECPs.

Ambivalence to tribal cultural systems undermines the identification and/or perceived relevance of eco-cultural preferences. Other underlying problems contributing to these circumstances probably include the following:

Community Not Sustained - Local tribal community and/or their cultural systems are not being sustained.

Sustenance Needs Overlooked - The sustenance needs of local tribal communities are not being ensured.

Preferences and Well-being Disregarded - Mechanisms to fulfill tribal community preferences and eco-cultural Well-Being needs are not pinpointed.

Drivers and Benefits Are Shortsighted – Socio-cultural drivers of local natural resources health and benefits to future populations are not evaluated.

Decision Outcomes Not Equitable - Local communities are not being equitably served through natural resources decisions.

1.4.1.2 Problem B: Selective Disregard Negates ECPs.

Selective disregard of natural resource qualities and diverse opportunities negates accommodation of local eco-cultural preferences. Other underlying problems contributing to these circumstances probably include the following:

Local Ecological Changes Overlooked - Local ecological variability not being addressed.

Community Goals Not Effected - Community targets for local biophysical processes not being effected.

Resources Inaccessible or Low Quality – The need for local natural resources to be both accessible and in high-quality conditions is not being acknowledged.

1.4.1.3 Problem C: Blockades To Tribal Decision Preferences Inhibits ECPs.

Blockades to tribal decision preferences thwart the realizing of high quality eco-cultural conditions. Other underlying problems contributing to these circumstances probably include the following:

Tribal Well-being and Eco-cultural Needs are Dismissed - Key factors needed to sustain tribal well-being and eco-cultural needs are not being acknowledged.

Community Organizations Omitted - Collaboration with local community organizations is lacking or disregarded.

Community Preferences Unfulfilled - Local tribal community or cultural preferences are insufficiently identified or not actually fulfilled.

High-Quality Salmon Preferences Inhibited - Tribal cultural preferences not being empowered to produce high-quality salmon fitness.

1.4.2 RESEARCH QUESTIONS

The primary research questions for this study are as follows:

Question A: Can ambivalence about ECPs be circumvented?

Question B: Can regard for highest-quality conditions and opportunities be re-instilled?

Question C: Can blockades to tribal decision preferences be alleviated or neutralized?

1.4.2.1 Problem A: Ambivalence Undermines ECPs.

Question A - Can ambivalence about ECPs be circumvented?

Pertinent related questions include:

How can ecosystem-related community and cultural dimensions be sufficiently characterized?

How can the social or cultural values attributed to natural resources be represented most effectively?

How can the range and scalar aspects of the cultural dimension be sufficiently represented?

What useful mechanisms are needed to foster decisions now regarding the future conditions of resources/land?

What protocols link management action risk assessments to cataloguing and accommodation of tribal perceptions of management actions?

1.4.2.2 Problem B: Subjective Disregard Negates ECPs.

Question B - Can regard for highest-quality conditions and opportunities be re-instilled?

Pertinent related questions include:

How can local ecological conditions at a variety of scales (temporal, spatial, and social) be characterized effectively?

What inhibits the natural resource values targeted by the community from being obtained?

What mechanisms enable access to high-quality natural resource conditions to be accommodated?

1.4.2.3 Problem C: Blockades to Tribal Decision Preferences Inhibits ECPs

Question C - Can blockades to tribal decision preferences be alleviated or neutralized?

Pertinent related questions include:

How can the relationships between tribal risk and empowerment issues, indigenous well-being and stewardship principles, and the psychological impacts of environmental degradation be represented effectively?

What are feasible and efficient mechanisms for procuring robust tribal natural resources information?

How can local decision outcomes adhere to tribal natural resource preferences information?

What mechanisms enable tribal cultural preferences to be empowered to produce higher-quality salmon fitness results?

1.4.3 ANTICIPATED BENEFITS OF RESEARCH

1.4.3.1 Anticipated Benefits A

- Characterizing ecosystem-related community and cultural dimensions of vulnerable, at-risk communities could contribute to reinforcing and stabilizing local tribal community and cultural systems through spotlighting the substantive attributes and qualities of local natural resources that are perceived as being irreplaceable.
- Representing natural resource values effectively fosters appreciation of the array of aspects involved when fulfilling tribal community sustenance needs.
- Representing the range and scale of cultural dimensions provides a platform for tribal community preferences and eco-cultural well-being needs to be highlighted.
- Promoting decisions now regarding future conditions fosters adaptive co-management and resilient community results.
- Reinforcing the purpose of risk assessments as being to accommodate tribal perceptions of management actions may serve to promote local communities' abilities to be equitably served through natural resources decisions.

1.4.3.2 Anticipated Benefits B

- Characterizing local ecological conditions at a variety of scales promotes examination of temporal and spatial variability trends.
- Elucidating the factors inhibiting community natural resources targets from being obtained could bolster the development of strategies to eliminate these blocking factors.
- Pinpointing mechanisms enabling access to high-quality local natural resource conditions to be accommodated could centralize the development of strategic approaches ensuring this occurs.

1.4.3.3 Anticipated Benefits C

- Representing the relationship between indigenous well-being, psychological impacts, risk, empowerment, and stewardship principles effectively could foster the development

of mechanisms to nurture tribal decision preferences targeting high-quality environmental conditions.

- Pinpointing feasible efficient mechanisms for procuring robust natural resources information could serve to institutionalize meaningful collaborations with local tribal community organizations.
- Detailing how local decision outcomes can accommodate tribal natural resource preference information may produce a platform for ensuring these preferences are actually identified and accommodated.
- Characterizing the mechanisms needed for empowering tribal eco-cultural preferences focused upon producing high-quality salmon fitness results could establish the platform needed to begin adopting and benefiting from the higher-quality salmonid recovery results.

1.5 INVESTIGATIVE PROJECT GOALS

1.5.1 PROJECT THESIS

“ECO-CULTURAL PREFERENCES CAN BE IDENTIFIED AND ACCOMMODATED”.

1.5.2 PROJECT GOALS

The investigative goal will be to focus upon improving the understanding of the dynamics involved with procuring tribal natural resources information, accommodating tribal eco-cultural preferences, and/or addressing tribal risk and empowerment concerns in order to produce a new theoretical model that can be used use to evaluate the quality of local environmental risk assessment work.

Recently published scientific articles will be systematically reviewed to ascertain whether they contain key concepts or visual model representations that have value for resolving the social and research problems being focused upon within this particular study.

1.5.2.1 Systematic Review

The investigative approach will be to use systematic review (Petticrew & Roberts, 2006) to pinpoint the key concepts needing to be collected for analysis using thematic synthesis (J. Thomas & Harden, 2008) where the data are inductively categorized into groups to detect inherent themes that can be used for final synthesis into a theory capable of explaining the underlying phenomenon.

The results of the systematic review and synthesizing the themes that are inherent within the collected data will then be compared to the management approaches and research concepts which are being underscored by the regional Puget Sound Partnership – and Timber/Fish/Wildlife - salmon recovery processes.

1.5.2.2 Topics Needing Greater Understanding (with Respect to Current Gaps in Practice or Literature)

The topics of local risk assessment, decision-making power, indigenous well-being, cultural dimensions, social values, indigenous health-based risk evaluations, ecosystem services and eco-cultural concepts will be the key topics being investigated to collect the qualitative data needed for completing a thematic synthesis. The review will seek qualitative data that can be used to broaden the scope of the components or deepen comprehension of the dynamics being featured within current frameworks and models via synthesizing the data into the elements of a new conceptual model.

Broaden Scope of Components - Key components of the existing frameworks that have been picked to be broadened in scope through this review are risk assessment, data analysis parameters, indigenous policies and consultation, cultural information and cultural losses,

community values and preferences, the risk and exposure of affected groups, and eco-cultural perspectives.

Deepen Comprehension of Dynamics - The dynamic aspects of current models that are being targeted for an even further deepening of the comprehension of their dynamics through this systematic review are human health foundations, decision making mechanisms, cultural values, community engagement, program improvements, targeted actions, incorporating knowledge, and social justice.

The initial goal will be to screen recent scientific articles in order to select ones that will be analyzed further in regards to specific topics whose components have been noted as needing to be broadened in scope, or whose dynamics are recognized as needing even greater comprehension.

The following criteria will be used to select the articles that will be systematically reviewed for pertinent data:

- social or cultural values attributed to local natural resources are visually represented,
- highlights the community or cultural dimension of socio-ecological systems,
- spotlights the links between environmental degradation and human socio-psychological impacts,
- natural resources values information is collected/analyzed using community or culturally-relevant approaches,
- refers to the term “eco-cultural”, and/or
- human ecosystems, socio-ecological systems, and/or a tribal eco-cultural health-specific conceptual model or framework (including potential indicators) are a central feature.

The following criteria will be used for selecting the visual representations within the articles that will be systematically reviewed for pertinent data:

- Visual representations are holistic.
- Socio-cultural-ecological systems components, factors and/or dynamics are interrelated.
- Ecological and socio-cultural systems are represented as interfacing, interacting and/or integrated.
- Ecological or socio-cultural well-being is represented as being the center of the integrated system.
- System relationships are represented using domains.
- Integrated systems consist of biophysical template, social template, and ecosystem services components.
- Social template represented with economic, political, community and/or cultural dimension elements.
- Biophysical template is represented as having socio-cultural attributes.
- Eco-cultural concepts are specifically referenced and/or depicted as being the focus of the model.

Selected Articles to Be Analyzed In-Depth for Key Concepts - The articles selected for in-depth analysis will be examined for key concepts being used to describe the reciprocal changes transpiring between ecological and cultural systems (and their basic systems impacts), as well as the dynamics that are most relevant to sustaining: a) the local community, b) the individual persons and families within the community, and/or c) local tribal social and cultural resources.

1.5.3 RESEARCH GOALS

The research goals for addressing the problems being focused upon within this research project as follows:

1.5.3.1 Research Goals - Problem A

- Devise model for characterizing community and cultural dimensions.
- Integrate the social (including intangible) values of ecosystem services into assessments and decisions.
- Integrate the cultural dimensions of ecosystem services into assessments and decisions.
- Ensure social or cultural values attributed to natural resources are richly represented.
- Thoroughly identify tribal cultural values.
- Incorporate holistic conceptual frameworks and their potential indicators.
- Nurture decisions needed to manage future conditions of resources/lands.
- Assess risks and impacts of management actions.
- Catalogue tribal perceptions of management actions.

1.5.3.2 Research Goals – Problem B

- Provide framework for characterizing ecological conditions at a variety of temporal, spatial and social scales.
- Collect, analyze and accommodate community natural resource values targets for local biophysical processes.
- Provide framework for characterizing ecological conditions at a variety of temporal, spatial and social scales.

1.5.3.3 Research Goals – Problem C

- Sustain and reinforce focus upon tribal risk and empowerment issues.
- Foster ongoing recognition and nurturing of Indigenous well-being and stewardship principles.
- Nurture characterizations of local risks at relevant temporal, spatial and social scales.
- Reverse environmental degradation that is inciting psychological impacts.
- Nurture the procurement of robust tribal natural resources information.
- Collect and analyze community natural resources values information using community and culturally-relevant approaches.
- Nurture meaningful adherence of responses to tribal natural resource preferences information.
- Spotlight and empower the local tribal cultural preferences which produce higher-quality salmon fitness results.

1.5.4 RESEARCH METHODS GLOSSARY

Qualitative Research Methodologies

Grounded Theory: A specific methodology developed by Glaser and Strauss (1967) for the purpose of building theory from data; or more generically – to denote theoretical constructs derived from qualitative data analysis (Corbin & Strauss, 2008)

Qualitative Analysis: A process of examining and interpreting data in order to elicit meaning, gain understanding, and develop empirical knowledge (Corbin & Strauss, 2008).

Qualitative Content Analysis: Categorizing and finding themes from categories (Cho & Lee, 2014).

Meta-Ethnography: The synthesis of interpretive research (Noblit & Hare, 1988). Meta-ethnography involves selecting relevant empirical studies to be synthesized, reading them

repeatedly and noting down key concepts (interpretive metaphors). These key concepts become the raw data for the synthesis (Campbell et al., 2003).

Grounded Qualitative Meta-Analysis: A cyclical process which requires investigators to construct theory from the data itself (Hossler & Scalese-Love, 1989).

Systematic Review: Literature reviews that adhere closely to a set of scientific methods that explicitly aim to limit systematic error (bias), mainly by attempting to identify, appraise and synthesize all relevant studies of (of whatever design) in order to answer a particular question (or set of questions) (Petticrew & Roberts, 2006).

Model-Centered Analyses: Meta-analyst pools the models that ethnographers have developed from their data rather than the data itself – and then looks for systematic patterns across the models. Using this general approach, meta-analysts have begun to characterize trends and patterns in the global change literature (Rudel, 2007).

Thematic Analysis: A search for themes that emerge as being important to the description of the phenomenon (Daly, Kellehear, & Gliksman, 1997). A process for encoding qualitative information. The encoding requires an explicit “code” (Boyatzis, 1998).

Hybrid Thematic Analysis: Methodological approach that integrates data-driven (inductive) codes with theory-driven (deductive) ones based on the tenets of social phenomenology (Fereday & Muir-Cochrane, 2006).

Thematic Synthesis: Reviewing and synthesizing qualitative research in a systematic way through line-by-line coding, the organization of these codes into descriptive themes, and the generation of analytical themes through the application of a higher level theoretical framework (J. Thomas & Harden, 2008). Thematic synthesis draws on the principles of thematic analysis and other established methods in primary qualitative research. It identifies the recurring themes or issues in the primary studies, analyzes these themes, and draws conclusions in systematic reviews. The purpose is to develop analytical themes through a descriptive synthesis and find explanations relevant to a specific review question (Cruzes & Dyba, 2011).

Thematic Analysis Elements

Initial Coding: Initial coding is often undertaken by analyzing text line by line (Glaser, 1978).

Open Coding: The process of breaking down, examining, comparing, conceptualizing, and categorizing data (Strauss and Corbin, 1990). Similar concepts were grouped into identifiable categories with properties and dimensions. This coding process involves recording (line by line)

identifiable relevant data from the case studies. Each mentioned concept or phenomenon is listed only once (Stall-Meadows & Hyle, 2010).

Concept: Codes are analyzed and those that relate to a common theme are grouped together. This higher order commonality is called a concept (Allan, 2003).

Category: A category refers items “with similar meaning and connotations”(Weber, 1990). Concepts are grouped and regrouped to find yet higher order commonalities called categories. It is these concepts and categories that lead to the emergence of a theory (Allan, 2003).

Theme: A theme is an outcome of coding, categorization, and analytic reflection, not something that is, in itself coded (Saldana, 2008). A way to link the underlying meanings together in categories (Granaheim, 2004). The concept of a theme has multiple interpretations – including “an expression of the latent content of the text” (Granaheim, 2004).

Empirical Model: Constructing practical models useful in describing and coping with real-world situations. Modeling refers to the process of generating a model as a conceptual representation of observed phenomena (Cruzes & Dyba, 2011).

Thematic Analysis Code Types

Code Definition: A variety of terms refer to codes, including concepts. Codes identify a feature of the data (semantic content or latent) that appears interesting to the analyst, and refer to ‘the most basic segment, or element regarding the phenomenon (Cruzes & Dyba, 2011).

In Vivo (Substantive) Code: Substantive codes are taken from the language of the data and may assume the form of “in vivo codes” (Glaser, 1978). The term “in vivo” is Latin for “within the living” and this type of code captures participants words as representative of a broader concept in the data (Birks & Mills, 2011).

Conceptual Code: Conceptual codes identify key concepts and essential dimension of these concepts. Conceptual codes are particularly helpful in generating categories, themes, and theory in research (Cruzes & Dyba, 2011).

Axial Code: Axial coding equates to making connections between categories. Each story is conceptualized into a formal statement, showing the relationships among categories (Stall-Meadows & Hyle, 2010).

Selective Code: Selective coding equates to the integration of concepts into theories. It requires a higher level of thinking and an abstract level of analysis. Categories developed during open and

axial coding becomes a picture of reality, or a storyline (Stall-Meadows & Hyle, 2010). Selective coding includes conceptualizing the most encompassing of categories into the core category, relating other categories to the core category, validate the relationships among categories, presenting relationship statements within the narrative, and developing hypotheses that relate to the categories at the dimensional level (Stall-Meadows & Hyle, 2010).

Analytical Measures

Purpose of Synthesis of Qualitative Research: The purpose of a synthesis of qualitative research is to achieve a level of conceptual development beyond that attained in the individual studies included - in effect, to move from second-order to third order constructs (Campbell et al., 2003).

Comparing Studies to See How they are Related: In doing a synthesis - create a list of the key phrases, key ideas and/or key concepts (and their relations) used in each account and to juxtapose them. Generate an initial assumption about the relationship between the studies (Noblit & Hare, 1988).

Group Categories into Themes: Reorganize categories into higher, broader categories - final categories can be formed now. Identify subthemes both within and across the categories and then organize the subthemes into main themes (Cho & Lee, 2014).

Developing Higher-Order Themes: Review the thematic map taking each branch in turn - create higher-order themes. Identify connections between the higher-order themes and the underlying evidence. Explore connections with relevant theory and prior research to further refine the higher-order themes. Create a model of the higher-order themes and their underlying evidence (Cruzes & Dyba, 2011).

Axial Coding Paradigm Model: Link subcategories to another category in a set of relationships denoting causal conditions, phenomenon, context, intervening conditions, action/interactional strategies and consequences (Strauss & Corbin, 1990).

1.5.5 DATA COLLECTION AND ANALYSIS

Thematic synthesis (J. Thomas & Harden, 2008) will be the specific method that will be used for analyzing the qualitative data compiled to identify inherent themes which might be synthesized into a new theoretical model capable of explaining important relationships existing between the initial data factors. See Glossary (Section 1.5.4) for definition of thematic synthesis.

A two-pronged strategy will be applied here so that the same data can be assigned independently to inductively generated data categories as well as separately generated overall themes because this will enable the original data and the independently created data categories and overall themes to be comparatively matched.

Direct matching of the original data with both of the independently generated categories and themes could lead to acknowledging key themes, or possible ways the originally separate inductive themes are interrelated with each other.

Model-Centered Analyses - Model-centered analyses (Rudel, 2007) will be the specific technique that will be used for pinpointing the primary attributes of current model representations to be pooled together to detect “systematic patterns across the models”. The goal will be to select key attributes underscored within current representations that can be synthesized into a new theoretical visual representation of the dynamics involved when comprehending community sustenance needs. See Glossary (Section 1.5.4) for definition of model-centered syntheses.

The main goals for research data collection and analysis will be to identify: 1) critical factors that must be represented and/or incorporated into the new model, 2) key themes and categories to synthesize together into a new grounded theoretical model capable of explaining the underlying phenomenon, and 3) visual formats that could be used to structure the new model.

1.6 PROJECT RESULTS

This project will generate a local community and cultural dimensions social-ecological systems model that focuses upon collecting and analyzing natural resource values information using community and culturally-relevant approaches.

The following steps will be used to create and use the new model:

- Complete a thematic analysis of existing scientific literature to broaden scope and comprehension involving current key topics.
- Group the individual themes from the thematic analysis so that a specific series of interrelationships between the themes revealed during thematic analysis can be identified.
- Examine the interrelationships occurring between the themes or categories (See Glossary – Section 1.5.4) and their underlying concepts when they are all integrated.
- Spotlight the thematic relationships serving to link the collection of tribal natural resources information with the resolving of tribal risk and empowerment concerns.
- Use the results to address tribal natural resources risk assessment and empowerment issues.

A visual representation of the key relationships that potentially exist between the themes is highlighted within the new model. The new visual representation is expected to highlight the following dynamics: 1) local environmental change impacts upon socio-cultural factors, including upon individuals or families; 2) the environmental elements that are critical for sustaining a healthy tribal community; and/or 3) the local social-ecological system mechanisms that are used to: a) collect and analyze natural resources information using community and culturally-relevant approaches, b) characterize risks at a variety of spatial, temporal, and social

scales; and c) to fulfill tribal community sustenance needs via concurrent efforts to address local environmental change, social and cultural stability, tribal well-being, and/or basic tribal sovereignty concerns.

1.7 TESTING

The new model will undergo preliminary testing by comparing it to the management approaches being advanced through the current regional Puget Sound Partnership (<http://psp.wa.gov/>) and Timber/Fish/Wildlife (http://file.dnr.wa.gov/publications/fp_hcp_29appl.pdf) salmon recovery approaches.

1.7.1 PRELIMINARY TESTING PRINCIPLES

Testing of the new model will be based upon the principles: 1) Fulfilling tribal well-being includes ensuring that local natural resources are accessible and ensuring that these natural resources are managed for the high-quality conditions needed to fulfill tribal community and culturally-specific needs; 2) Fulfilling tribal community sustenance needs requires appreciating the key relationships and the dynamics that are most relevant to sustaining the local community, including tribal livelihoods, psychological Well-Being, and personal spirituality, and a general array of other local tribal eco-cultural needs; 3) Accommodating tribal eco-cultural preferences includes identifying local tribal community or cultural preferences, as well as specifying how tribal cultural preferences will be used to foster decisions that produce higher quality salmon recovery results; and 4) Eco-cultural preferences actually need to be fulfilled as the outcomes of natural resource protection or restoration decisions as intended by the Tribe(s).

The purpose of testing the new model is to demonstrate whether the elements of the new theoretical model have practical value and can be used as an instrument for evaluating the quality of site-specific environmental risk assessment efforts and/or evaluate the quality of multi-scalar cultural resources protection and management programs (e.g. Puget Sound Partnership and Timber /Fish/Wildlife salmon recovery processes, etc.).

1.7.2 PUGET SOUND PARTNERSHIP PROGRAM – COMPARISON TESTING

This test will focus upon comparing the elements that are currently featured within the prevailing Puget Sound Partnership salmon recovery process with the elements represented within the new model to assess the gaps and how they can be incorporated into the salmon recovery strategies that are currently being advanced.

As such, the preliminary testing is expected to focus upon the following elements of the Puget Sound Partnership process: the strategies used to identify tribal cultural values, the steps used to ensure that local communities are being equitably served through natural resource decisions, the public discourse procedures used to effect the local biophysical processes being targeted by the community, and/or the approaches used to address local ecological variability, or tribal environmental justice, or the decisions needed to manage the future conditions of tribal natural resources and lands.

Chapter 2 RESEARCH METHODS

2.1 RESEARCH METHODS

2.1.1 SCIENTIFIC METHODS BACKGROUND

Meta-Analysis Combined with Grounded Theory Development Procedures - Metadata is often called "data about data", and meta-data-analysis is a method used to study the findings of reported research in a particular substantive area of inquiry (Noblit & Hare, 1988). Meta-data are structured data which describe, explain, locate or otherwise makes it easier to retrieve, use or manage an information resource (Organization, 2004). The main purpose to compile metadata is to facilitate the discovery of relevant information. Meta-data analysis is the technique being used to structure the research that is being undertaken here to first collect and analyze existing scientific journal information, and then use those data to generate a new theory explaining how tribal risk assessment cultural data may be related to higher-quality salmon recovery results.

This project combines meta-analysis and grounded theory development procedures, recognizing that Hossler and Scalese-Love (1989) demonstrated that qualitative data can be meta-analyzed, and Strauss and Corbin (1990) provides a detailed procedure for basic grounded theory development - e.g., from (Stall-Meadows & Hyle, 2010). A modified grounded theory approach of thematic analysis will be used here (Paterson, Thorne, Canam, & Jillings, 2001), because thematic analysis is considered to be a particularly useful method for investigating an under-researched area (Braun & Clarke, 2006). The analytical methods will focus upon describing the original journal data to show patterns in semantic content - and then summarizing, and finally interpreting the data to theorize the significance of detectable patterns and their broader meanings and implications (Patton, 1990).

This meta-study consolidates widely scattered literature into a usable and coherent whole, and synthesizes the compiled information into a more applied understanding of their accepted findings and conclusions (Paterson et al., 2001). This analysis transforms isolated islands of information into an integrated body of knowledge about the phenomenon under study (Sandelowski, Docherty, & Emden, 1997) and will uplift the common insights that are discernible within a body of qualitative research studies so that they can be rendered visible, analyzed, and interpreted (Paterson et al., 2001). Information that is extracted from the primary research reports will be compared for similarities and differences that might be of value for developing an applicable theory, and will interpreted to better comprehend the meaning of the phenomenon under study, focusing upon the possible relationships occurring between the various categories of data. Judgments may be made about the conclusions of other researchers, and relationships may be extrapolated between their key concepts, research decisions, and policy implications (Paterson et al., 2001). Theoretical sampling will be used so that a theory which uses the categories that are intrinsic to the data can be constructed (Birks & Mills, 2011).

Assess Current Thinking and Knowledge – The existing literature regarding the empowering of local tribal communities and the links that tie tribal community health to their local natural resource decision-making and empowerment concerns will be reviewed in order to establish current thinking, and this will be used to represent scientific professionals’ and researchers’ perceptions regarding the integration of tribal eco-cultural preferences into local salmon recovery decisions, priorities, and and/or actions, as currently expressed through scientific journal publications (Fereday & Muir-Cochrane, 2006). The scientific articles which contain information that may be important for synthesizing the existing body of knowledge will be selected for final review (Onwuegbuzie, N.L., & K.M.T., 2012). The source documents will be

research articles drawn from the existing body of work produced by researchers within the last fifteen years, where theoretical and research publications in scientific journals and other materials about the theory, practice, and results of accommodating tribal ecocultural views regarding local salmon recovery were used.

The sampling strategy here will be to treat documentary sources as research “sites”, and the authors of scientific journal articles as being informants - per Helmericks et al. (1991) procedures ((Helmericks, Nelsen, & Unnithan, 1991) - and to recognize existing literature as being “accumulated knowledge” (Dey, 1993). Text analysis will involve proofreading the material and underlining key phrases that make “inchoate sense” (Ryan & Bernard, 2001), and potential useful content will consist of something interesting or compelling that stands out upon reading - and may be the basis of a category or group (Guest, 2012).

The study uses research questions (as opposed to hypotheses, which are more suited for capturing objectives of a confirmatory nature) - and the nature and distribution of relevant studies and other sources are ascertained before committing to a final set of questions. These questions may be stated in broad terms initially, and are likely to be refined later during the research process - in response to the findings that emerge during data collection and analysis (Glaser 1992).

Purposive and Theoretical Sampling - Potential data are collected through initial open sampling to identify documents that contain data which is relevant to the research questions (Cooper, Chenail, & Fleming, 2012). These documents will then undergo purposive sampling “to access the richest data”, so that theoretical sampling can then be used to sample the data - until

data saturation is reached within the in each of the categories constituting the grounded theory (Whiteside, Mills, & McCalman, 2012). The theoretical sampling enables new data sources to be identified based upon the codes and categories developed during the early rounds of data generation or collection (Whiteside et al., 2012), and theoretical sampling is useful for deciding what data to collect next (and where to find it), so that a theory can develop as the data emerge (Glaser & Holton, 2004). These unique characteristics of theoretical sampling make it impossible for the actual type of data needed to develop the theory from being known at the outset of the study (Birks & Mills, 2011).

Data collection will employ an exhaustive purposive sampling regimen which does not require every available study containing the same concept to be located - but does depend on the range of concepts found in the studies, their context, and whether they are in agreement or not (J. Thomas & Harden, 2008). Personal knowledge and published guides will be used to facilitate procedures analogous to snowball sampling – e.g. when no more likely sites are being generated, sampling stops (Lee, 2000). Data collection will target the compilation of a dataset of sufficient size and depth to enable a high degree of theoretical sampling, and being able to use this data to construct a new consequent theory (based upon a sufficient density of categories and properties).

Synthesize the Findings of Current Research to Produce New Knowledge - An extensive search for relevant research “highlighting the findings of the research” can be conducted, upon which a systematic review may become conceptually similar to primary research – in which the data can be analyzed and the results of many studies brought together to produce new knowledge (Harden & Thomas, 2005). “In vivo codes” can be created when particularly interesting language to use is found within the data, or a term is identified that neatly encapsulates an idea or theme (Lewins & Silver, 2007). “Key concepts” may be abstracted from

published reports - similar to Campbell et al. (2003) extracting 'key concepts' (Campbell et al., 2003) from the qualitative studies they found (J. Thomas & Harden, 2008) - and the data that are considered to be the most relevant to the study objectives can be selected for coding - or as themes for theory development (Guest, 2012). Finally, initial grouping of the in vivo codes may lead to the formation of multi-dimensional categories through identifying explanatory, conceptual patterns in the analysis (Birks & Mills, 2011). This particular meta-data-analysis is intended to be model-centered, and as such will be pooling the models that were developed from data (rather than the raw data itself), so that other pertinent "systematic patterns across the models" can be identified (Rudel, 2007).

Use Systematic Review to Collect Data to Analyze via Synthesizing the Themes - The goals for this study necessitate that this research takes a broader perspective, and as such a systematic review of the literature is being used as the most beneficial design for the study (Cooper et al., 2012). This systematic review employs a narrative synthesis process to generate new insights or knowledge based upon the evidence that is being extracted from the multiple studies (Mays, Catherine, & Popay, 2005), and thematic analysis (Daly et al., 1997) is being chosen as the most common method adopted within 'narrative reviews' for producing a synthesis of findings across included studies (Kastner et al., 2012). The study is using this conceptualization of thematic analysis because this approach uses the techniques that are commonly described as 'thematic analysis' to formalize the identification and development of themes (J. Thomas & Harden, 2008). Thematic analysis is characterized by theories and is considered to be the method to use for identifying, analyzing and reporting patterns (themes) within the data (Braun & Clarke, 2006).

Thematic synthesis ' is a version of thematic analysis that highlights adapting and combining approaches from both meta-ethnography and grounded theory to synthesize

qualitative information (Barnett-Page & Thomas, 2009). The term 'thematic synthesis' was embraced because methods used for analyzing primary research – often termed 'thematic' – were translated for use in systematic reviews (J. Thomas & Harden, 2008). This project uses a hybrid version of the qualitative methods of thematic analysis that uses both the deductive a priori template of codes approach (Crabtree & Miller, 1999), and the data-driven inductive approach of Boyatzis (1998) to collect and analyze the data (Boyatzis, 1998). This hybrid approach will complement the research questions by allowing the tenets of socioecological systems and human well-being to be integral to the process of deductive thematic analysis, while still allowing for themes to emerge directly from the data by way of inductive coding (Fereday & Muir-Cochrane, 2006).

Use Emergent Themes and Patterns for Theory Building - Thematic analysis is a method to use for bringing the main, recurrent and/or most important issues or themes within the literature involving a certain topic together, based upon some initial review questions (Mays et al., 2005), and as such key issues or themes can be fairly broadly specified and/or identified from existing literature and theories. This study's review of scientific journals begins with just a few preliminary codes (e.g. eco-cultural, human well-being indicators, natural resource values), recognizing that key issues or themes of general interest can be generated independently of the data at any stage. All of the themes are generated as the outcomes of coding, categorization, and/or analytic reflection – and are not used as codes themselves (Cruzes & Dyba, 2011).

The study creates a rich thematic description of the entire data set to identify predominant or important themes, so that the themes can be analyzed to provide an accurate reflection of the content of the entire data set. The overall method is to identify prominent or recurring themes in the literature (largely shaped by research questions), and then summarize the findings of different

studies under thematic headings, to inform a description of key points (Kastner et al., 2012). The general approach is to look across the body of primary research studies, for the purpose of aggregating findings - in order to identify represented themes that reflect this body of findings – and to develop potential solutions to the challenges that are identified. A thematic map will be produced, and then applied to, and revised in relation to the data (Braun & Clarke, 2006).

The descriptive themes that emerged from inductively analyzing the study findings (to answer the review questions) are used to answer the project research questions overall (J. Thomas & Harden, 2008). The fundamental concept is to systematically analyze the available scientific literature to find emergent themes and patterns that may be useful in theory building using coded qualitative data (Stall-Meadows & Hyle, 2010).

Develop a Grounded Theory - A grounded theory methodology is being used “given that little is known about the area of study” (Birks & Mills, 2011) - but a fully worked-up grounded-theory analysis was not needed, and so a “lighter” modified form of grounded theory is being used for this thematic analysis (Braun & Clarke, 2006), where the study findings will be presented as “themes which provide insight into the phenomena being explored by the study” (Birks & Mills, 2011). The methodological approach is to use constructivist grounded theory to develop a theory out of the analysis that might be useful to workers in the natural resource tribal risk assessment field. Constructivist-approach theoretical coding involves the merging of concepts into groups, which happens throughout the process, and constructivist grounded theories are descriptive theories (Evans, 2013).

To conform with this approach to grounded theory, data analysis includes open coding (as “key concepts”), consequent theoretical coding (as “categories” and “themes”), and then theory

construction – to explain relationships between the data (Cooper et al., 2012). The methods will highlight using ethnographic-inductive research approaches to develop a theory – utilizing grounded theory as being a research design that can evolve (Birks & Mills, 2011) to build theoretical models derived from the data - and using exploratory analyses to generate hypotheses for further study (Guest, 2012).

2.1.2 RESEARCH DESIGN RATIONALE

This project uses qualitative data analysis and development of a new theoretical model capable of explaining relationships between the underlying factors to form conclusions regarding whether “eco-cultural preferences can be identified and accommodated” during natural resource risk assessments and the outcomes that result from the decisions that are made. This is critically important given that detailing tribal concerns regarding how “eco-cultural” resources are impacted is becoming an increasingly pertinent topic that arises every time a tribal community needs to assess the risks that a natural resource management proposal could impose upon its tribal community, especially in terms of its basic personal well-being and/or other eco-cultural concerns.

The basic rationale used to guide the approach taken in this project is as follows: Specify Problems and Questions to Resolve - Characterize potential problem in need of resolution along with problems that may hinder research investigations to locate relevant solutions or answers.

Survey existing literature to ascertain if there are gaps in current information or practices that exist. Identify specific problems, pertinent questions to resolve, and the anticipated benefits.

Establish Research Goal and Research Design – Identify investigative project thesis, goals, initial topics (components and dynamics), and research design (including data collection and analysis)

– e.g., as outlined in Chapter. Examine Selected Articles for Key Concepts – Use key topics to locate candidate articles, and then use criteria to select articles to be examined further for key concepts that can be excerpted as data to use for the thematic analysis (Daly et al., 1997) procedures. Synthesize Key Concepts Into New Model – Use key concepts as a qualitative data set to identify relevant themes and categories that may be coalesced into a new model (including themes and visual representations), employing a general grounded theory approach (Strauss & Corbin, 1990). Test and Use Components/Dynamics of the Model - Test and demonstrate the value of the components/dynamics of the new model according to specific principles and focal points. Recommend relevant upgrades to current management system elements as needed.

2.1.3 RESEARCH TARGETS

The following steps are taken to create and test a new theoretical model:

- Complete a thematic analysis of existing scientific literature to broaden scope and comprehension involving current key topics.
- Bunch the individual themes together so that a specific series of interrelationships between the themes revealed during thematic synthesis could be acknowledged and recognized for their systemic significance.
- Examine the interrelationships occurring between the themes or categories (See Glossary, Section 1.5.4) and their underlying concepts when they are all integrated.
- Spotlight the relationships serving to link the collection of tribal natural resources information with the resolving of tribal risk and empowerment concerns.
- Use the results to address tribal natural resources risk assessment and empowerment issues.

The research goal was to focus upon improving the understanding of the dynamics involved with procuring tribal natural resources information, accommodating tribal eco-cultural preferences, and/or addressing tribal risk and empowerment concerns in order to produce a new theoretical model that can be used to evaluate the quality of local environmental risk assessment efforts.

The articles selected for in-depth analysis were examined for key concepts being used to describe the reciprocal changes transpiring between ecological and cultural systems (and their basic systems impacts), as well as the dynamics that are most relevant to sustaining: a) the local community, b) the individual persons and families within the community, and/or c) local tribal social and cultural resources.

The initial goal was to screen recent scientific articles to select ones to analyze further for qualitative data to be used for identifying the scope of the components or increasing comprehension of the dynamics being featured within current models via thematic synthesis of the data into the elements of a new conceptual model.

2.1.4 DATA COLLECTION

Peer review scientific articles published in the last 15 years were systematically reviewed to ascertain whether they contained key concepts or visual model representations that were of value for resolving the social and research problems being focused upon within this particular study.

The topics of local risk assessment, decision-making power, indigenous well-being, cultural dimensions, social values, indigenous health-based risk evaluations, ecosystem services and eco-cultural concepts were the key topics that were investigated to collect the qualitative

data needed for completing a thematic synthesis.

Scope of Components – The key components of the existing frameworks that were targeted to be broadened in scope through this review and synthesis were risk assessment purposes, data analysis parameters, indigenous policies and consultation, cultural information and cultural losses, community values and preferences, the risk and exposure of affected groups, and eco-cultural perspectives (e.g., as described in Section 1.3.2 Current Topics Needing Broader Scope or Deeper Comprehension).

Deepen Comprehension of Dynamics - The dynamic aspects of current models that were targeted to be deepened in comprehension through this review and synthesis were human health foundations, decision making mechanisms, cultural values (including spiritual and cosmological), community engagement, program improvements, targeted actions, incorporating knowledge, and social justice.

2.1.5 DATA ANALYSIS

Thematic synthesis (J. Thomas & Harden, 2008) was the specific method that was used to analyze the qualitative data compiled to identify inherent themes for synthesizing into a new theoretical model capable of explaining important relationships existing between the initial data factors.

A two-pronged strategy was applied to the synthesis so that the same data could be assigned independently to both the inductively generated data categories and the separately generated overall themes so that the original data and their independently corresponding themes and categories (see Glossary) could be comparatively matched.

Every original “key concept” is associated with a final analysis theme, and as such was assigned to the theme using a dual, independent assignment approach. The approach was to: 1) identify original “in vivo” data concepts, 2) assign each in vivo data code to a larger categorical group and a final theme independently, and 3) independently assign the larger category to a final theme, resulting in some categorical groups - and their “in vivo” counterparts - being recognized as shared between final themes (as described below).

Any visual representation of the key relationships that potentially exist between the themes or categories (and/or the original data factors) found within the search of source documents were noted and then considered as possible contributors to the new model being generated through the thematic synthesis.

2.1.6 TESTING FOR THEMES

The results of the theme analyses inherent within the collected data were then compared to the management approaches being advanced by the regional Puget Sound Partnership (PSP) <http://psp.wa.gov/>, and T/F/W (http://file.dnr.wa.gov/publications/fp_hcp_29appl.pdf salmon recovery processes.

2.2 SYSTEMATIC REVIEW and DATA THEMATIC SYNTHESIS - INDIVIDUAL STEPS

2.2.1 PINPOINT SOCIAL PROBLEM(S) AND GAPS IN INFORMATION OR PRACTICES

Puget Sound salmon recovery management actions and T/F/W work trigger tribal environmental duties and screening of proposals for potential risks to the tribal community. Tribal risk assessment priorities underscore tribal cultural values, tribal well-being sustainment factors,

and/or community eco-cultural needs and the irreplaceable need for accurate relevant information. However, current approaches to collecting tribal natural resource information, accommodating tribal eco-cultural preferences and/or addressing tribal environmental justice or sovereignty concerns have serious shortcomings that need to be overcome or improved upon altogether.

2.2.2 RESEARCH PROJECT THESIS AND INITIAL TOPICS

The working thesis for this project is that “eco-cultural preferences can be identified and accommodated”, and as such initial investigations were focused upon selecting the pertinent topics and their dynamics.

2.2.3 SYSTEMATIC REVIEW FOR DATA (CANDIDATE ARTICLES OPENLY SAMPLED FOR FURTHER SCREENING)

Peer reviewed scientific articles regarding identification of local tribal community or cultural preferences - or actually ensuring these preferences are fulfilled as the outcomes of natural resource protection or restoration decisions – that were published within the last 15 years were obtained and sampled to select candidate articles that were then screened further for key concepts to be collected as qualitative data for eventual thematic synthesis.

This study used inductive analysis techniques to identify 4 main themes which were organized as 9 shared (as well as 14 unshared) categories of data. Some 50 different scientific articles were used as the source of qualitative in vivo data (See Glossary) which was then categorized for the purpose of identifying overall theoretical themes. These resulting themes were then synthesized using thematic synthesis methods whose focus is developing an overall

theory that is able to explain the phenomenon, and is essentially grounded within the original scientific text information.

These initial scientific articles were screened for a more thorough examination using the following inclusion criteria: 1) Refers to the term “eco-cultural”; 2) Highlights the community or cultural dimension of socio-ecological systems; 3) Spotlights environmental degradation links to human socio-psychological impacts; 4) Promotes visual representation of social or cultural values attributed to local natural resources; 5) Collects or analyzes natural resources values information using community or culturally-relevant approaches; and/or 6) Features human ecosystems, socio-ecological systems, and/or a tribal eco-cultural health-specific conceptual model (and/or suggests potential indicators).

157 in vivo concepts were excerpted from the 50 journal articles finally selected as featuring a key concept to be used as the in vivo data that would be inductively categorized and analyzed for main themes, and developing a final theoretical explanation - using grounded thematic analysis and synthesis approaches. See Table 7 for the list of authors whose articles – along with excerpted key excerpts – were used for the thematic analysis.

2.2.4 THEMATIC SYNTHESIS OF DATA (USING KEY CONCEPTS)

2.2.4.1 Key Concept Data Assigned To Themes and Categories

See Glossary (Section 1.5.4) for the definition of themes and categories being used for this project.

In Vivo Data Excerpted as “Key Concepts” - The entire collection of in vivo data extracted from scientific journals was assigned to certain categories which had been identified using

grounded inductive approaches. The very same set of in vivo data items was independently assigned to each of the main themes that had been generated via the final thematic synthesis of the original in vivo data. Employing this two-pronged approach of assigning the in vivo data to the categories and the final main themes independently then allowed the categories containing the data and the themes containing the same data to be matched. The analysis revealed that: 1) specific categories of data were matched with specific themes of data, 2) particular categories of data were actually shared in-common between particular themes, and 3) the in vivo concepts within the shared categories may be of special importance because they are linking two of the final main themes.

A spreadsheet (See Appendix X) was created with the key concepts data (n = 157) collected from scientific articles listed alphabetically in column one. These were then grouped into a first set of inductively generated categories (column two). This list of key concepts was resorted and then grouped into a second independently generated set – that were labelled as being “alternative categories” (column three). A spreadsheet with an alphabetical list of the original key concepts was created, where the first set of corresponding categories was located as a column directly beside them, and then a second set of alternative theme options was located as a third column alongside the other two so that the concepts and alternative category options could be compared.

The most preferred category to use for each key concept was selected for each of the 157 individual key concepts (and the other rejected category choice was then discarded). These final selected categories were then collected into a new list that was inductively assessed (column four) whereupon the group of final categories was clumped according to initial inductively generated overall themes (column five).

The same set of original key concepts (n = 157) were then assigned to the new overall themes without any reference to the inductive categories to which each concept had already been assigned. The key concepts data were then resorted and grouped into a second set of independently generated themes (just as had been done to produce the two independent sets of alternative categories). The two alternate sets of themes were contrasted against each other to determine which alternatives have the most of the original key concepts in common, and/or contain key concepts that are distributed throughout other themes - such that the themes could be dropped as being redundant with the key concepts contained within the other themes.

2.2.4.2 Spreadsheet-Based Final Themes and Categories Relationships Analysis

A final spreadsheet (Appendix X) presenting the alphabetized list of original key concepts, alongside the final category as well as final theme that each key concept had been assigned to independently was created. The column order was shifted so that the order of the information within the rows could be rearranged. The positions of the key concepts and the themes columns were swapped so that theme information was featured 1st, category information 2nd, and the original key concept 3rd.

The rows of the spreadsheet were then resorted according to the theme so that all of the categories and key concepts contained within a single theme were grouped together. The rows of categories and key concepts within each theme were then resorted by category so that each of the individual themes were now organized according to the categories that were still linked to the original key concepts to which they had been originally assigned.

The final categories grouped within each theme were then compared between the themes

to identify any categories that any themes might have in common. Certain themes did have certain categories in common whereas other categories were only associated with one specific theme. Categories that were found to be shared between themes were catalogued as being “shared”, while those which were not shared between any themes were catalogued as being “unshared” categories that were unique and stand-alone.

2.2.4.3 Connecting the Main Themes Using a Diamond-Cornered Relational Concept

Inductive analysis and thematic synthesis (Fereday & Muir-Cochrane, 2006) approaches resulted in four main themes being identified as best representing the qualitative data that had been taken from leading scientific journals for this study’s systematic review. Thematic analysis of excerpted in vivo data using inductive techniques led to differing categories to represent the data being identified, while each data item was also independently assigned to each of the final four main themes. The data occurring within some particular categories was eventually allocated into differing themes, resulting in these particular categories then being shared between these particular (and respective) final themes.

Chapter 3 RESULTS

3.1 THEMATIC ANALYSIS RESULTS

Based on the thematic analysis, four inter-related themes emerged, i.e. Eco-Cultural Change Dynamics (ECCD), Socio-Cultural Meaning and Stability (SCMS), Personal Well-Being (PWB), and Tribal Sustenance Imperatives (TSI) were identified as early results. Later analysis resulted in the development of the “Community Sustenance Dynamics Model” to visually represent the key relationships that could exist between these themes (or their specific data categories and/or the original data factors which are represented by the models).

Analyzing the full set of qualitative data collected from scientific journal articles using inductive techniques resulted in 4 implicit themes and 23 individual categories being identified (some of which were shared between the 4 themes) – see Glossary for definitions. The new data themes are Eco-cultural change dynamics, Socio-cultural meaning and stability, Personal well-being, and Tribal sustenance imperatives. The new theme categories are as listed in [Table 1](#).

Table 1. The final CSD Model categories that were generated via thematic synthesis procedures

- Accumulated knowledge
- Social meaning and relevance of the biophysical environment
- Common vs. diverse needs and imperatives
- Using and respecting natural resource gifts
- What is being used in what amounts
- What uses prevail
- Responsible natural resources stewardship and duties
- Who decides what amount of protecting/restoring
- What needs restoring
- Cultural stability vs. social-spatial-temporal multidimensional change
- Socio-ecological foundations and expressions
- Temporal vs. spatial vs. social scales and distinctions
- Embodiment and expression of natural resources meaning
- Environmental relationships and components
- Dimensions of relevance and use
- Knowing how to respect, use and manage
- Importance of use
- Dependence on biophysical conditions and use
- Arrays vs. specific service categories, standards and expectations
- Essential conditions at-risk
- What kinds of uses by whom
- What available for use
- Who decides what for whom

3.1.1 NEW MODEL CATEGORIES AND THEMES PRODUCED VIA THEMATIC ANALYSIS

3.1.1.1 Connecting the Main Themes Using a Diamond-Cornered Relational Concept

Inductive analysis and synthesis approaches resulted in four main themes being identified as best representing the qualitative data that had been taken from leading scientific journals for this study's systematic review. Thematic analysis of excerpted in vivo data using inductive techniques led to differing categories to represent the data being identified, while each data item was also independently assigned to each of the final four main themes. The data occurring within some particular categories was eventually allocated into differing themes, resulting in these particular categories then being shared between these particular (and respective) final themes.

The potential links between these themes was then contemplated using an overall four-cornered relational concept, viewing the final four separate themes as being interrelated with each other in fashions similar to that occurring between the separate bases of a baseball diamond (where specific interactions between any of the four main players are all possible but still occurring in an uncertain but ongoing manner).

3.1.1.1(A) *Eco-cultural Change Dynamics and Socio-cultural Meaning and Stability Themes.*

These two themes have three categories of data in common: Accumulated knowledge, Social meaning and relevance of the biophysical environment, and Common vs. diverse needs and imperatives.

3.1.1.1(A)(i) Accumulated Knowledge Category - The in vivo concepts within the Eco-cultural Change Dynamics theme are cyber-Atlas technologies, aboriginal mapping networks, cultural

mapping, and cultural landscape research. The in vivo concepts within the Socio-cultural Meaning and Stability theme are geo-database contextual data, the conceptual domains and attributes of collected data, using interviews to collect data, the importance of articulating values, creating consensual maps to portray cultural values, and using computer-assisted qualitative data analysis software programs as all being relevant for addressing socio-cultural meaning and stability concerns.

These two themes are related by these “accumulated knowledge” concepts in that certain of these concepts are needed for assessing eco-cultural change dynamics, while others are crucial for focusing the collecting and analysis of qualitative data in ways that reinforce local socio-cultural meaning and stability.

3.1.1.1(A)(ii) Social Meaning and Relevance of the Biophysical Environment Category - The in vivo concepts within the Eco-cultural Change Dynamics theme are specific landscape features, the cultural benefits of specific land and waters, and the sensitivities of local sites. The in vivo concepts within the Socio-cultural Meaning and Stability theme are mapping and quantifying social values using geographic information systems, spatial indices of social value, social values mapping using computer software programs, and social-ecological hotspots.

These two themes are related by these “social meaning and relevance of the biophysical environment” concepts in that certain of these concepts are valuable for pinpointing where eco-cultural change dynamics are specifically important, while others represent approaches for highlighting socially-relevant biophysical features in ways that reinforce local socio-cultural meaning and stability.

3.1.1.1(A)(iii) Common vs. Diverse Needs and Imperatives Category - The in vivo concepts within the Eco-cultural Change Dynamics theme are enhancing livelihood opportunities and environmental justice. The in vivo concepts within the Socio-cultural Meaning and Stability theme are ecological attributes that play a role in the lives of people, the importance of fishing and hunting opportunities, the significance of economic and psychological Well-Being, the need to conduct individual versus focus group interviews as being complementary, and the need to assist informants express their values.

These two themes are related by these “common vs. diverse needs and imperatives” concepts in that certain of these concepts are needed for linking fairness and equity to eco-cultural change dynamics, while others foster articulating the range of fashions in which healthy ecological systems reinforce local socio-cultural meaning and stability.

3.1.1.1(B) Socio-cultural Meaning and Stability and Personal Well-Being Themes

These two themes have one category of data in common: Cultural stability vs. social-spatial-temporal multidimensional change.

3.1.1.1(B)(i) Cultural Stability vs. Social-Spatial-Temporal Multidimensional Change

Category – The in vivo concepts within the Socio-cultural Meaning and Stability theme are attributes of tribal Well-Being, the relevance of tribal subsistence values, tribal sacred ground and cultural resources, tribal values regarding research policies, and tribal environmental justice analysis. The in vivo concepts within the Personal Well-Being theme are nourish the soul and adhere to traditional tribal community health frameworks.

These two themes are related by these “cultural stability vs. social-spatial-temporal

multidimensional change” concepts in that certain of these concepts spotlight factors for linking multidimensional change effects to socio-cultural meaning and stability, while others focus upon local multidimensional change factors being archetypically linked to other key factors involved with reinforcing personal Well-Being.

3.1.1.1(C) *Personal Well-Being and Tribal Sustenance Imperatives Themes*

These two themes have two categories of data in common: Dimensions of relevance and use; and, Knowing how to respect, use and manage.

3.1.1.1(C)(i) Dimensions of Relevance and Use Category - The in vivo concepts within the Personal Well-Being theme are the significance of natural resource socio-cultural values and ensuring that natural resource values are included as entry points when conducting interviews. The in vivo concepts within the Tribal Sustenance Imperatives theme are the need for high quality environmental resources, local plant and animal species changes, the state of key resource units at-stake, key ecological processes or components at stake, managing resources in culturally-appropriate ways, and the impact of different strategies at different sites.

These two themes are related by these “dimensions of relevance and use” concepts in that certain of these concepts establish platforms for linking dimensions of relevance and use to personal Well-Being, while others underscore specific dimensions of relevance and use that are linked to and reinforce local tribal sustenance imperatives.

3.1.1.1(C)(ii) Knowing How to Respect, Use and Manage Category - The in vivo concepts within the Personal Well-Being theme are landscape values, landscape values typologies, heritage values and identity, place attachment mapping, sense of place mapping, indigenous

community and environmental health knowledge frameworks, indigenous health indicators, and actively improving both natural resources and human Well-Being. The in vivo concepts within the Tribal Sustenance Imperatives theme are integrated socioeconomic and biophysical data, humans as a central driving factor and member of ecosystems, landscape ecological knowledge, human ecology mapping, local ecological knowledge mapping, traditional resource unit mappings, mapping and analysis training, interactive multimedia, and intergenerational knowledge exchange.

These two themes are related by these “knowing how to respect, use and manage” concepts in that certain of these concepts are needed for underscoring ways that knowing how to respect, use and manage ecological systems is linked to personal well-being, while others focus upon integrated, community-oriented means of honoring and reinforcing tribal sustenance imperatives.

3.1.1.1(D) Tribal Sustenance Imperatives and Eco-cultural Change Dynamics Themes

These two themes have three categories of data in common: Using and respecting natural resource gifts, What being used in what amounts, and What uses prevail.

3.1.1.1(D)(i) Using and Respecting Natural Resource Gifts Category - The in vivo concepts

within the Tribal Sustenance Imperatives theme are access to and the quality of cultural resources, affording wanted tribal opportunities, mapping and assessing cultural resources, culturally-distinct stewardship methods and paths, culturally-defined paradigms, culturally-appropriate resource management, co-management agreements, and co-managing cultural and natural significance of the same place. The in vivo concepts within the Eco-cultural Change

Dynamics theme are changes to the local environment, characterizing change using contrast scenarios, addressing the cultural significance of altered or heavily managed ecosystems, decision-making procedures being what shapes biophysical processes, behavioral decisions determining ecosystem services quantity and quality, and applying indigenous ecological knowledge to restoration.

These two themes are related by these “using and respecting natural resource gifts” concepts in that certain of these concepts spotlight culturally-distinct perspectives elucidating links between using and respecting natural resource gifts and tribal sustenance imperatives, while others underscore key factors to link using and respecting natural resource gifts to the protection or restoration decisions being associated with eco-cultural change dynamics.

3.1.1.1(D)(ii) What Being Used in What Amounts Category - The in vivo concepts within the Tribal Sustenance Imperatives theme are cultural services, types of cultural services, tangible and intangible cultural values, metrics for intangible cultural values, cultural opportunities, and activities distinctive to native people. The in vivo concepts within the Eco-cultural Change Dynamics theme are scientific as compared to cultural indicator measurements, and their overall relevance when addressing local eco-cultural change dynamics.

These two themes are related by these “what being used in what amounts” concepts in that certain of these concepts highlight the cultural significance of what is being used in what amounts to tribal sustenance imperatives, while another focuses upon using cultural as well as scientific indicators to examine what is being used in what amounts whenever seeking to better understand local eco-cultural change dynamics.

3.1.1.1(D)(iii) What Uses Prevail Category - The in vivo concepts within the Tribal Sustenance Imperatives theme are comparing stakeholder values to actual political efforts, comparing stakeholder issues to management options effects, and optimizing stakeholders power to influence what happens. The in vivo concepts within the Eco-cultural Change Dynamics theme are stakeholder preferences and stakeholder analysis methods.

These two themes are related by these “what uses prevail” concepts in that certain of these concepts identify key outcomes to focus upon when assessing what uses prevail in terms of tribal sustenance imperatives, while others focus upon stakeholder support approaches to use when relating what uses prevail to local eco-cultural change dynamics.

3.1.2 DEVELOPING THE NEW MODEL

The Community Sustenance Dynamics model was created to visually represent the relationships that emerged as being pertinent when collectively analyzing the concepts which had been collected as in vivo data from the original scientific article sources. See Figure 6.

This model construes the theoretical themes and theme categories as being surrogates for the general group of in vivo concepts that were encompassed within that respective theme or category. This model enables the relative roles that each original data concept fulfills in terms of the operational links being theorized through the “Community Sustenance Dynamics” model to be symbolically visualized, when needed.

3.1.2.1 Designing the Conceptual Model

The model is designed to highlight:

1. The mutually reinforcing four-point relationship existing between the four themes (as identified using thematic analysis),
2. The shared (as well as unshared) categories of data associated with each of the individual themes,
3. The original scientific concepts upon which each theme and data category are based and the linkages the analysis determined were important between them;
4. The presence of a collective system where all of the original data concepts, and/or the data categories or themes produced to represent them are all viewed as having key roles supporting local “community sustenance dynamics”;
5. The socio-ecological systems orientation of the model;
6. The community and/or cultural dimension-specific underpinnings of the model,
7. The importance of addressing socio-ecological systems exposure, vulnerability, resilience and adaptation concerns, and
8. The need to fulfill local tribal community preferences and their collective eco-cultural Well-Being needs in particular.

The Community Sustenance Dynamics model is designed to spotlight a particular theme and theme categories and to examine the interrelationships occurring between the themes or categories and their underlying concepts when they are all integrated together and focused upon sustaining eco-cultural well-being. This model focuses attention upon the need to ensure local natural resources are not just accessible, but are in the high-quality conditions needed for supporting tribal community livelihoods, psychological well-being, deep-seated spirituality, and/or other locally-based eco-cultural well-being needs. This model portrays the elements and

relationships that were identified in this study as being vital to address whenever investigating and accommodating tribal community sustenance concerns – e.g. socio-ecological factors considered to be vital for sustaining local tribal communities and/or their cultural systems established for their particular tribe.

3.1.3 NEW THEORETICAL MODEL

3.1.3.1 Conceptual Model Development

3.1.3.1(A) Community Sustenance Dynamics Theory I – Eco-cultural Change Dynamics

The thematic synthesis of the entire collection of original in vivo concepts led to Eco-cultural Change Dynamics being pinpointed as one of the four overarching themes to use for explaining community sustenance dynamics. Spotlighting eco-cultural change dynamics draws attention to the local impacts of eco-cultural change and specific factors being recommended to focus upon. The eco-cultural change dynamics theme includes 6 categories of data that are shared with at least two of the other themes, and three categories of data that are not shared (and are therefore unique to this specific overarching theme).

These categories are relevant to eco-cultural change dynamics in that their in vivo concepts focus upon assessing eco-cultural change, pinpointing where eco-cultural change is important, linking fairness and equity to the outcomes of eco-cultural change, linking change to protection and restoration decisions, employing both cultural and scientific indicators, fostering stakeholder support mechanisms, accommodating natural resources stewardship and duties, needing to include who decides amounts of eco-cultural protection or restoration, and/or ensuring that decisions regarding what needs restoring are addressed as all being critical concepts. The first 6 items on this list correspond to the categories of data that Eco-cultural

Change Dynamics shares with other themes; while the final 3 items correspond to categories that this theme does not share.

3.1.3.1(B) Community Sustenance Dynamics Theory II: Socio-Cultural Meaning and Stability

The thematic synthesis of the entire collection of original in vivo concepts led to Socio-cultural Meaning and Stability being pinpointed as one of the four overarching themes to use for explaining community sustenance dynamics. Spotlighting socio-cultural meaning and stability draws attention to the local impacts of socio-cultural disruption and specific factors that are being recommended to focus upon. The socio-cultural meaning and stability theme includes four categories of data that are shared with at least two of the other themes, and four categories of data that are not shared (and are therefore unique to this specific overarching theme).

These categories are relevant to socio-cultural meaning and stability in that their in vivo concepts focus upon collecting and analyzing qualitative data, socially-relevant biophysical features, the reinforcing role of healthy ecological systems, factors linking multidimensional change to cultural stability, the relevance of addressing socio-ecological foundations and expressions, the socio-cultural distinctions between temporal, spatial, and social scales of changes being important to address, the socio-cultural embodiments and expressions of natural resources meaning being important to include, and the need to accommodate socio-cultural relationships with local environmental components as all being crucial to socio-cultural meaning and stability. The first 4 items on this list correspond to the categories of data which Socio-cultural Meaning and Stability shares with other themes; whereas the final 4 items correspond to categories that this theme does not share with other themes.

3.1.3.1(C) Community Sustenance Dynamics Theory III - Personal Well-Being

The thematic synthesis of the entire collection of original in vivo concepts led to Personal Well-being being pinpointed as one of the four overarching themes to use for explaining community sustenance dynamics. Spotlighting personal Well-Being draws attention to the individual or family-scale impacts of local environmental degradation and specific factors being recommended to focus upon. The personal well-being theme includes 3 categories of data that are shared with at least 2 of the other themes, and 4 categories of data that are not shared (and are therefore unique to this specific overarching theme).

These categories are relevant to personal well-being in that their in vivo concepts focus upon the deep-seated links between temporal-spatial-social multidimensional changes and the essential factors of human well-being, links between the relevance and use of natural resources and personal Well-Being at the individual/family level, and links between knowing how to respect and manage ecological systems and personal well-being at the individual/family level.

Other key aspects of personal well-being being focused upon by these categories are that actually using local natural resources is important to personal well-being and this needs to be accommodated, that ways in which personal well-being is dependent upon biophysical conditions and their use should be included when addressing concerns, that the specific – and even arrays of - categories of ecological services important to personal well-being (including standards and expectations) are all relevant to address, and that it is invaluable to address essential ecological conditions at-risk as key factors important to personal well-being. The first 3 items on this list correspond to the categories of data that Personal Well-being shares with other

themes; whereas the final 4 items correspond to categories that this theme does not share with other themes.

3.1.3.1(D) Community Sustenance Dynamics Theory IV – Tribal Sustenance Imperatives

The thematic synthesis of the entire collection of original in vivo concepts led to Tribal Sustenance Imperatives being pinpointed as one of the four overarching themes to use for explaining community sustenance dynamics. Spotlighting tribal sustenance imperatives draws attention to the diverse ecologically-based sustenance needs of healthy tribal societies and specific factors being recommended to focus upon. The tribal sustenance imperatives theme includes 5 categories of data that are shared with at least 2 of the other themes, and 2 categories of data that are not shared (and are therefore unique to this specific overarching theme).

These categories are relevant to tribal sustenance imperatives in that their in vivo concepts focus upon tribal communities needing to be sustained through focusing upon the relevance and use of ecological systems as being critical to tribal health, reinforcing the community through knowing how to respect-use-manage local natural resources in eco-culturally-relevant ways, using eco-cultural perspectives valuing natural resources as spiritual gifts, fully understanding what local natural resource uses prevail, clearly understanding what kinds of local uses are occurring by whom, and clearly understanding and agreeing with what local natural resources and ecological systems are available for use. The first 5 items on this list correspond to the categories of data that Tribal Sustenance Imperatives shares with other themes; whereas the final 2 items correspond to categories that this theme does not share with other themes.

3.1.3.2 Theoretical Model Development

3.1.3.2(A) Model-Centered Analyses: Pooling Models and Identifying Systematic Patterns

This analysis used the “model-centered analyses” concept suggested by Rudel (2007), where the original models developed from the raw data are pooled and examined for other systematic patterns across the models that may be important to represent through a newly synthesized and grounded theoretical model. Seven original models were selected for pooling due to the specific factors and dynamics they highlighted, along with the manner in which they visually represented the integrated nature of their inherent relationships.

The inclusion criteria used for picking the original models which were selected to be pooled are as follows:

1. Holistic visual representation.
2. Interrelated socio-cultural-ecological systems components, factors and/or dynamics.
3. Ecological and socio-cultural systems represented as interfacing, interacting and/or integrated.
4. Ecological or socio-cultural well-being represented as being the center of the integrated system.
5. System relationships represented using domains.
6. Integrated system consists of biophysical template, social template, and ecosystem services components.
7. Social template represented as having economic, political, community and/or cultural dimension elements.
8. Biophysical template represented as having socio-cultural attributes.

9. Eco-cultural concepts specifically referenced and/or depicted as being the focus of the model.

The following seven models were picked to be pooled and scrutinized for other “systematic patterns across the models” (Rudel, 2007):

- The **Eco-Centric Subsistence** model (J. P. Thomas, 1992)
- The **Eco-Cultural Systems Management** model (J. P. Thomas, 1995b)
- The **Human Ecosystem** model (Machlis, Force, & Burch Jr., 1997)
- The **Eco-Cultural Restoration Systems Universe** model (J. P. Thomas, 2001)
- The **Social-Ecological Systems** model (Anderies, Janssen, & Ostrom, 2004)
- The **Press-Pulse Dynamics Conceptual Framework** model (Collins et al., 2011)
- The **Quinault Well-Being and Salmon Framework** model (Amberson, 2013)

These models were picked because they met the model inclusion criteria, and were rated as being potentially complementary to each of the other selected models. The key attributes of these original models were all pooled together so that other potential “systematic patterns across the models” (Rudel, 2007) could be identified for possible representation through a new theoretical model. The key attributes identified for these models are as follows:

- **Eco-Centric Subsistence Model** (J. P. Thomas, 1992): *Concept = Holistic, Interacting Social and Cultural Components using an Ecological System center.* Social Components = Families (Individuals/Husband-Wife-Children-Elders), Local Community (Relatives-Friends-Needy), Task Groups (Hunting- Gathering –Processing), Health Anomalies and Remedies (Personal-Family-Community, Physical-Psychological, Cumulative Costs). Cultural Components = Subsistence Dynamics (Specialization-Self Esteem-Self Image-Self Worth), Cultural Dimension, Spiritual Dimension, Cultural Survival.
- **Eco-Cultural Systems Management Model** (J. P. Thomas, 1995a): *Concept = Holistic, Ecological/Social Systems Realms using a Critical Resources Interface link.* Human Social System Realm/Dimensions = Economic-Political-Community-Cultural Dimension; Critical Resources Interface Realm = Cultural Resources-Socioeconomic Resources-Natural Resources; Ecological Systems Realm/Socio-cultural Attributes = Biota-Habitat Types-Ecological Processes-Physical Processes-Geology/Landforms-Sites-Socio-cultural Meaning.

- **Human Ecosystem Model** (Machlis et al., 1997): *Concept = “Two Interacting Elements and Flows”*. 1) Critical Resources (Kinds = Natural Resources-Socioeconomic Resources-Cultural Resources); 2) Human Social System (Subsystems = Social Institutions-Social Cycles-Social Order [Identity-Social Norms-Hierarchy]); 3) Critical Resource Flows (incl. Distribution).
- **Eco-Cultural Restoration Systems Universe Model** (J. P. Thomas, 2001): *Concept = Holistic, Domain-Oriented Systems Relationships using an Eco-Cultural Well-Being center*. Eco-Cultural Restoration Systems = Eco-Centric Subsistence, Cultural Systems, Eco-Cultural Systems, Eco-Cultural Restoration. Cosmological symbology.
- **Social-Ecological Systems Model** (Anderies et al., 2004): *Concept = “Four Interacting Elements”*. Components A thru D = Resource-Resource Users-Public Infrastructure Providers-Public Infrastructure. Interaction Paths #1 - #8.
- **Press-Pulse Dynamics Conceptual Framework Model** (Collins et al., 2011): *Concept = “Four-Square (incl. External Drivers)” Concept*. Core Components = Press-Pulse Events, Biophysical Template (Community Structure, Ecosystem Function), Ecosystem Services (Regulating, Provisioning, Cultural, Supportive), Social Template (Human Behavior, Human Outcomes), External Drivers.
- **Quinault Well-Being and Salmon Framework Model** (Amberson, 2013): *Concept = Wheel-Oriented, Pie-Shaped Relationship using Human Well-Being center*. Human Well-Being Domains (and Attributes/Indicators) = Psychological, Social, Cultural, Spiritual, Economic, Governance, Physical.

A thematic synthesis of the primary attributes of these models focused upon identifying “systematic patterns across the models”. The results of this synthesis were that: 1) important “systematic patterns across the models” were identified; 2) a new conceptual theoretical framework was devised to describe the patterns; and 3) a visual model representing the new theoretical concepts and patterns was produced to depict them.

3.1.3.2(B) Thematic Synthesis of Original Data – Systematic Patterns across the Models

Synthesizing the key attributes of these original models verified that certain elements of these models were complementary and useful for creating a new theoretical model underscoring the significance of tribal community sustenance dynamics. Collective examination of the models

verified that each model had features that could be used to create a useful and practicable new theoretical model.

3.1.3.2(B)(i) Eco-Centric Subsistence (J. P. Thomas, 1992) – This model acknowledges local ecological systems as being a central feature that tribal socio-cultural systems rely upon at every social scale - from the individual person and family level, up through the community and other broader tribal socio-cultural dimensions (especially overarching spirituality and ancient concepts). The elements of this model relate to and interact with each other. See Figure 1.

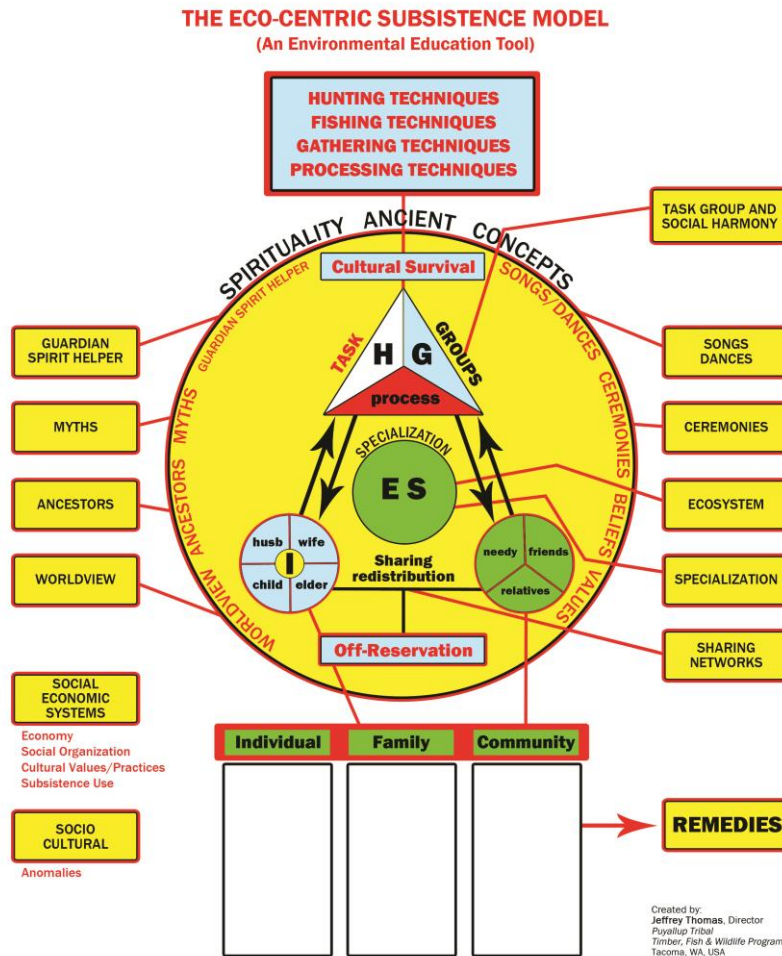


Figure 1. The Eco-Centric Subsistence Model. By Jeffrey P. Thomas, circa 1992.

3.1.3.2(B)(ii) Eco-Cultural Systems Management (J. P. Thomas, 1995a) - This model

highlights eco-cultural systems as being the aspects of the ecological systems which interface with human social systems via natural, socioeconomic and/or cultural resource factors. The ecological systems categories highlight “social attributes of the natural environment” (biota, habitat types, ecological processes, physical processes, geology-landforms, sites, socio-cultural meaning); whereas the human social system is separated into the economic, political, community, and cultural dimensions. The elements of this model relate to and interact with each other. See Figure 2.

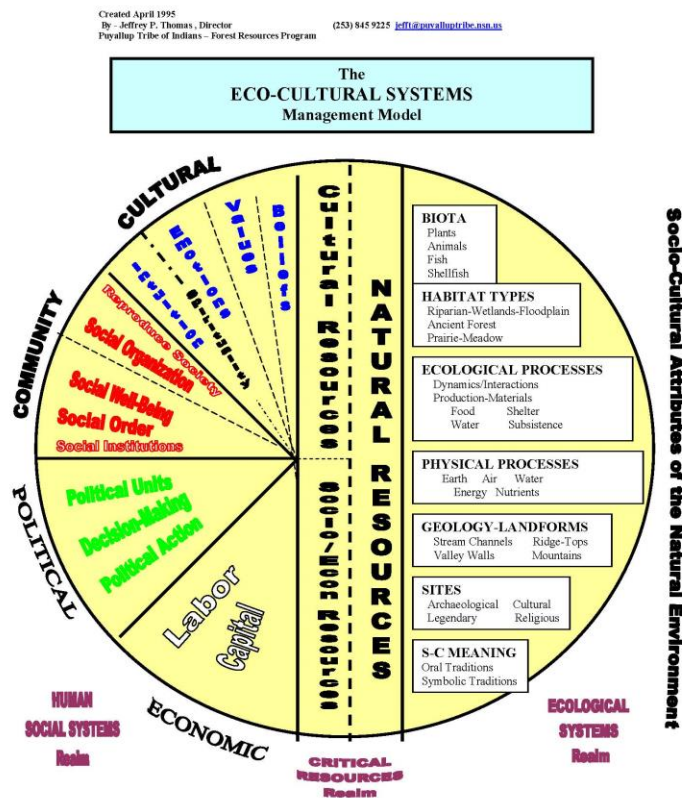


Figure 2. The Eco-Cultural Systems Management Model (April 1995). By Jeffrey P. Thomas

3.1.3.2(B)(iii) Human Ecosystems (Machlis et al., 1997) - This model spotlights the human social system and critical resources as being the two components of a total system where flows within each component operate independently, or may be shared between the two elements together. Human social system highlights social order, social cycles and social institutions. Critical resources are classified as being within the natural resource, socioeconomic resource, or cultural resource categories.

3.1.3.2(B)(iv) Eco-Cultural Restoration Systems Universe (J. P. Thomas, 2001) - This model depicts eco-centric subsistence, cultural systems, eco-cultural systems, and eco-cultural restoration as each being relevant when eco-cultural Well-Being is the central focus.

3.1.3.2(B)(v) Social-Ecological Systems (Anderies et al., 2004) - This model depicts a conceptual framework composed of six entities (Resource, Resource Users, Public Infrastructure Providers, Public Infrastructure, Institutional Rules, External Environment). The framework highlights understanding "...the broad structure of the entities and links in a social-ecological system and showing how the strategic interactions within and between entities affect the likelihood of long term robustness."

3.1.3.2(B)(vi) Press-Pulse Dynamics Conceptual Framework (Collins et al., 2011) - This model presents a conceptual framework containing four core components (Press-Pulse Events, Biophysical Template, Ecosystem Services, Social Template) where the dynamics of biophysical systems are driven by press and pulse events, and ecosystem services "form the bridge between the biophysical and social templates". Press events are sustained and chronic, whereas pulse events are discrete with rapid impacts. The Biophysical Template categories highlight community structure and ecosystem function; whereas the Social Template is separated into

human outcomes and human behavior. Ecosystem Services are comprised of the regulating, provisioning, cultural and supporting categories. See [Figure 3](#).

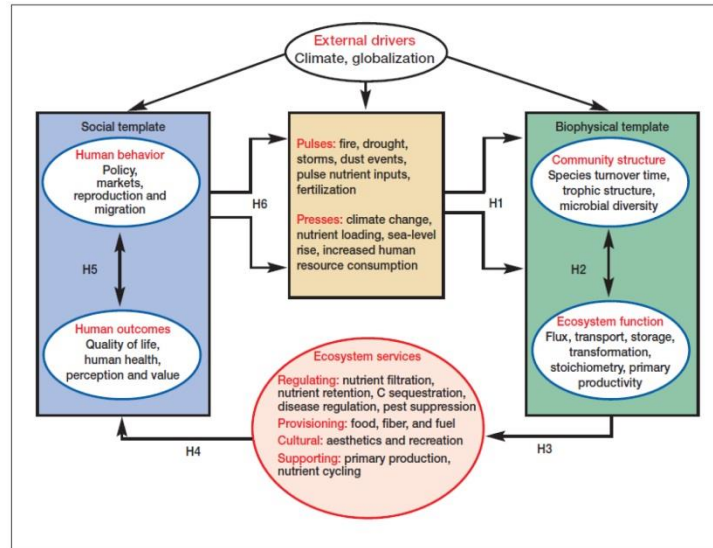


Figure 3. Press-Pulse Dynamics Social-Ecological Systems Framework (Collins et al, 2011)

3.1.3.2(B)(vii) Quinault Well-being and Salmon Framework (Amberson, 2013) - This model depicts categories of domains and their attributes through which “...holistic indicators/metrics of human Well-Being associated with natural resource management” can be described, using a wheel-like concept centered around a human well-being axis. The wheel highlights separate categories usable by resource managers, as well as allows for tribal perspectives regarding the “important well-being aspects of salmon”. Human Well-Being Domains are classified into being psychological, social, cultural, spiritual, economic, governance and/or physical. 29 separate attributes are associated with the seven domains and individual indicators for these attributes may be visualized through varying the sizes of the different spokes of the wheel. “This wheel provides a holistic approach to describing the values identified with salmon.” See [Figure 4](#).

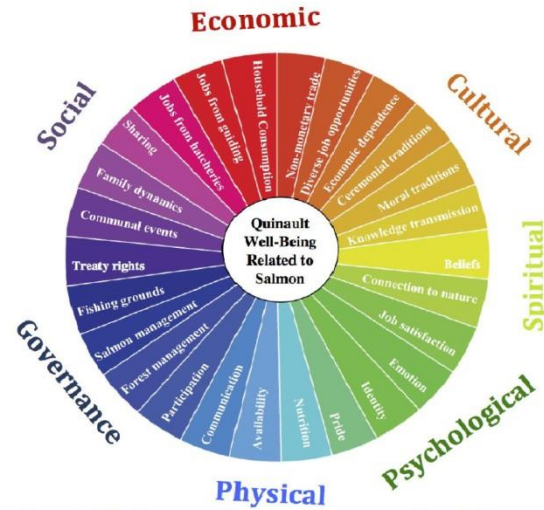


Figure 3. Quinault well-being related to salmon. Seven domains with 29 attributes.

Figure 4. Quinault Well-Being and Salmon Framework (Amberson, 2013)

3.1.3.2(C) “Systematic Patterns across the Models” – Used for Synthesizing a New Model

The same criterion used for selecting the original models was used as a general framework for identifying “systematic patterns across the models”. The primary attributes of these models were pooled together and contrasted with the criteria so that attributes of the greatest relevance to each criterion could be identified and grouped together. Each of these attribute groups were then assessed as possibly constituting an important systematic pattern. The results were that holistic representations and approaches, interrelated systems, integrated systems, central core features, system domains, integrated template or service components, biophysical templates, social templates, and an eco-cultural concepts focus were each recognized as being among the important systematic patterns being featured across the models.

As such, synthesizing these original models included highlighting the features of these original models that might be most useful to incorporate into the new conceptual theoretical model, as follows (See [Table 2](#)):

Holistic Representations and Approaches - can incorporate descriptions of tribal values (Amberson, 2013).

Interrelated Systems - can spotlight tribal subsistence systems (J. P. Thomas, 1992), socio-cultural attributes of the environment (J. P. Thomas, 1995a), social and natural systems Well-Being indicators and metrics (Amberson, 2013), and categories that are usable by resource managers (Amberson, 2013).

Integrated Systems - may illustrate the interface of ecological systems with human social systems (J. P. Thomas, 1995a), differing elements related to and interacting with each other (J. P. Thomas, 1995a), the flows of components operating independently or together (Machlis et al., 1997) and specific relational concepts - such as wheeled spoke-axis categories, etc. (Amberson, 2013).

Central Core Features – can refer to ecological, human, and/or eco-cultural Well-Being as the core feature(s) of the system (Thomas, 1992, Thomas 2001, Amberson 2013).

System Domains – can organize system attributes, indicators, metrics, and/or relationships (Amberson 2013).

Integrated Template or Services Components – can represent inseparable natural/socioeconomic/cultural resource factors (Machlis et al. 1997), or strategic interactions affecting robustness (Anderies et al. 2004), or press-pulse events and/or ecosystem services - e.g. as a bridge between the biophysical and social templates (Collins et al. 2011).

Biophysical Template – can highlight socio-cultural attributes related to ecosystem community structures or ecosystem functions.

Social Template – can organize into economic and political and community and cultural dimensions (Thomas 1995), can organize community dimension as involving social order and social cycles and social institutions (Machlis 1997), can depict persons and families and communities as the significant scales of the social system (Thomas 1992), can depict broader socio-cultural dimensions - such as spirituality (Thomas 1992), may spotlight human outcomes and human behavior (Amberson 2013), and may spotlight decision-making systems (Collins 2011).

Eco-cultural Concepts Focus – can highlight eco-centric subsistence, eco-cultural systems, tribal well-being and/or personal spirituality perspectives.

Table 2. Key Features of Original Models for Potential Use in New Theoretical Model

<p>a. Holistic visual representation.</p> <ul style="list-style-type: none"> • holistic approach to describing the values (Amberson 2013) 	<ul style="list-style-type: none"> • indicators (e.g. varying the sizes of different spokes of a wheel) (Amberson 2013)
<p>b. Interrelated socio-cultural-ecological systems components, factors and/or dynamics.</p> <ul style="list-style-type: none"> • tribal subsistence systems (Thomas 1992) • socio-cultural attributes of the natural environment (Thomas 1995) • holistic indicators/metrics of human Well-Being associated with natural resource management” (Amberson 2013) • categories usable by resource managers (Amberson 2013) 	<p>f. Integrated system consists of biophysical template, social template, and ecosystem services components.</p> <ul style="list-style-type: none"> • natural resource, socioeconomic resource, or cultural resource (Machlis et al. 1997) • strategic interactions within and between entities affecting likelihood of robustness (Anderies et al. 2004) • Press-Pulse Events, Biophysical Template, Ecosystem Services, Social Template (Collins et al. 2011) • ecosystem services form “the bridge” between the biophysical and social templates (Collins et al. 2011)
<p>c. Ecological and socio-cultural systems represented as interfacing, interacting and/or integrated.</p> <ul style="list-style-type: none"> • ecological systems interface with human social systems (Thomas 1995) • elements related to and interact with each other (Thomas 1995) • flows within each component operate independently, or may be shared (Machlis et al. 1997) • wheel-like concept (Amberson 2013) 	<p>g. Biophysical template represented as having socio-cultural attributes.</p> <ul style="list-style-type: none"> • community structure and ecosystem function (Collins et al. 2011)
<p>d. Ecological or socio-cultural Well-Being represented as being the center of the integrated system.</p> <ul style="list-style-type: none"> • local ecological systems as being a central feature (Thomas 1992) • eco-cultural Well-Being is the central focus (Thomas 2001) • centered around a human well-being axis (Amberson 2013) 	<p>h. Social template represented as having economic, political, community and/or cultural dimension elements.</p> <ul style="list-style-type: none"> • individual person and family level, up through the community (Thomas 1992) • other broader tribal socio-cultural dimensions (Thomas 1992) • economic, political, community, and cultural dimensions (Thomas 1995) • social order, social cycles and social institutions (Machlis et al. 1997) • human behavior and human outcomes (Collins et al. 2011)
<p>e. System relationships represented using domains.</p> <ul style="list-style-type: none"> • categories of domains and their attributes (Amberson 2013) • attributes are associated with the seven domains (Amberson 2013) 	<p>i. Eco-cultural concepts specifically referenced and/or depicted as being the focus of the model.</p> <ul style="list-style-type: none"> • eco-centric subsistence (Thomas 1992) • spirituality (Thomas 1992) • eco-cultural systems (Thomas 1995) • allows for tribal perspectives regarding the “important well-being aspects of salmon” (Amberson 2013)

3.1.3.2(D) Other Key Attributes Picked For Incorporating into New Model

Other key attributes of the original models that were picked for possible incorporation into the new theoretical model were as follows. See Table 3.

Table 3 Other Key Attributes of Original Models for Possible Incorporation into New Model

<p><i>Eco-Centric Subsistence (J. P. Thomas, 1992):</i></p> <ul style="list-style-type: none"> • Holistic Representation and Approaches • Families (individuals = husband-wife-children-elders) • Local Community (relatives-friends-needy) • Task Groups (hunting- gathering –processing) 	<ul style="list-style-type: none"> • Health Anomalies and Remedies (personal-family-community; physical-psychological; cumulative costs) • Subsistence Dynamics • Cultural Dimension • Spiritual Dimension • Cultural Survival
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Eco-Cultural Systems Management (J. P. Thomas, 1995a):

- Economic-Political-Community-Cultural Dimension
- Ecological Systems Realm/Socio-cultural Attributes = biota-habitat types-ecological processes-physical processes-geology/landforms-sites-socio-cultural meaning

Human Ecosystem (Machlis et al., 1997):

- “Two Interacting Elements and Flows”
- Critical Resource Flows (incl. distribution)

Eco-Cultural Restoration Systems Universe (J. P. Thomas, 2001):

- Domain-Oriented Systems Relationships using an Eco-Cultural Well-Being center
- Cosmological Symbology

Social-Ecological Systems (Anderies et al., 2004):

- “Four Interacting Elements”.
- Interaction Paths

Press-Pulse Dynamics Conceptual Framework (Collins et al., 2011):

- “Four-Square (incl. External Drivers)” concept
- Biophysical Template (community structure, ecosystem function)
- Ecosystem Services (including cultural)
- Social Template (human behavior, human outcomes)

Quinault Well-Being and Salmon Framework (Amberson, 2013):

- Well-Being Domains (and Attributes/Indicators) = psychological, social, cultural, spiritual, economic, governance, physical

3.1.3.3 New Model: Representing Systematic Patterns

The systematic patterns identified through synthesizing the themes and visual representations underscored within original models revealed that a new and useful model could be composed of: 1) a holistic visual representation; 2) depicting interrelated socio-cultural-ecological systems factors and dynamics as being integrated, interfacing, and/or interacting together; 3) pinpointing ecological and/or socio-cultural Well-Being as a central focus of the system; 4) specific domains representing specific attributes/indicators and systems relationships; 5) integrated biophysical and social templates bridged through ecosystem services components; 6) the biophysical template represented as having social and cultural attributes; 7) the social template recognized as consisting of economic, political, community and cultural dimensions; and/or 8) eco-cultural concepts being spotlighted as the focus of the model.

3.1.3.3(A) *New Model: Represent In Vivo Codes and Themes*

Certain topics and relationships were picked (by the researcher) from the in vivo data as being the most pertinent to represent with the new model. See [Table 4](#).

Table 4. CSD Model – Main Themes w/ Examples of Categories and Core In Vivo Concepts

ECO-CULTURAL CHANGE DYNAMICS - [THEME]

- What Needs Restoring - [CATEGORY]
 - **Eco-cultural concepts** (Thomas 2014) - [“IN VIVO” CONCEPT]
- Common vs. Diverse Needs and Imperatives
 - **Environmental justice** (Ernstson 2013/p. 1).
- Using and Respecting Natural Resources as Gifts
 - **Decision-making procedures shape biophysical processes** (Ernstson 2013/p. 2).
 - **Changes to the local environment** (Gregory and Trousdale 2009/p. 4).
- Social Meaning and Relevance of the Biophysical Environment
 - **Cultural benefits of specific lands and waters** (Tipa and Nelson 2008).

SOCIO-CULTURAL MEANING AND STABILITY - [THEME]

- Environmental Relationships and Components
 - **Cultural values** (Chan et al. 2012/p. 3).
- Embodiment and Expression of Natural Resources Meaning
 - **Typologies to express socio-cultural values** (Sherrouse et al. 2011/p. 3 and p.5).
 - **Identifying human values and beliefs and practices** (Tipa and Nelson 2008/p. 13)
- Cultural Stability vs. Social-Spatial-Temporal Multidimensional Change
 - **Subsistence values** (Burger 20??)
- Common vs. Diverse Needs and Imperatives
 - **Fishing and hunting opportunities** (Burger 2010/p. 6).
 - **Ecological attributes that play a role in the lives of people** (Sangha et al 2011/p. 5).
- Social Meaning and Relevance of the Biophysical Environment
 - **Spatial indices of social value** (Bryan et al 2010/p. 9).
- Socio-ecological Foundations and Expressions
 - **Well-Being metrics** (Amberson 2013/p. 4).

PERSONAL WELL-BEING - [THEME]

- Essential Conditions At-Risk
 - **Well-Being indicators** (Hanein and Biedenweg 2012/p. 1).
- Knowing How to Respect, Use and Manage
 - **Indigenous health indicators** (Donatuto ??)
- Knowing How to Respect, Use and Manage
 - **Landscape values** (Fagerholm et al. 2011/p. 3?).
- Dimensions of Relevance and Use
 - **Natural resource values** (MacDonald et al. 2013/p. 4).
- Arrays vs. Specific Service Categories, Standards and Expectations
 - **Ecosystem services provided through natural resources** (Harris and Harper 2011/p. 3).
- Dependence on Biophysical Conditions and Use
 - **Social value domains** (Amberson 2013/p. 9).
- Arrays vs. Specific Service Categories, Standards and Expectations
 - **Social values of ecosystem services** (Bryan et al 2010/p. 1).

Table 4 (cont).

- - Arrays vs. Specific Service Categories, Standards and Expectations
Cultural values of ecological restoration (Breslow 2014/p. 20).
- Cultural Stability vs. Social, Spatial, Temporal Multidimensional Change
- **Nourish the soul/spirituality** (Donatuto 2011/p. 1).

TRIBAL SUSTENANCE IMPERATIVES - [THEME]

- What Available For Use
- **Effects of resource changes upon spiritual or ceremonial practices** (Gregory and Trousdale 2009/p. 7).
- What Kind of Uses By Whom
- **Hunting and gathering (including medicinal) within forests** (Karjalainen et al 2010/p. 4).
- What Being Used in What Amounts
- **Activities distinctive to native people** (Gregory and Trousdale 2009/p. 4).
- What Being Used in What Amounts
- **Cultural services** (Schaich et al. 2010/p. 1).

3.1.3.3(A)(i) Theme: Eco-cultural Change Dynamics

Specific topics or relationships to represent here are eco-cultural concepts (J. P. Thomas, 2014), environmental justice (Ernstson, 2013, p. 9), decision-making procedures shape biophysical processes (Ernstson, 2013, p. 8), changes to the local environment (Gregory & Trousdale, 2011, p. 2472), and cultural benefits of specific lands and waters (Nelson, 2008, p. 323).

3.1.3.3(A)(ii) Theme: Socio--cultural Meaning and Stability

Specific topics or relationships to represent here are cultural values (K. A. Chan et al., 2012b, p. 746), typologies to express socio-cultural values (Bryan et al., 2010, p. 112)/(Sherrouse et al., 2011, p. 750 and 752), identifying human values and beliefs and practices (Nelson, 2008, p. 324), subsistence values (Burger, 2008, p. 1265), fishing and hunting opportunities (Burger, 2010, p. 141), ecological attributes that play a role in the lives of people (Sangha, Butler, Delisle, & Stanley, 2011, p. 935), spatial indices of social value (Bryan et al., 2010, p. 119), and well-being metrics (Amberson, 2013, p. 4).

3.1.3.3(A)(iii) Theme: Personal Well-Being

Key topics or relationships to represent here are well-being indicators (Hanein & Biedenweg, 2012, p. 1), indigenous health indicators (Donatuto et al., 2011, p. 111), landscape values (Fagerholm et al., 2011), natural resource values (MacDonald et al., 2013, p. 4), ecosystem services provided through natural resources (Harris & Harper, 2011, p. 233), social value domains (Amberson, 2013, p. 9), social values of ecosystem services (Bryan et al., 2010, p. 111), cultural values of ecological restoration (Breslow, 2014, p. 325), and nourish the soul/spirituality (Donatuto et al., 2011, p. 103).

3.1.3.3(A)(iv) Theme: Tribal Sustenance Imperatives

Key topics or relationships to represent here are effects of resource changes upon spiritual or ceremonial practices (Gregory & Trousdale, 2011, p. 2475), hunting and gathering (including medicinal) within forests (Karjalainen, Sarjala, & Raitio, 2010, p. 4), activities distinctive to native people (Gregory & Trousdale, 2011, p. 2472), and cultural services (Schaich, Bieling, & Plieninger, 2010, p. 269).

The original sources of the in vivo data are listed chronologically below, by year and author. See Table 5.

Table 5 Original Sources of In Vivo Concepts – Chronologically (per Year and Author)

1995	O'Hara	discursive ethics
1997	Machlis and Force	conceptual framework - human ecosystem
2000	Berkes EA	knowledge as adaptive management
2000	Kaplowitz	ecosystem services - cultural ecosystem services - community discourse
2001	Kaplowitz and Hoehn	focus groups v. individual interviews = complementary
2002	Wilson and Howarth	reveal unshared information
2004	Anderies EA	social-ecological systems
2006	Brown and Raymond	mapping - place attachment
2006	Pollnac EA	social impact assessments - model variables (and indices)
2007	Failing EA	ecological improvements - cultural significance

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2007	Stephenson	cultural sustainability
2008	Alessa EA	values typologies ·social-ecological hotspots
2008	Kumar and Kumar	psycho-cultural perspective: ecosystem services ·ecological identity
2008	Tipa and Nelson	theme v. dimension v. element v. indicator
2009	Armitage EA	successful adaptive co-management
2009	Gregory and Trousdale	express values - assistance needed
2009	Hall EA	geospatial knowledge
2009	Reed EA	injustices-marginalization ·stakeholders need power to influence what happens
2009	Termorshuizen and Opdam	landscape ecological knowledge ·values that humans attribute to landscapes
2009	Tipa	productive collaborations
2009	Turner and Clifton	health of the environment
2010	Bryan EA	ecosystem services - social values
2010	Burger	tribal values - subsistence
2010	Karjalainen EA	health/environmental professionals - cooperating ·hunting and gathering (incl. medicinal) - forest ·degraded forests - health effects
2010	Schaich EA	cultural services ·cultural services - types
2011	Collins EA	"press-pulse dynamics"/integrated conceptual framework ·behavioral decision = determine ES quant and quality
2011	Donatuto EA	nourish the soul
2011	Fagerholm EA	landscape values - typology ·cultural services ·landscape values
2011	Harris and Harper	ecosystem services - provided through natural resources ·ecosystem service losses - impacts and quantifying ·tribal environmental justice - analysis eco-cultural impacts
2011	Ranco EA	ensure tribally-derived regulatory-cultural approaches are applied
2011	Sangha EA	ecological attributes that play a role in the lives of people
2011	Sherrouse EA	ES social values - types
2012	Brown and Nicholas	cultural mapping
2012	Chan EA	economic valuation ·ecosystem services - cultural ·cultural values ·re-envision ecosystem services ·sociological change - actions, impacts, metrics ·key ecological processes/components - at stake ·key resource units/resource states - at stake ·contrast scenarios - characterize change ·stakeholders issues VS. management options effects
2012	Daniel EA	ecosystem services - community discourse
2012	Edouard and Duhaime	despair: variables-measures ·satisfaction with life in community - predictors
2012	Hanein and Biedenweg	Well-Being indicators
2012	Leon and Nunez	psychological Well-Being indicators
2012	Tengberg EA	cultural ecosystem services
2013	Amberson	data collection - interviews ·interview questions ·collected data - concept domains and attributes ·economic and psychological Well-Being ·human Well-Being metrics ·tribal Well-Being - attributes
2013	Aradottir EA	drivers of ecological restoration
2013	Biedenweg and Nelson	PSP social science - research gaps (themes)
2013	Brown and Kytta	public participation - evaluation criteria. local judgments - reflected in decision outcomes ·local values and preferences - deference to ·place-based information

2013	Ernstson	social production of ecosystem services ·ecological complexity ·environmental justice ·depends on social practices = management and protection ·ecosystem services - community discourse ·social-ecological networks: analyzing ·social-ecological network analysis ·decision making procedures - shape biophysical processes
2013	MacDonald	interview methodology - community leaders values
2013	McLain EA	values typologies
2013	Petursdottir EA	depends upon - sustainability of socio-ecological systems
2013	Satterfield	environmental management - options ·culture, intangibles and metrics
2013	Schure EA	need for high quality environmental resources ·health of the natural environment ·view natural and social environments as inseparable
2013	Viles	indigenous knowledge framework - community and environmental health
2014	Biedenweg EA	collected data - concept domains and attributes
2014	Biedenweg EA	collected data - concept domains and attributes ·Well-Being realms and components
2014	Breslow	ecological and cultural values - restoration links ·ecological restoration - cultural values ·cultural loss and/or historical trauma
2014	Donatuto EA	ecologic costs and benefits
2014	Wellman EA	Well-Being and urban areas - link human and ecological processes

3.1.3.3(C) Generation of New Theoretical Model

3.1.4.3(C)(i) The Theoretical Model – Structural Elements and Factors to Incorporate

Specific key concepts and visual models from scientific journals were excerpted and pooled and analyzed for: 1) visual formats that should be used to structure the new model, 2) critical factors that must be represented and/or incorporated into the new model; and 3) key themes and categories to synthesize together into a new grounded theoretical model.

Visual Formats – Structural elements from the original models selected for incorporating into the new model included using four interacting elements (Anderies et al. 2004), a four-square (incl. external drivers) concept (Collins et al. 2011), well-being domains and attributes and indicators – e.g. psychological, social, cultural, spiritual, economic, governance, physical (Amberson 2013), domain-oriented system relationships focused upon an eco-cultural well-being center (Thomas 2001), holistic representations and approaches (Thomas 1992), and cosmological symbology (Thomas 2001).

- Model visuals should spotlight: element interaction paths (Anderies et al. 2004); elements being related to and interacting with each other (Thomas 1995); flows within each

component operating independently or being shared (Machlis et al. 1997); and/or strategic interactions within and between entities affecting their likelihood of robustness (Anderies et al. 2004).

Critical Factors to Represent/Incorporate – Basic components of the original models that were picked for incorporating into the new model included: using categories of domains and their attributes, using attribute indicators (including representing varying amounts); using categories that are relatively useful for resource managers (Amberson 2013); and using social-ecological systems framework for portraying the interactive relationships occurring between the biophysical template and ecosystem services and the social template. e.g., decision-making, in particular (Collins et al. 2011).

- **Biophysical Template** – The new model should strive to highlight: local ecological community structures and ecosystem functions (Collins et al. 2011); as well as ecosystem services - including cultural (Collins et al. 2011); along with socio-cultural attributes being assigned to the ecological systems realm. e.g., biota, habitat types, ecological processes, physical processes, geology/landforms, sites, and/or socio-cultural meaning (Thomas 1992).
- **Ecosystem Services** – The new model may portray ecosystem services as forming a “bridge” between the biophysical and social templates (Collins et al. 2011), and/or consisting of cultural, provisioning, regulating, or supportive elements.
- **Social Template** – The new model should strive to highlight: economic; political, community, and cultural dimensions (Thomas 1995); social order, social cycles and social institutions (Machlis et al. 1997); human behavior and human outcomes (Collins et al. 2011); individual person, family and/or community levels of society (Thomas 1992); families composed of individuals (e.g. husband-wife-children-elders, local communities composed of relatives-friends-needy-others, task groups focused on hunting-gathering-processing); and/or insidious health anomalies with needed remedies and cumulative costs. e.g., personal-family-community; physical-psychological; financial, etc.) (Thomas 1992).
- **Eco-Cultural Concepts** - The new model should strive to highlight other broader tribal socio-cultural dimensions such as the cultural dimension, the spiritual dimension and cultural survival (Thomas 1992); and should strive to represent tribal subsistence systems (Thomas 1992) and socio-cultural attributes of the natural environment (Thomas 1995), in particular. The new model should also strive to represent eco-cultural systems (Thomas 1995), eco-centric subsistence (Thomas 1992), and spirituality (Thomas 1992), as well as allow for tribal perspectives regarding the “important well-being aspects” of ecological systems, and portraying local ecological systems as being a central feature (Thomas 1992), where eco-cultural Well-Being is the central focus (Thomas 2001).

3.1.3.4 The New Theoretical Model - Community Sustenance Dynamics (CSD)

The Community Sustenance Dynamics model was devised to portray the themes, categories and relationships that were identified as being grounded within the qualitative text and model data specifically excerpted from recent scientific journals. This model was devised to highlight the various dynamics involved when appreciating, investigating and/or accommodating basic community sustenance needs.

Final “Thematic Map” – Each overall theme was initially depicted as being surrounded by all its’ associated categories (See Glossary) that it was associated with, where the categories that were catalogued as being shared with a separate different theme were clearly distinguished from the categories that were catalogued as being “unshared”, or unique and stand-alone. A final thematic map for each separate theme was then created in which all of the key concepts that were associated with a specific category surrounding the final theme were now added onto the visual portrayal presented within the initial thematic map. See Appendix A for the visual representations of each of the thematic maps.

Visual Data Pooled to Synthesize a New Model – The final thematic maps were gathered together so that interrelationships represented by the shared categories might be better appreciated or visualized. The categories shared between the themes were linked together through repositioning the themes or categories so that the various shared categories could be depicted as being directly linked (as best possible).

Unanticipated patterns that were detected during the spreadsheet analysis were then used to synthesize a new visual model. These significant patterns were that: 1) the shared categories that linked the themes were recognized as linking two – but never three - of the four main

themes; and 2) the inter-linkages were complementary in that the linkages could be depicted as constituting a loop-like system in which the categories that were shared between themes could be organized into a generally continuous series of systemic linkages.

The inter-relationships between these overall themes and their shared categories (and the original key concepts associated with them) were characterized as having a four-cornered, diamond shaped relationship, where the themes are depicted as being in the corners of the diamond and the shared categories served as the dynamic links which connected these separate themes together, using a comprehensive holistic view. The visual representation that was generated from synthesizing these pertinent features was then labeled as being the “Community Sustenance Dynamics Model”.

3.1.3.4(A) Community Sustenance Dynamics Model - Structural and Operational Features

3.1.3.4(A)(i) Structural Features

The Community Sustenance Dynamics model uses a diamond-cornered relational concept to represent possible relationships between the four data themes and/or theme categories which were identified during the inductive thematic analysis. Four separate inductive themes are portrayed as each occupying a separate corner of a diamond-shaped holistic model while still interacting all together (similar to the four bases/basemen of a baseball field). See Figure 5.

An overall circular shape is used to portray an encompassing holistic system and the basic interrelationships existing between the four primary themes (and/or their shared and unshared categories of data). The shared categories are portrayed as linking whichever two themes share a specific category of key concepts, whereas the unshared categories (and their data codes/concepts) are portrayed as being linked to the particular theme it was specifically assigned

to. The circular shape encompasses all of the factors, relationships and metrics associated with the “community sustenance dynamics” concept, and these elements are illustrated as all being focused around a central, core state of eco-cultural well-being.

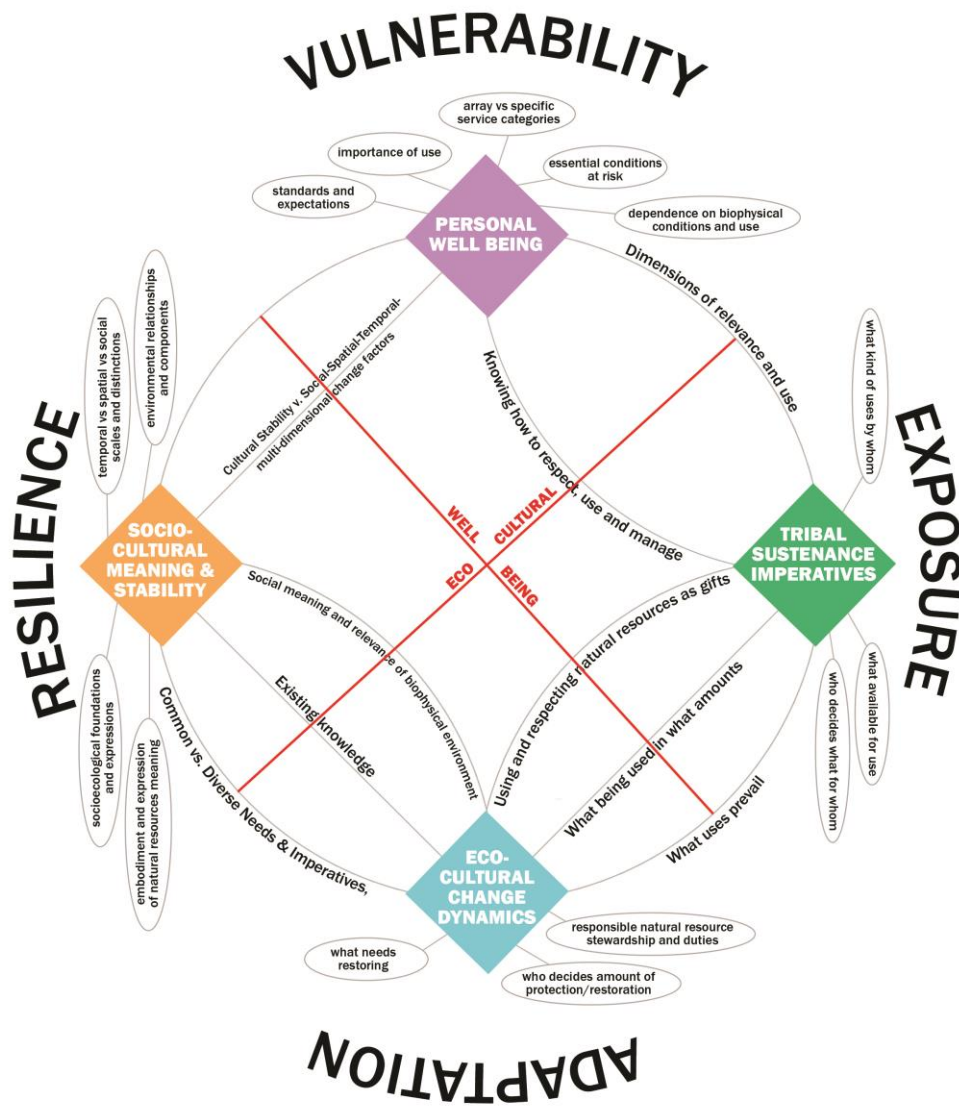


Figure 5. The Community Sustenance Dynamics Model. (Thomas, 2015).

The four-cornered interrelated elements arrangement is presented as a closed system where the four main elements interact through their shared theme categories in both continuous loop-like, as well as two-way fashions. The categories of data that themes do not share with other themes are recognized as being unique to that theme and are thus significant in a stand-alone fashion. Every data category contains the final group of “key concepts” excerpted from original scientific articles which were assigned to that specific category for greater representation.

3.1.3.4(A)(ii) Operational Features

The Community Sustenance Dynamics model represents how the Eco-cultural Change Dynamics, and Socio-cultural Meaning and Stability, and Personal Well-being, and Tribal Sustenance Imperatives themes are all interacting in a closed-system fashion to facilitate the overall sustainment of a local tribal community’s socio-cultural systems. The model highlights the categories of data that thematic analysis determined were shared between two of the separately identified, independent main themes – while the model is designed to depict the other categories of data that are not shared (and are unique to a specific main theme) as well. The model allows the interrelating themes, categories and key concepts to be explored from both a single theme, as well as an interacting theme operational perspective (depending upon the particular research and/or systems management need).

3.1.3.4(B) Community Sustenance Dynamics Model - Single Theme Operations

3.1.3.4(B)(i) Eco-cultural Change Dynamics

The Community Sustenance Dynamics model allows specific key concepts - and the theoretical categories they were grouped into - to represent the central theme of eco-cultural change

dynamics (and be spotlighted when needed). The categories are used to foster acknowledgement of particular aspects of eco-cultural change dynamics, while the key concepts provide examples of specific factors, relationships and/or techniques to acknowledge when addressing these particular aspects of eco-cultural change dynamics.

Exploring eco-cultural change dynamics - as reciprocal changes occurring between ecological and cultural systems (and their overall system impacts) – could involve determining what is already known, how the socio-cultural meaning or relevance of ecological systems will be affected, and/or if there are diverse in comparison to common needs that must be balanced. Other key concerns are whether natural resources are being used and respected as gifts, what is being used in what amounts, and what resource uses actually prevail. Additional topics to address are relative commitments to natural resource stewardship duties, who is deciding what is being protected or restored, and what is being recognized as needing to be restored.

3.1.3.4(B)(ii) Socio-cultural Meaning and Stability

The Community Sustenance Dynamics model allows specific key concepts - and the theoretical categories they were grouped into - to represent the central theme of socio-cultural meaning and stability (and be spotlighted when needed). The categories are used to foster acknowledgement of particular aspects of socio-cultural meaning and stability, while the key concepts provide examples of specific factors, relationships and/or techniques to acknowledge when addressing these particular aspects of socio-cultural meaning and stability.

Exploring socio-cultural meaning and stability – highlighting the factors, dynamics and/or relationships that are most relevant to sustaining the local community - could involve determining what is already known, and how socio-cultural meanings or the relevance of

ecological systems will be affected, and/or if there are diverse in comparison to common needs that must be balanced. Other key concerns involve how cultural stability is being threatened from multidimensional (temporal-spatial-social) change, the reinforcing role socio-ecological systems provide to socio-cultural stability, how differing temporal-spatial-social scales of impacts effect socio-cultural meaning and stability, how embodiments or expressions of natural resource meanings reinforce socio-cultural stability, and/or how environmental components relate to (or reinforce) the meaning and stability of socio-cultural systems.

3.1.3.4(B)(iii) Personal Well-Being

The Community Sustenance Dynamics model allows specific key concepts - and the theoretical categories they were grouped into - to represent the central theme of Personal Well-Being (and be spotlighted when needed). The categories are used to foster acknowledgement of particular aspects of personal well-being, while the key concepts provide examples of specific factors, relationships and/or techniques to acknowledge when addressing these particular aspects of personal well-being.

Exploring personal well-being – spotlighting the factors, dynamics and /or relationships that are most relevant to the individual persons and families being sustained within the community – may include highlighting the ways human well-being is reinforced by cultural stability and/or destabilized by excessive multidimensional change (social-spatial-temporal), well-being is likely rooted within broad dimensions of relevance and use, and well-being is contingent upon knowing how to respect, use and manage local ecological systems. Personal well-being is also linked to the need to recognize the personal relevance of resource use, as well as recognize each person’s dependence upon local biophysical conditions and uses, or that personal preferences may need tempering with ecosystem services categories-standards-

expectations, and/or that personal well-being assessments need to incorporate indicators that are focused upon the essential conditions at-risk.

3.1.3.4(B)(iv) Tribal Sustenance Imperatives

The Community Sustenance Dynamics model allows specific key concepts - and the theoretical categories they were grouped into - to represent the central theme of tribal sustenance imperatives (and be spotlighted when needed). The categories are used to foster acknowledgement of particular aspects of tribal sustenance imperatives, while the key concepts provide examples of specific factors, relationships and/or techniques to acknowledge when addressing these particular aspects of tribal sustenance imperatives.

Exploring tribal sustenance imperatives – spotlighting the factors, dynamics and /or relationships that are most relevant to local tribal communities striving to sustain their social and cultural resources – may include underscoring how sustaining tribal systems could be contingent upon the breadth of the dimensions being relied upon for determining natural resource relevance and use, or tribal community principles and mechanisms for knowing how to respect-use-manage ecological systems and/or using and respecting natural resources as gifts, or knowing what is being used in what amounts, or knowing what uses actually prevail, and/or who decides what for whom.

3.1.3.4(C) Community Sustenance Dynamics Model - Interacting Theme Operations

The Community Sustenance Dynamics model was also designed to group the individual themes together so that a specific series of interrelationships between the themes revealed during thematic synthesis could be acknowledged and recognized for their systemic significance.

This model is used to illustrate that ensuring the sustenance needs of a local community are being met may rely upon whether links between key aspects of eco-cultural change dynamics, socio-cultural meaning and stability, personal Well-Being, and/or tribal sustenance imperatives are being adequately addressed. The analysis conducted here revealed a pattern in which all four of the main themes are interrelated by way of their being related to each other, such that three categories of data associated with the theme of eco-cultural change dynamics (and their in vivo data) are shared with the theme of socio-cultural meaning and stability, one category is shared between socio-cultural meaning and stability and personal Well-Being, two categories are shared between personal Well-Being and tribal sustenance imperatives, and three categories are shared between tribal sustenance imperatives and eco-cultural change dynamics – and therefore are linked to the next subsequent theme again, and so on - effectively producing a theoretical closed loop.

3.1.3.4(C)(i) Theme Categories

This analysis determined that a closed loop linking eco-cultural change dynamics, socio-cultural meaning and stability, personal well-being, and tribal sustenance imperatives all together could be a core feature of community sustenance dynamics, whereby each of these themes are linked together through the various categories (and/or key concepts) that each different theme is sharing with another. This closed loop may serve a core role in sustaining a local community in that their adapting to local environmental change could depend upon: 1) their combined ability to compile accumulated knowledge, characterize the social meaning and relevance of the biophysical environment, balance common with unique socio-cultural needs and imperatives, and foster resilience while faced with multidimensional social-spatial-temporal change; as well as 2) their ability to embrace personal along with tribal health dimensions of natural resource relevance and

use, embrace knowing how to respect-use-manage ecological systems in a spiritually-relevant manner, embrace using and respecting natural resources as honored gifts, and be certain regarding what is being used in what amounts, and/or agree regarding which natural resource/ecological system uses actually prevail (and who is benefiting by how much).

3.1.3.4(C)(ii) In Vivo Data

The entire collection of in vivo data (See Glossary) extracted from scientific journals was assigned to certain categories which had been identified using grounded inductive approaches. The very same set of in vivo data items was independently assigned to each of the main themes that had been generated via the final thematic synthesis of the original in vivo data. Employing this two-pronged approach of assigning the in vivo data – AKA “key concepts” (See Glossary) - to the categories and the final main themes independently then allowed the categories containing the data and the themes containing the same data to be matched. The analysis revealed that: 1) specific categories of data were matched with specific themes of data, 2) particular categories of data were actually shared in-common between particular themes, and 3) the key concepts within the shared categories may be of special importance because they are linking two of the final main themes.

3.1.4 PRELIMINARY TESTING OF NEW THEORETICAL MODEL

3.1.4.1 Using CSD Model to Evaluate the Quality of the Puget Sound Partnership

Evaluate the Quality of the Puget Sound Partnership

Elements of the Model to Test: This project used model-centered analyses to generate a new model that visually-represents the basic components and dynamics involved when fulfilling local

tribal natural resources-related risk assessment work. The new model was generated using grounded theory thematic analysis techniques, and as such the model utilizes key concepts, categories and themes as its structural features.

Original in vivo data were labelled as “key concepts”, and these key concepts were separated according to the differing theoretical categories they matched, and then these categories were collected into four different overall themes. As such, 157 key concepts were separated into 23 categories, and these categories were collected under four overall themes. The model then relies upon the merits of these features and their inter-relationships as being the operative elements that are used to make the model work.

The Community Sustenance Dynamics Model was produced to upgrade the social-ecological system results that are being obtained through local natural resource risk assessment efforts. The model does this by spotlighting current key concepts - and theoretical categories and overarching themes that they could belong to – as each being vital to address when evaluating a local land use proposal for the impacts it is likely to have upon the cultural dimensions a local tribal community.

The CSD model is used to visually represent the cultural aspects of local tribal social-ecological systems that need to be addressed during local risk assessment. As such, the model is not only representational but may be useful for guiding the scope of local land use proposal risk assessments, and/or guiding the evaluation of existing (or future) natural resource-based cultural resources protection and management programs as well. e.g., the Washington State Puget Sound

Partnership (PSP) salmon recovery program established in 2006, which has the potential to affect every local salmon stock - as well as every Tribal community - within the Puget Sound area.

Comparison Test Objectives: The PSP program was picked for testing of the CSD model because it is a broad-based local salmon recovery program that does have tribal implementation goals, along with other concurrent goals specific to ecosystem management and human well-being. The basic approach is to compare the PSP program tribal provisions against the basic elements of the new Community Sustenance Dynamics model to see how well they match - the presumption is that PSP elements should match CSD elements, and that the PSP program probably needs strengthening in the areas where it does not have any elements that match with any of the CSD model elements overall.

This comparative testing consisted of locating PSP foundational or directional documents containing official tribal provisions, or identified any tribal objectives associated with PSP salmon recovery implementation work - e.g., human well-being indicator identification, etc. The tribally-specific information was excerpted so that the PSP concepts could be compared to the CSD categories to determine how strongly they actually matched. The main topics of the PSP various excerpts were identified, and the main points that each of the different topics represented were then listed alongside of their topics, so that all of the PSP main topics (and the main points they represented) could be displayed together upon a master list.

All of the PSP main topics were compared to all of the CSD model categories to determine which PSP topics, if any, was a reasonable match to any of the CSD categories overall. Each PSP topic was then assigned to the CSD category that was deduced to be its best

match, if any, so that the main points within each PSP topic could be compared with the key concepts within each CSD category to determine how these two groups matched as well.

Comparison Testing Steps: The overall purpose of the comparative test is to determine how well the elements of the program being evaluated match with both the categorical and the underlying key concept elements of the Community Sustenance Dynamics model. The overall steps that were utilized for comparison testing are as follows:

1) *Document Search* - An electronic search for PSP foundational and directional documents using internet MSN Explorer searches, and 17 references were discovered which contained official tribal provisions or identified tribal objectives associated with PSP salmon recovery work - these references ranged in date from August 2006 up through December 2014.

2) *Excerpt PSP Tribal Topics and Main Points* - The tribal information that was specified within each PSP document was labelled according to the main topic that the entry was associated with within the PSP document. All of the pertinent main points relating to that main topic within the PSP document were excerpted and grouped along with their PSP main topics for comparing with the CSD model key concepts and/or categories overall.

3) *PSP Main Topics Master List* - The PSP Main Topics and associated Main Points were compiled into a master list, and each of the PSP Main Topics was compared to each of the CSD categories to identify any potential matches between the two groups.

4) *Match PSP Topics to CSD Categories* - Those PSP Main Topics that potentially matched a

CSD category were assigned to the best matching category for a more in-depth comparison of their respective main points (PSP) and key concepts (CSD) to see how well they match.

5) *Match PSP Topics to CSD Themes* - Each PSP Main Topic that potentially matched a CSD Category was compared to each of the four CSD overall themes, and was then assigned to the best matching CSD Theme as well. This step was key to determining which CSD Theme a PSP Main Topic would be assigned to - in the event that they had been assigned to a CSD shared category.

6) *PSP Topics-to-CSD Themes Comparative List (per CSD Theme)* - A comparative list was created for each of the CSD Themes presenting all of the CSD categories associated with that specific theme in the first column, and whatever PSP Main Topics were identified as best correlating with each of the specific CSD categories in an adjacent second column. Separate lists were used for each separate theme because each theme shares certain categories with other themes, and the key concepts that are within a CSD shared category are different within the portions of the category that is associated with a respective theme, and as such comparing the PSP main points to the CSD key concepts does need to theme specific.

7) *PSP Main Points-to-CSD Key Concepts Comparison (per CSD Theme)* - The CSD-to-PSP comparative list was revised to display the main points related to a PSP Main Topic alongside of the key concepts associated with their matching CSD Category as well. The primary objective here is to compare the main points of a PSP topic with the key concepts of the CSD Category that they were matched with and assigned to.

Comparison Test Results: Twenty-eight separate PSP main topics - involving tribal provisions - were identified and presented together upon the PSP Main Topics Master List. All of these PSP Main Topics did match with some of CSD categories within the four CSD model themes, and some of them did match with CSD shared categories in particular. Other CSD categories were not matched with at all, indicating that the PSP program may not address these particular categories of information, and as such did not offer any topics or main points that could be matched to these CSD categories overall.

CSD Categories That Were Matched By a PSP Main Topic: The CSD categories that direct comparison testing indicated could be matched by a PSP Main Topics (per CSD theme) are listed below.

- **Eco-Cultural Change Dynamics (ECCD) Theme** - The comparison testing indicated that certain PSP Main Topics could be matched with the following categories of the ECCD theme: Accumulated knowledge; Social meaning and relevance of biophysical environment; Using and respecting natural resources as gifts; Responsible natural resource stewardship and duties; and, What needs restoring.
- **Socio-Cultural Meaning and Stability (SCMS) Theme:** The comparison testing indicated that certain PSP Main Topics could be matched with the following categories of the ECCD theme: Accumulated knowledge; Social meaning and relevance of biophysical environment; Cultural stability vs. social-spatial-temporal multidimensional change; Socio-ecological foundations and expressions.
- **Personal Well-Being (PWB) Theme:** The comparison testing indicated that certain PSP Main Topics could be matched with the following categories of the ECCD theme: Knowing how to respect, use and manage; Importance of use; Dependence on

biophysical conditions and use; Arrays vs. specific service categories, standards and expectations; Essential conditions at risk.

- **Tribal Sustenance Imperatives (TSI) Theme:** The comparison testing indicated that certain PSP Main Topics could be matched with the following categories of the TSI theme: Using and respecting natural resources as gifts; Dimensions of relevance and use; Knowing how to respect, use and manage; What available for use; Who decides what for whom.

CSD Categories That Were Not Matched By a PSP Main Topic: The CSD categories that direct comparison testing indicated could not be matched to a PSP Main Topic (per CSD theme) are listed below.

- **Eco-Cultural Change Dynamics (ECCD) Theme** - What being used in what amounts; What uses prevail; Common vs. diverse needs, imperatives and strategies; Who decides amount of protecting or restoring; What needs restoring.
- **Socio-Cultural Meaning and Stability (SCMS) Theme:** Common vs. diverse needs, imperatives and strategies; Temporal vs. spatial vs. social scales and distinctions; Embodiment and expression of natural resources meaning; Environmental relationships and components.
- **Personal Well-Being (PWB) Theme:** Cultural stability vs. social-spatial-temporal multidimensional change; Dimensions of relevance and use.
- **Tribal Sustenance Imperatives (TSI) Theme:** What being used in what amounts; What uses prevail; What kind of uses by whom.

Comparison Test Conclusion – A comparison of the tribally-specific provisions and management objectives of the Puget Sound Partnership salmon recovery program with the CSD categories revealed that the PSP program does not provide any counterparts to certain CSD model categories, and as such probably should recognize these as being areas of their current

system that are relatively weak and in need of strengthening to optimize the quality of their current salmon-resource related risk assessment work, as well as their local, tribal-oriented, cultural resource protection and management approaches and programs. The PSP main topics that the test indicated do match with the CSD model categories should be investigated further to determine how well their actual PSP main points match with the actual CSD key concepts to verify whether they are dissimilar, complementary, or conflictual, and as such evaluate how meaningful they are in relation the existing, as well potentially improved Puget Sound Partnership salmon recovery program.

Chapter 4 DISCUSSION

4.1 RESEARCH FINDINGS

Investigating the original problem included a literature survey in which key gaps in the frameworks or models that are being used to structure local tribal risk assessments were identified. As such, a new social-ecological systems model that might be used to contextualize these gaps using a holistic and local, social-ecological systems perspective was created. The new model was produced by grouping existing key concepts into categories and themes that were inductively created, and then synthesizing these new elements into a grounded and holistic, final model. The new model depicts four main themes as being in a dynamic diamond-shaped relationship where the themes are in the corners of the diamond and the different categories that are being shared between the themes serve as the links through which these four themes inter-relate with each other, in an overall theoretically closed-loop.

4.1.1 USE SHARED CATEGORIES TO HIGHLIGHT FACTORS RELATIONSHIPS and/or SOCIAL-ECOLOGICAL SYSTEMS CONTEXT

The different key factors contributing to the original problem were matched to each of the specific categories of the new Community Sustenance Dynamics (CSD) model, where applicable. This allowed each factor to be incorporated into the model and related to the other components and dynamics of the new model system.

The matching led to many key factors being assigned to the categories that were shared between the themes. Assigning these gap factors to shared categories is significant because it

enables the gap factors to be encompassed within a systems context, highlights the relationship of the gap factors to the other CSD model elements, allows the pertinent qualities of the gap factor to be recognized, and enables the gap factors to be characterized from an eco-cultural perspective. This allocation of the problem factors resulted in all but one of the shared categories being included.

4.1.1.1 Specific Tribal Risk Assessment Gaps Receiving Attention through This Study

The gaps being recognized as contributing to the basic problem are:

- 1) Value-based knowledge (Failing et al., 2007), and providing needed assistance articulating values (MacDonald et al., 2013) are usually excluded.
- 2) Social values (Kaplowitz, 2000) and tribal community held-values (MacDonald et al., 2013) are being excluded as superfluous information.
- 3) Scales for important cultural values (Satterfield et al., 2013), and ecological-cultural-health-governance components being inter-related (Schure et al., 2011) receiving just minimal attention.
- 4) Spatial indices for social values (Bryan et al., 2010), and indigenous cultures perceiving the natural environment as being linked to key health dimensions (Schure et al., 2011) are usually disregarded.
- 5) Eco-culturalism principles are not being recognized (Slack & Whitt, 1992).
- 6) Expertise at the local level (Fagerholm et al., 2011), specific ecosystem services and management actions (Bryan et al., 2010), and/or the original eco-cultural concepts (J. P. Thomas, 1995a, 1995b); (Martinez, 1995) are excluded from the analysis.

7) Community suggestions on how ecosystem services should be managed (Bryan et al., 2010) are overshadowed by private economic forces.

8) integrating cultural heritage and identity into policy-making (Tengberg et al., 2012), ensuring appropriate methods are used to assess losses (Gregory & Trousdale, 2011), and detailing who benefits (Ernstson, 2013) are not prioritized as being relevant to the decision process.

Additional gaps that are being recognized as contributing to the problem are:

A - Community involvement and participatory mapping (Fagerholm et al., 2011) are rarely accomplished.

B - Specific ecosystem services and management actions (Bryan et al., 2010) are usually omitted.

C - Ecosystem services concepts (Daily, 1997); and explanations of why cultural values define and prioritize health - especially health risks and impacts (Donatuto et al., 2011) are rarely included.

D – Non-material values (K. M. A. Chan et al., 2012a); intangible values (Donatuto et al., 2011), and/or the potential range of cultural values and their dynamics (Stephenson, 2007) are not recognized.

E – Determining and accommodating tribal perspectives regarding what health really includes (Schure et al., 2011) are always omitted.

F – Ensuring that analyses detail which ecosystems are being prioritized (Ernstson, 2013), and/or how the natural environment plays an integral role in achieving and maintaining health (Schure et al., 2011) is usually overlooked.

G – The connections between community engagement and policy decisions (MacDonald et al., 2013) are rarely examined.

H - Needing to involve indigenous constituents (Satterfield et al., 2013); truly consulting with constituents (Satterfield et al., 2013); ensuring power, loss of power, and empowerment are central within the discourse (Donatuto et al., 2011); ensuring the cultural dimension focuses on how cultural knowledge and practices and scientific approaches can be communicated and integrated (Tipa, 2009); and ensuring decision-making is both ecologically appropriate and socially-just (K. M. A. Chan et al., 2012a) are all viewed as being too complex or irrelevant to be accommodated.

4.1.2 ASSIGNING GAP FACTORS TO SHARED CATEGORIES ENABLES FACTORS TO BE LINKED TO THE CSD MODEL DYNAMICS

Given that the shared categories connect the different themes of the model together in a closed loop, the gap factors assigned to the shared categories were recognized as being possible connectors between the corresponding themes within the model. The CSD dynamic systems outcome was that the gap factors were assigned to a least one of the categories that is shared between the respective pairs of themes within the CSD loop, creating the net effect of all of the continuous portions of the CSD closed-loop being filled-in.

4.1.2.1 Selected Key Concepts Provide the Data Needed To Operate the CSD Model

The model incorporates key concepts as variable factors that can be run through the model so that the factors relationships to the CSD system and its' various components and dynamics can be examined. These key concepts are used to operate the model, and these key concepts can consist of variable (and even constant), quantitative or qualitative data. Categories and themes serve as surrogates for the original key concept data and these categories and themes are used to identify dynamic relationships that could be linking the specific factors that the data represents. Each of the four CSD themes encompasses a variety of categories (and their inherent key concepts) - and some of these categories are literally “shared” between the themes.

The CSD model is designed to portray a system in which the shared categories - and the key concepts they represent – are operating together in a continuous loop-like pattern which culminates in all of the differing themes of the CSD model being relatively linked together. The mechanistic concepts of the CSD model are that the four themes of the model are inter-related through a closed-circuit of shared categories. The system operates best when at least one of the shared categories between each of the four pairs of theme combinations within the loop have been populated with at least some form of initial key concept data, where applicable - and as such, the CSD closed-loop can actually operate off of just four initial key concepts.

4.1.2.2 Recognize Tribal Risk Assessment Gaps as Being the Key Concepts to Use for Operating the CSD Loop

Current gaps in natural resource risk assessment could be construed as being key concepts associated with the various CSD categories and themes. The CSD model can be used to analyze these original program gaps by evaluating the risk assessment gap factors in terms of basic CSD

system dynamics. Integration of the gap factors into the model allows the current gaps to be compared with each other, and with other various CSD themes or categories, and/or with the other original CSD key concepts; it also allows prospective sequencing of the gap factors in terms of the shared categories of the CSD themes to be predicted as well. If gap factors are viewed as conceptually equivalent to their assigned category, it enables the gap factors - rather than the shared categories – to be recognized as being the links that are inter-relating the specific pairs of CSD themes in a successive fashion.

4.1.3 HIGHLIGHT THE SYSTEMS SIGNIFICANCE OF TRIBAL RISK ASSESSMENT GAPS USING THE CSD MODEL

The CSD is designed to highlight basic social-ecological systems dynamics and the significance of specific key concepts in a social-ecological systems context, so that gaps in the components or dynamics of current social-ecological systems frameworks and models can be re-interpreted using a new, grounded and holistic, social-ecological systems perspective. A basic example of how the significance of current risk assessment gap factors can be reassessed from a CSD social-ecological systems perspective, by using the gap factors as the key concepts that are being associated with the CSD model categories and themes, is provided below. Gap factors assigned to shared categories of the CSD model are especially notable because they may be used as a key concept that links the main themes of the CSD loop, whereas gap factors assigned to unshared categories are notable because they serve to underscore the unique significance that a factor may have in regards to the specific CSD theme they are being associated with.

4.1.3.1 Problem Gap Factors Were Integrated Into CSD System through Assignment to CSD Categories

The current list of risk assessment gap factors (n=25) were sorted into CSD categories resulting in most of the shared and unshared categories being populated with at least some risk assessment gap factor data. The gap factors that occupy shared categories are significant here given this enables those gap factors to be acknowledged as being the connectors that are inter-relating the CSD themes in a successive manner. Sorting current gap factors according to CSD shared categories resulted in 15 of the 25 gap factors being assigned to shared categories, and 10 being assigned to unshared categories.

The number of gap factors assigned to CSD shared categories is as follows: Accumulated Knowledge (AK) = 2. Common vs. Diverse Needs, Imperatives and Strategies (CD) = 2. Cultural Stability vs. Social-Spatial-Temporal Multidimensional Changes (CS) = 2. Dimensions of Relevance and Use (DR) = 2. Knowing How to Respect Use and Manage (KH) = 1. Using and Respecting Natural Resources as Gifts (UR) = 2. What Being Used In What Amounts (WB) = 1. What Uses Prevail (WU) = 3.

The number of gap factors assigned to CSD unshared categories is as follows: Responsible Natural Resource Stewardship and Duties (RN) = 1. What Needs Restoring (WN) = 1. Environmental Relationships and Components (ER) = 2. Responsible Natural Resource Stewardship and Duties (RN) = 1. Arrays vs. Specific Service Categories, Standards and Expectations (AS) = 2. Dependence on Biophysical Conditions and Use (DB) = 1. Essential Conditions At-Risk (EC) = 2. Social-Ecological System Foundations and Expressions (SE) = 1. What Kind of Uses by Whom (WK) = 1. Who Decides What for Who (WD) = 5.

4.1.3.2 Current Gap Factors Were Transformed Into CSD Key Concepts

Each of the initial gap factors was converted into a specific CSD key concept. The gap factors assigned to shared categories - as applied key concepts - were grouped as follows: (AK) = Value-based knowledge; Assistance articulating values. (CD) = Social values; Tribal community held-values. (CS) = Scales for important cultural values; Components being inter-related. (DR) = Spatial indices for social values; Indigenous cultures perceive the natural environment as linking. (KH) = Initial “eco-culturalism” concepts. (UR) = Specific ecosystem services and management actions; Expertise at the local level; Original eco-cultural concepts. (WB) = Community suggestions on how ecosystem services should be managed. (WU) = Integrate cultural heritage and identity into policy-making; Elaborate on who benefits; Ensure appropriate methods are used to assess losses.

The gap factors assigned to unshared categories were also grouped - as applied key concepts - as follows: (RN) = Community involvement and participatory mapping. (WN) = Specific ecosystem services and management action. (ER) = Ecosystem services concept; Why these values define and prioritize health, especially health risks and impacts. (RN) = Potential range of cultural values and their dynamics. (AS) = Non-material values; Intangible values. (DB) = Health includes...etc. (EC) = Ensure analyses detail which ecosystems are being prioritized; Natural environment plays an integral role in achieving and maintaining health. (SE) = Potential range of cultural values and their dynamics. (WK) = Connections between community engagement and policy decisions. (WD) = Need to involve indigenous constituents; “consult with constituents”; Power, loss of power, and empowerment are central within the discourse; Ensure cultural dimension focus upon how cultural knowledge and practices and scientific

approaches can be communicated and integrated; Decision-making that is both ecologically appropriate and socially-just.

4.1.3.3 Gap Factor Key Concepts Replaced the Shared Categories as the Links between the CSD Themes

Each gap factor key concept was viewed as being capable of replacing their shared category to serve as the new link connecting the theme pairs of the CSD loop. The net result of replacing the shared categories with their gap factor key concepts was for these gap factors to be recognized as being possible connectors between the recognized pairs of model themes, and that they may be inter-relating these specific pairs of CSD themes in a continuing successive fashion. Linking all four pairs of the CSD themes together then resulted in closing the CSD loop.

Original CSD Theme Links (with Respect to Shared Categories) Using the Original CSD

Model - The relevant categories being shared between CSD themes *before* being replaced by the speculated gap factor key concepts were as follows: ECCD and SCMS - Accumulated Knowledge (AK), and Common vs. Diverse Needs, Imperatives and Strategies (CD). SCMS and PWB - Cultural Stability vs. Social-Spatial-Temporal Multidimensional Changes (CS). PWB and TSI - Dimensions of Relevance and Use (DR), and Knowing How to Respect Use and Manage (KH). TSI and ECCD - Using and Respecting Natural Resources as Gifts (UR). What Being Used In What Amounts (WB). What Uses Prevail (WU).

New Gap-Based Links Using an Adapted CSD Model – The specific gap factor key concepts serving to link the CSD themes *after* replacing the shared categories are as follows: ECCD and SCMS - Value-based knowledge, and Assistance articulating values; plus, Social values; Tribal community held-values. SCMS and PWB - Scales for important cultural values, and Components

being inter-related. PWB and TSI - Spatial indices for social values, and Indigenous cultures perceive the natural environment as linking; plus, Initial “eco-culturalism” concepts. TSI and ECCD - Expertise at the local level, and Original eco-cultural concepts; plus Community suggestions on how ecosystem services should be managed.; plus Integrate cultural heritage and identity into policy-making, and Elaborate on who benefits; and Ensure appropriate methods are used to assess losses.

4.1.3.4 Gap Factor Key Concepts Were Able To Close the CSD Loop via Linking the CSD Themes

The CSD themes consisting of Eco-Cultural Change Dynamics (ECCD), Socio-Cultural Meaning and Stability (SCMS), Personal Well-Being (PWB), and Tribal Sustenance Imperatives (TSI) can all be linked together using key concepts to create a continuous closed-circuit loop. Given that just one key concept may link a pair of CSD themes, the CSD loop circuit is able to be closed using just four pertinent key concepts. CSD loop analyses of key concepts can be launched in either direction from any CSD theme when assessing how a specific key concept connecting a pair of CSD themes relates to each of these themes, or relates to the other key concepts within the same categorical group.

The CSD loop is designed to represent a social-ecological systems perspective, and as such the relative significance of the various gap factor key concepts can be hypothesized as applicable - See Figure 6.

The possible social-ecological systems significance of the initial risk assessment gap factors when they are sorted and converted to key concepts linking the CSD themes – to then

close the CSD loop circuit - is speculated to be as follows (starting with Eco-Cultural Change Dynamics, and moving clockwise around the loop):

ECCD and SCMS: The current risk assessment gaps important for linking ecological change assessments and local cultural stability would be collecting value-based knowledge, providing assistance articulating values, embracing basic social values, and embracing tribal community held-values.

SCMS and PWB: The current risk assessment gaps important for linking local cultural stability and personal well-being would be devising scales for important cultural values, and underscoring the principle that the CSD ecological, social, cultural and health system components are all inter-related.

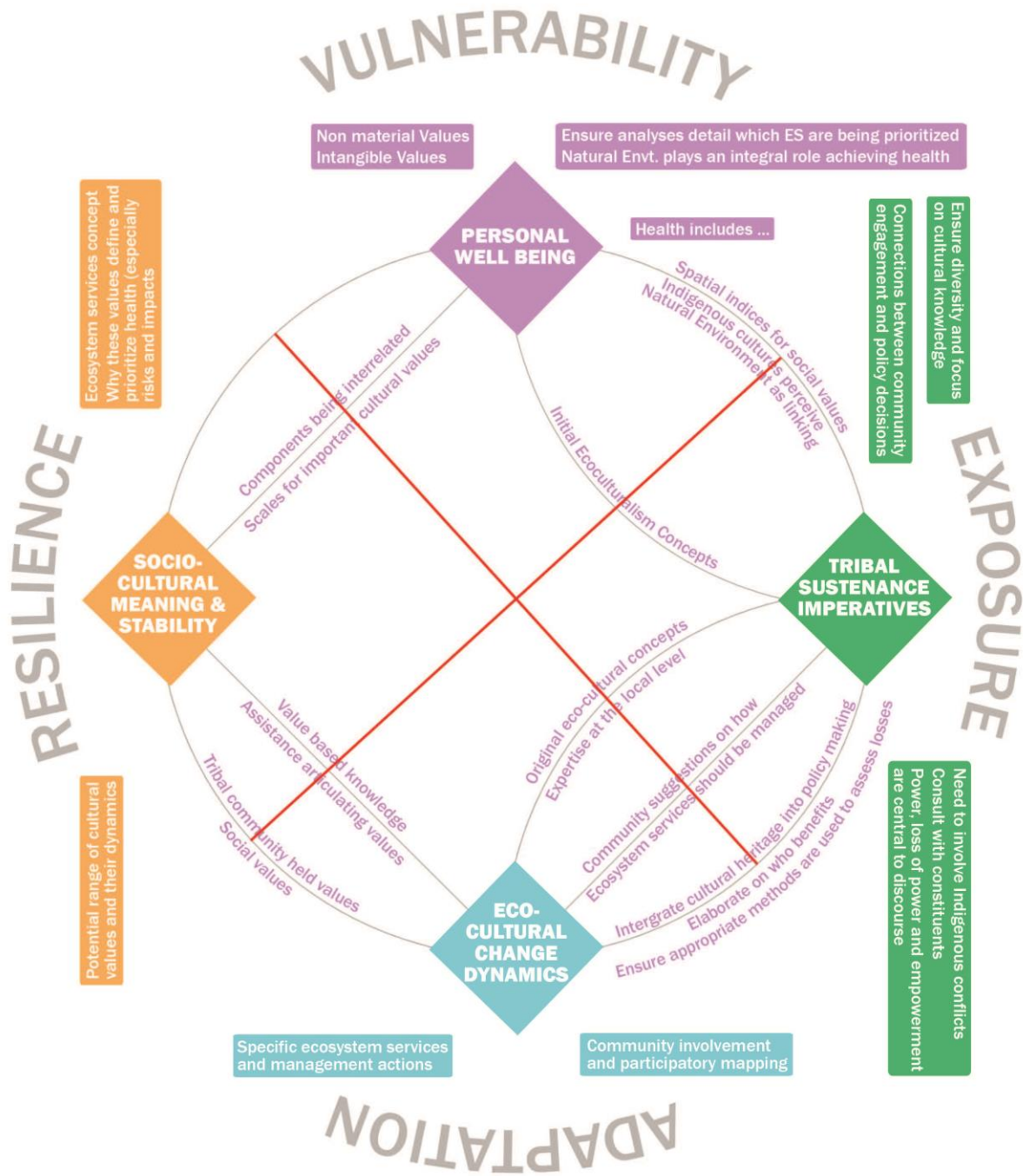


Figure 6. Initial Gap Factors Modified CSD Model - Gap factors substitutes for CSD categories.

PWB and TSI: The current risk assessment gaps important for linking personal well-being and tribal sustenance imperatives would be employing spatial indices for social values, highlighting indigenous cultures perception that the natural environment links well-being parameters, and by adopting initial eco-culturalism principles.

TSI and ECCD: The current risk assessment gaps important for linking tribal sustenance imperatives and eco-cultural change assessments would be integrating cultural heritage and identity into policy-making, elaborating on who benefits, and ensuring appropriate methods are used to assess losses. Other links may be accommodating community suggestions on how ecosystem services should be managed, incorporating expertise at the local level, and embracing original eco-cultural concepts.

4.1.4 CSD MODEL CLOSED-CIRCUIT LOOP

The CSD closed loop is operative whenever the four CSD themes are linked together using shared categories populated by pertinent underlying key concepts. The loop is closed when at least one shared category between each of the recognized CSD theme pairs contains prospective key concept data. Some pairs of CSD themes share more categories than other pairs. All of the CSD Model elements are engaged whenever the CSD loop is activated every time a new proposal is pitched and the potential risks are reviewed by a Tribe – e.g. via preparing to review risks, risk review responses, risk response system interactions.

The CSD loop has analytical qualities that allow the significance of potential CSD theme connectors to be assessed using a key concept inclusion strategy, such as successive analytical passes. The quality of the CSD loop may be strengthened through more key concepts being added to a shared category, and/or more shared categories linking the respective CSD themes.

The CSD loop analysis is able to focus upon the significance of prospective key concepts based upon just one category with one concept linking a pair of CSD themes, and/or as more key

concepts (including other shared categories) are added. Potential examples include using one or more key concepts per theme pair, or using one or more shared categories per theme pair, etc.

The CSD loop was used to determine how gap factor key concepts could contribute to CSD dynamics, while recognizing that characterizing the significance of every gap factor key concept that might link CSD themes (or enable closure of the CSD loop) is feasible, but unnecessary here. As such, a theoretical minimal loop employing just one of the gap factor key concepts from each of the CSD pairs during a first analytical pass could incorporate the following factors: ECCD and SCMS = Embracing tribal community-held values; SCMS and PWB = Devising scales for important cultural values; PWB and TSI = Employing spatial indices for social values; and TSI and ECCD = Accommodating community suggestions on how ecosystem services should be managed. The next successive pass may proceed in either direction, but could add-on the following other factors: ECCD and SCMS = Collecting value-based knowledge; SCMS and PWB = Underscoring that ecological, social, cultural and health system components are all inter-related; PWB and TSI = Highlighting the perception that the natural environment links well-being parameters; and TSI and ECCD = Elaborating on who benefits.

4.1.5 KEY GAPS THWARTING TRIBAL RISK ASSESSMENT OUTCOMES MIGHT BE ADDRESSED VIA CSD MODEL

Address Existing Gaps through Transforming Existing Frameworks and Models -

The CSD model is designed to improve the precision and accuracy of the tribal risk assessment information which is currently being procured using the components and dynamics offered within the frameworks and models that are presently available. The model is also designed to

provide a means for evaluating the qualities, merits, relevance or worth of current risk assessment gaps to serve as new key concepts within the CSD model, from an eco-cultural perspective.

CSD Model Enhances Current Approaches - The CSD model represents a holistic, social-ecological system that is operable at a variety of temporal, spatial and social scales. The model is designed to enhance current approaches through using key concepts whose actual strength or significance may be rated in relation to an idealized eco-cultural center, and/or attaining a balanced endpoint of eco-cultural well-being. The model is designed to be a rotated adaptation of the original Pulse-Press Dynamics social-ecological systems conceptual framework (Collins et al., 2011). The CSD model can also be interpreted as underscoring local community health and resilience targets - e.g. via the Community Sustenance Dynamics Resilience Medicine Wheel – See [Figure 7](#).

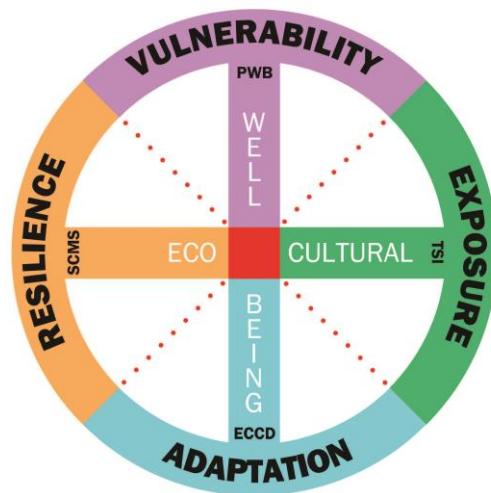


Figure 7. Community Sustenance Dynamics “Resilience Medicine Wheel”. By Jeffrey P. Thomas.

The CSD can also be interpreted as demonstrating that the most optimal core team for conducting tribal risk assessments will consist of tribal environmental, cultural, health, and governance experts - along with other relevant specialty topics support. And finally, the CSD model might also be symbolized using a human well-being cosmological representation. e.g., Central Star, Inter-related Planets and Orbits, Planet-Moon Dynamics.

4.2. CONCLUSIONS

The model offers four main themes divided into twenty-three categories (with underlying key concepts) to organize the high-quality data that is being procured (for assessing risks in terms of CSD). The model is designed to represent a social-ecological system because it inter-relates a biophysical template (eco-cultural change dynamics) that is producing ecosystem services (socio-cultural meaning and stability) with a social template (human well-being) that affects the biophysical template through external forces (tribal sustenance imperatives).

Actively recovering local salmon stocks within the Pacific Northwest includes the need for Tribes and others to continuously review an endless stream of local land use proposals for their potential impacts upon local salmonid fitness factors, and to assess these proposals for the foreseeable risks they might impose upon federally-recognized local tribal communities as well. Given the vast size of the Pacific Northwest, and the immense amount of land use occurring throughout this region, a great number of salmon-related risk assessments occur within any particular river basin every year. The overall bulk of these natural resource risk assessments do little to recognize or accommodate local tribal eco-cultural concerns.

The CSD model was developed, tested, and then used to evaluate the significance of the gaps within the approaches that are currently being used to collect or respond to natural resource values information. Overall findings for this study indicate that the CSD model may be of great use for curtailing the ambivalence, disregard, and/or blockades currently serving to inhibit the identification and/or accommodation of tribal eco-cultural preference concerns. Key conclusions for this study are that these deterring forces can probably be alleviated by upgrading the factors that are being used during risk assessments, and by bolstering efforts to identify eco-cultural preferences during the assessment, collecting and analyzing high quality information, and by fostering the accommodation of eco-cultural preferences as being the outcomes to be realized as the tangible result of the decision-making process.

Upgrading the Factors Being Used in Assessments – The study indicated that enriching the factors being relied upon during present risk assessments could be of great use in reducing the present ambivalence to tribal eco-cultural preferences. Specific targets should include increasing the scope of current risk assessment duties, reinforcing the current gaps within the risk assessment framework, and/or accepting tribal eco-cultural preferences as being the primary natural resource management goals to be accommodated whenever possible.

Collecting and Analyzing High-Quality Information – The study indicated that expanding efforts to identify eco-cultural preferences could be vital for reversing the rampant disregard for tribal eco-cultural preferences. Such expansion efforts need to be focused upon collecting relevant high-quality information, spotlighting environmental change trends, incorporating social values and cultural dimensions, recognizing key dynamic relationships, and/or planning now for future resource conditions.

Accommodating Eco-Cultural Preference Goals – The study indicated that facilitating the accommodation of eco-cultural preferences is critical to neutralizing the blockades that are preventing tribal eco-cultural preferences from being fulfilled. The most relevant targets include promoting the ongoing sustainment of the tribal community, facilitating community empowerment, nurturing equitable resource decision outcomes, upgrading current theoretical frameworks and management systems, pursuing high-quality resource conditions, and – most specifically - to prioritize attaining high-quality local salmon recovery outcomes throughout all relevant risk assessment studies and their resulting decision outcomes.

4.2.1 ENRICH THE FACTORS BEING USED IN RISK ASSESSMENTS TO CURTAIL AMBIVALENCE TO ECPs

4.2.1.1 Risk Assessment Duties

A key conclusion of this study is that risk assessments could be enriched through increasing the scope of what is being encompassed as risk assessment duties, and as such this study produced a new theoretical model that can be used to evaluate the quality of local environmental risk assessment efforts. This new product was tested to demonstrate whether the theoretical model has any practical value and may be used as an instrument for evaluating the quality of local environmental risk assessment approaches.

The CSD model recognizes that every federally-recognized tribe within the Puget Sound is being bombarded by endless streams of natural resource management risk assessments and as such is challenged with being in an endless CSD play mode. The CSD model recognizes that virtually every land use proposal equates to a proposal with potential risks that needs to be assessed by the Tribe. e.g., every proposal that is being furthered or approved through the state Puget Sound

Partnership – and/or state Timber/Fish/Wildlife - processes within the watersheds of the Puget Sound has a potential to impose unwanted risks upon the Tribe.

CSD concepts highlight that the purpose of risk assessments is to accommodate tribal perceptions of proposed management actions as well as ensure that the tribal community is being equitably served through local natural resource decisions. The CSD concepts herald the importance of conducting risk assessments based upon the health requirements of the affected Tribe(s), and to concentrate attention upon relative power and overall empowerment - and especially “who is liable, and who is in charge”.

4.2.1.2 “Current Gap” Factors

Another key conclusion is that risk assessments could be enriched by addressing key gaps within the risk assessment framework. The CSD model was therefore designed to highlight the social-ecological systems significance of the initial risk assessment gap factors, and how current gap factors can be reassessed from a CSD social-ecological systems perspective. The CSD model was also designed to represent a social-ecological systems perspective - and as such the relative significance of the various gap factor key concepts can be hypothesized, as applicable. See Table 6.

Table 6. CSD Theme: Original CSD shared categories with corresponding initial gap factors

<i>CSD THEME(S)</i>	<i>CSD SHARED CATEGORY</i>	<i>INITIAL GAP FACTOR(S)</i>
ECCD and SCMS	Accumulated Knowledge	<i>Value-based knowledge Assistance articulating values</i>
	Common vs. Diverse Needs, Imperatives and Strategies	<i>Social values Tribal community held-values</i>
SCMS and PWB	Cultural Stability vs. Social-Spatial-Temporal Multidimensional Changes	<i>Scales for important cultural values Components being inter-related</i>

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PWB and TSD	Dimensions of Relevance and Use	<i>Spatial indices for social values</i> Indigenous cultures perceive the natural environment as linking
	Knowing How to Respect Use and Manage	<i>Initial “eco-culturalism” concepts</i>
TSD and ECCD	Using and Respecting Natural Resources as Gifts	<i>Specific ecosystem services and management actions</i> Expertise at the local level Original eco-cultural concepts
	What Being Used In What Amounts	<i>Community suggestions on how ecosystem services should be managed</i>
	What Uses Prevail	<i>Integrate cultural heritage and identity into policy-making</i> Elaborate on who benefits <i>Ensure appropriate methods are used to assess losses</i>
ECCD	Responsible Natural Resource Stewardship and Duties	Community involvement and participatory mapping
	What Needs Restoring	Specific ecosystem services and management actions
SCMS	Environmental Relationships and Components	Ecosystem services concept Why these values define and prioritize health, especially health risks and impacts
	Responsible Natural Resource Stewardship and Duties	Potential range of cultural values and their dynamics
PWB	Arrays vs. Specific Service Categories, Standards and Expectations	Non material values Intangible values
	Dependence on Biophysical Conditions and Use	Health includes
	Essential Conditions At-Risk	Ensure analyses detail which ecosystems are being prioritized Natural environment plays an integral role in achieving and maintaining health
TSD	Social-Ecological System Foundations and Expressions	Potential range of cultural values and their dynamics
	What Kind of Uses By Who	Connections between community engagement and policy decisions
	Who Decides What for Who	Need to involve indigenous constituents “consult with constituents” Power, loss of power, and empowerment are central within the discourse Ensure cultural dimension focus upon how cultural knowledge and practices and

		scientific approaches can be communicated and integrated Decision-making that is both ecologically appropriate and socially-just
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The CSD model was used to encompass the current gap factors within a systems context, and this enabled the relationship of the gap factors to the other CSD model elements to be examined. The model allowed for the pertinent qualities of gap factors to be recognized, and enabled the gap factors to be characterized from an eco-cultural perspective. The model also provides a means for the merits of current risk assessment gaps to serve as new key concepts within the CSD model to be usefully evaluated.

4.2.1.3 Eco-Cultural Preferences

An additional key conclusion is that risk assessments may be enriched through accommodating Tribal eco-cultural preferences whenever possible. The CSD concepts are used to underscore that indigenous well-being and stewardship must be recognized and nurtured, and that the eco-cultural preferences of tribal communities need to be identified and accommodated – especially when contrasted with the ambivalence, disregard and blockades that they are routinely subjected to now. The practical conclusion for this entire study is that local tribal eco-cultural preferences are able to be identified and could be accommodated in conjunction with all Puget Sound (and T/F/W) salmon recovery risk assessment decisions.

CSD concepts underscore that the community’s targets for local biophysical processes are usually stymied, and that the cultural preferences of local tribes to produce higher-quality salmon fitness results are rarely realized in full. The CSD model strives to elucidate factors that inhibit community natural resources targets from being attained, and strives to pinpoint specific

mechanisms through which tribal community preferences and eco-cultural well-being needs might be fulfilled.

CSD principles highlight that tribal assessment goals are to: 1) institute innovative ways in which community-based natural resource preferences can be realized as local salmon recovery outcomes, and 2) fulfill the tribal eco-cultural preferences that are specifically focused upon producing high-quality salmonid fitness results.

4.2.2 EXPAND CURRENT EFFORTS TO IDENTIFY ECPS TO REVERSE THE DISREGARD OF TRIBAL ECPS

The CSD model was created to spotlight key aspects of the social-ecological system through which Pacific Northwest Tribes are linked to their local salmon resources. An underlying premise of the CSD model is that spotlighting the salmon-related aspects of tribal social-ecological systems during risk assessments will ultimately depend upon the type and quality of the information that is available for identifying and accommodating whatever it is that tribal communities and their individuals prefer. A main conclusion for this study is that expanding the breadth and depth of present efforts to identify eco-cultural preferences will prove to be what is most vital for overcoming the disregard (or convenient oblivion) pertaining to eco-cultural preferences that tribal communities have always had to endure.

4.2.2.1 Information Collection

Efforts to identify tribal eco-cultural preferences should be expanded by improving the quality of the information that is being collected for risk assessment analysis. The main topics to focus upon are ecological changes and variability, social values, cultural dimensions, key dynamic relationships, and planning for future environmental conditions. The CSD model provides a

catalogue of themes, categories and key concepts to use for pinpointing the specific types of information that could be included as data whenever conducting tribal natural resource risk assessment work.

The CSD themes, categories and key concepts may be used to organize and evaluate natural resource values data collected during risk assessment work. The model is designed to place a high premium upon the quality of the information that is being used for risk decisions, and promotes using the most accurate and precise information that is available when analyzing data using CSD elements. The approach focuses upon collecting and analyzing natural resource values information using community and culturally-relevant approaches.

4.2.2.2 Ecological Variability

Identifying eco-cultural preferences virtually centers upon the prospect that ecological conditions can change (for better or worse) and that these changes can affect tribal culture (for better or worse). As such, CSD principles promote using accurate, precise data regarding the variability – and the relative changes - in local natural resource conditions, during CSD analysis. The CSD model uses a specific theme (ECCD) and various CSD categories to spotlight environmental change effects, and the framework spotlights the risks and impacts of locally-specific environmental change concerns as being a high-priority for tribal risk assessments as well.

4.2.2.3 Social Values and Cultural Dimension

Identification of tribal eco-cultural preferences is greatly expanded when social values and cultural dimensions are incorporated into tribal risk assessment work. The CSD framework promotes collecting and analyzing pertinent social values and cultural dimensions information by using relevant themes, basic categories, specific key concepts - and even potential indicator

metrics (See Appendices). The model spotlights the need for procuring tribal social values data – while focusing upon natural resource values, intangible values, and the attributes of socially-relevant biophysical features, in particular.

CSD principles highlight cultural dimensions as being the primary focus of tribal natural resource risk assessment work. Key conclusions for this study are that risk assessments should recognize the potential ranges or scales associated with cultural dimensions, and that tribal assessment goals should always include identifying both tribal cultural values and tribal well-being indicators. The CSD model highlights that ecosystem services have a cultural dimension and that healthy ecosystems reinforce cultural stability.

CSD analyses focus upon the impacts of changing ecological-cultural relationships, and integrating cultural dimensions into natural resource recovery. Testing indicated that CSD concepts will be useful for evaluating the quality of multi-scalar cultural resources protection and management programs, such as those being furthered or approved through the Puget Sound Partnership - or the state Timber/Fish/Wildlife - salmon recovery processes.

4.2.2.4 Dynamic Relationships

Identifying eco-cultural preferences is also enriched through highlighting key dynamic relationships. The CSD model is designed to underscore basic relationships existing between the various factors represented by the underlying data. The CSD model is structured to focus attention upon the fundamental relationships that link indigenous well-being, psychological impacts, natural resource risks, community empowerment, and tribal stewardship principles altogether in a systems fashion.

The model highlights dynamic relationships within all of the main themes and most of the

CSD categories. The model highlights that the category of Cultural Stability vs. Multi-Dimensional Temporal, Spatial and/or Social Change may be the most critical link connecting the CSD theme of Socio-Cultural Meaning and Stability to that of Personal Well-Being.

4.2.2.5 Future Conditions

Identifying tribal eco-cultural preferences during risk assessment is also enhanced by projecting and planning for future natural resource conditions. The CSD model promotes decisions being made now regarding future resource conditions by including this prospect as one of the specific CSD key concepts.

4.2.3 NURTURE EFFORTS TO ACCOMMODATE ECPs – NEUTRALIZES BLOCKADES TO TRIBAL ECPs

The CSD model is designed to offer themes, categories and key concepts that can be used to represent the components and dynamics of the local social-ecological system that has always connected the relative fitness of local salmon stocks to the relative well-being of the members and communities of the Puget Sound tribes. The CSD model operates on the premise that tribal eco-cultural preferences can be identified and accommodated, including the preferences that are specific to local salmon recovery.

The operational conclusion for this study is that tribal eco-cultural preferences for salmon could be accommodated through focusing upon six main ECP accommodation goals. These goals are to: foster sustaining the community, actively empower the community, nurture decision outcomes, upgrade current management systems, pursue high-quality resource conditions, and prioritize high-quality local salmon fitness results. Each of these goals could apply to most other Pacific Northwest tribal natural resource risk assessment work as well. Risk

assessments being completed using CSD analysis should strive to fulfill these goals as each of them could serve to neutralize blockades within the system that are inhibiting the realization of tribal ECPs.

4.2.3.1 Community Sustenance

Tribal ECPs may be accommodated by actively promoting sustainment of the tribal community and recognizing the key factors that are needed to sustain the well-being and eco-cultural needs of local tribes. CSD principles advise that intangible values should be incorporated into risk assessment decision-making, and that local resource users need to be linked to natural resource protection and restoration decisions as well. The CSD framework commemorates sustenance as being both a theme topic as well as the central focus of the Community Sustenance Dynamics Model, where ecological conditions (eco-cultural changes) and individual health (personal well-being) factors are recognized as being the vehicles through which governance (sustenance decisions) is linked to ecosystem services (cultural dimension).

4.2.3.2 Community Empowerment

Tribal ECPs may be accommodated by actively empowering the community. CSD precepts stipulate that environmental change assessments should be fair and equitable, and that communities should be involved in natural resource decisions. CSD precepts caution workers to be certain that risk assessments include issues relating to risk, power, and empowerment (and who is in charge, and who is liable) when working on environmental issues within a tribal community.

4.2.3.3 Decision Outcomes

Tribal ECPs may be accommodated by nurturing equitable natural resource decisions. The CSD model is structured to highlight the social-ecological system connections that link the outcomes of natural resource decisions to the overall quality of tribal eco-cultural well-being. The CSD framework promotes the precepts that local risk assessments have to address prevailing decision-making regimes, and that those benefiting the most from natural local resources need to nurture decisions that are equitable for those others that hope to benefit from accessing those same resources in a high-quality condition too. CSD analysis promotes the need for reconciling “what uses prevail” with needed local environmental change responses.

4.2.3.4 Current System Upgrades

Tribal ECPs may be accommodated by upgrading current theoretical frameworks and management systems. Study findings indicate that tribal natural resource risk assessments should be conducted by a tribal core team composed of tribal environmental (ECCD), cultural (SCMS), health (PWB), and governance (TSI) experts - along with other needed CSD specialty topics support.

The CSD model and visual representation - and CSD themes, categories and key concepts in particular - was designed to highlight gaps within the current system that might be filled through adopting and using additional CSD analytical tools and approaches.

4.2.3.5 High-Quality Resource Conditions

Tribal ECPs may be accommodated by pursuing high-quality natural resource conditions. CSD model precepts herald the need for pursuing and maintaining high-quality natural resource conditions, along with access to them.

4.2.3.6 Local Salmon Recovery

Tribal ECPs may be accommodated through ensuring high-quality local salmon fitness results are obtained as the outcomes of all natural resource risk assessment work. Puget Sound tribal communities value their local salmon resources with the highest esteem, but the tribal communities' preferences for local salmon recovery - and salmon habitat conditions in particular – are usually downplayed during local salmon resource management decision-making. The CSD framework is designed to overcome these inhibiting factors through pinpointing local salmon recovery risk assessment targets and outcomes as being the attribute of the management system that could be most critical for fulfilling tribal eco-cultural preference needs and objectives.

The CSD model provides specific themes, categories, and key concepts to use for evaluating the local tribal cultural resource protection and management programs of the regional Puget Sound Partnership - and/or state Timber/Fish/Wildlife – salmon recovery process. The CSD framework pinpoints the components and dynamics of the local tribal-salmonid social-ecological system that may be most critical to incorporate into the salmon recovery strategies that are currently being advanced within every local salmon recovery area.

4.3 RECOMMENDATIONS

4.3.1 USE CSD CATEGORIES and RESILIENCE ELEMENTS TO ADDRESS COMMUNITY-BASED RESILIENCE CONCERNS

Use CSD themes, categories, and key to highlight the relational aspects of underlying data, CSD operations to highlight the functional aspects of data, and use the CSD model resilience elements to address resilience-vulnerability-exposure-adaptation (R-V-E-A) concerns. One basic assumption of the CSD model is that fulfilling tribal sustenance needs is the cumulative result of how resilient (R) the tribal social and cultural dimensions are, how vulnerable (V) the tribal community members are, how exposed (E) the tribal community sustenance parameters are, and/or how sufficient the adaptive (A) responses to eco-cultural changes really are (in terms of fostering the resilience that is needed for sustaining the social and cultural dimensions of any particular tribal community).

4.3.1.1 Use the SCMS Categories to Increase Resilience (to Local Environmental Change)

Use the categories and operations of the CSD Socio-Cultural Meaning and Stability realm to increase the resilience of the tribal social and cultural dimensions. SCMS resilience to local environmental change may be fortified through highlighting the relational and functional aspects of the SCMS data.

SCMS Categories – SCMS categories highlight relational aspects of the underlying key concepts data. Specific relationships within the SCMS realm to use to fortify community resilience to local environmental change could include: 1) compiling relevant accumulated knowledge, 2) characterizing the social meaning and relevance of the biophysical environment, 3) balancing common with unique socio-cultural needs and imperatives, and 4) evaluating multidimensional social-spatial-temporal change.

SCMS Operations – SCMS operations highlight functional aspects of the underlying data.

Specific functions within the SCMS realm that may be critical to fortifying the communities' resilience to local environmental change could include: a) Collecting and analyzing of socio-cultural qualitative data; b) Highlighting socially-relevant biophysical features; c) Articulating the range of fashions in which healthy ecological systems reinforce cultural meaning; and d) Spotlighting the factors linking multidimensional change effects to cultural stability.

4.3.1.2 Use the PWB Realm to Reduce Vulnerability (to Local Environmental Change)

Use the categories and operations of the CSD Personal Well-Being realm to daunt the vulnerability of persons at the individual level to local environmental change. PWB vulnerability to local environmental change may be daunted through highlighting the relational and functional aspects of PWB data.

PWB Categories – PWB categories highlight relational aspects of the underlying key concepts data. Specific relationships within the PWB realm to use to daunt personal-level vulnerability to local environmental change includes: 1) assessing multidimensional social-spatial-temporal change; and 2) embracing personal (along with tribal) health dimensions of natural resource relevance and use – and, knowing how to respect-use-manage ecological systems in a spiritually-relevant manner.

PWB Operations – PWB operations highlight functional aspects of the underlying data.

Specific functions within the PWB realm that may be critical to daunting personal-level vulnerability to local environmental change could include: a) Focusing on local

multidimensional change factors being archetypically linked to other key factors involved with reinforcing personal Well-Being; b) Establishing platforms for linking dimensions of relevance and use to personal Well-Being; and c) Underscoring ways that knowing how to respect, use and manage ecological systems is linked to personal well-being.

4.3.1.3 Use the TSI Realm to Circumvent Exposure (to Local Environmental Change)

Use the categories and operations of the CSD Tribal Sustenance Imperatives realm - see following section for CSD realm definition - to circumvent the exposure of tribal community sustenance parameters to local environmental change. TSI exposure to local environmental change can be circumvented through highlighting the relational and functional aspects of TSI data.

TSI Categories – TSI categories highlight relational aspects of the underlying key concepts data. Specific relationships within the TSI realm to use to circumvent exposure of community sustenance parameters to local environmental change includes: 1) embracing personal along with tribal health dimensions of natural resource relevance and use – and, knowing how to respect-use-manage ecological systems in a spiritually-relevant manner; and 2) embracing using and respecting natural resources as honored gifts, and being certain regarding what is being used in what amounts - and/or agreeing as to which natural resource/ecological system uses really do prevail (and who is benefiting by how much).

TSI Operations – TSI operations highlight functional aspects of the underlying data. Specific functions within the TSI realm that may be critical to circumventing community sustenance parameters exposure to local environmental change could include: a) Underscoring specific dimensions of relevance and use that are linked to and reinforce local tribal sustenance

imperatives; b) Focusing upon integrated, community-oriented means of honoring and reinforcing tribal sustenance imperatives; c) Elucidating links between using and respecting natural resource gifts and tribal sustenance imperatives; and d) embracing the cultural significance of what is being used in what amounts as being a tribal sustenance imperative.

4.3.1.4 Use the ECCD Realm to Improve Adaptation (to Local Environmental Change)

Use the categories and operations of the CSD Eco-Cultural Change Dynamics realm to improve the tribal communities' adaptability to local environmental changes. Community adaptation to local environmental change may be improved through highlighting the relational and functional aspects of ECCD data.

ECCD Categories – ECCD categories highlight relational aspects of the underlying key concepts data. Specific relationships within the ECCD realm to reinforce to improve the tribal communities' adaptability to local environmental change includes: 1) embracing using and respecting natural resources as honored gifts, and being certain regarding what is being used in what amounts, and/or agreeing as to which natural resource/ecological system uses actually prevail (and who is benefiting by how much); and 2) fostering the compilation of accumulated knowledge, characterizing the social meaning and relevance of the biophysical environment – and/or balancing common with unique socio-cultural needs and imperatives.

ECCD Operations – ECCD operations highlight functional aspects of the underlying data. Specific functions within the ECCD realm that may be critical to improving the tribal communities' adaptability to local environmental change could include: a) Assessing eco-cultural change dynamics; b) Pinpointing where eco-cultural change dynamics are specifically

important; c) Linking fairness and equity to eco-cultural change dynamics; d) Underscoring key factors to link use and respect for natural resource gifts to ecological protection and restoration decisions; e) Focusing on using cultural as well as scientific indicators to examine what is being used in what amounts; and f) Focusing upon stakeholder support approaches to use when relating what uses prevail to local eco-cultural change dynamics.

4.3.2 USE CSD REALMS AND QUADRANTS TO ADDRESS TRIBAL COMMUNITY ECO-CULTURAL RISK CONCERNS

CSD Realms and Quadrants – Community Sustenance Dynamics (CSD) themes, categories and/or key concepts can be organized according to whether they are within a CSD Realm or a CSD Quadrant. CSD Realms are composed of “theme-unique” categories (where the key categories are unique to a particular CSD theme) - while CSD Quadrants consist of the “theme-shared” categories (where the key categories are shared between the CSD themes). A CSD realm involves only one CSD theme, whereas a CSD quadrant involves a pair of CSD themes.

4.3.2.1 CSD “Realms” – Neutralize Ambivalence, Disregard and Blockades Using “Theme-Unique” Categories

Use the “theme-unique” categories of a specific CSD realm to neutralize the adverse factors that are underlying mainstream ambivalence, disregard, and/or blockades (A-D-B) to tribal eco-cultural preferences (ECPs). Actively convert these A-D-B factors into CSD “neutralization goals” and then employ the key concepts of the CSD themes to eradicate these factors as being among the inhibitors that are obstructing the identification and/or accommodation of local tribal ECPs.

4.3.2.1(A) Neutralize Ambivalence - via Realm Based “Theme-Unique” Categories

Recognize the factors contributing to mainstream ambivalence of tribal ECPs as equating to a tangible CSD “neutralization goal” – for which the key concepts data within each of the “theme-unique” categories’ can be used to neutralize the particular ambivalence factor which has been thwarting the actualization of local tribal ECPs.

The ambivalence “neutralization goals” which were targeted for this project – and corresponding “theme-unique” CSD categories (including their underlying key concepts) that were selected to neutralize them - are as follows: **Spotlight irreplaceable attributes of natural resources** - Environmental relationships and components; Dependence on biophysical conditions and use; Essential conditions at-risk. **Highlight community preferences and eco-cultural well-being** - Dependence on biophysical conditions and use. **Foster adaptive co-management with a resilient tribal community** - Responsible natural resources stewardship and duties; Who decides what for whom. **Promote community being equitably served via decisions** - Arrays vs. specific service categories, standards and expectations; What kinds of uses by whom; Who decides what for who. **Identify array of aspects involved with sustenance needs** - All CSD categories.

Use the key concepts data within each of these “theme-unique” categories to fulfill each of these listed ambivalence factor neutralization actions.

4.3.2.1(B) Neutralize Disregard - via Realm Based “Theme-Unique” Categories

Recognize the factors contributing to mainstream disregard of tribal ECPs as equating to a tangible CSD “neutralization goal” – for which the key concepts data underlying each of the

“theme-unique” categories’ can be used to neutralize the specific disregard factor that has been preventing the actualization of tribal community ECPs.

The disregard “neutralization goals” which were targeted for this project – and corresponding “theme-unique” CSD categories (including their underlying key concepts) that were selected to neutralize them - are as follows: **Promote examination of temporal and spatial variability trends** - Temporal vs. spatial vs. social scales and distinctions; Environmental relationships and components; Essential conditions at-risk; What available for use. **Centralize high-quality resource condition strategies** - Responsible natural resources stewardship and duties; What needs restoring; Dependence on biophysical conditions and use; Essential conditions at-risk; What kinds of uses by whom; What available for use. **Bolster strategies to eliminate factors blocking ECPs** - All CSD Categories.

Use the key concepts data within each of these “theme-unique” categories to fulfill each of these listed disregard factor neutralization actions.

4.3.2.1(C) Neutralize Blockades - via Realm Based “Theme-Unique” Categories

Recognize the factors contributing to mainstream blockades of tribal ECPs as equating to a tangible CSD “neutralization goal” – for which the key concepts data underlying each of the “theme-unique” categories’ can be used to neutralize the specific blockade factor that has been preventing the actualization of tribal community ECPs.

The blockade “neutralization goals” which were targeted for this project – and corresponding “theme-unique” CSD categories (including their underlying key concepts) that were selected to neutralize them - are as follows: **Foster tribal decision preference support**

mechanisms - Responsible natural resources stewardship and duties; Who decides what amount of protecting or restoring; What kinds of uses by whom; What available for use; Who decides what for who. **Institute meaningful collaboration with tribal community** - Who decides what amount of protecting/restoring; Dependence on biophysical conditions and use; Who decides what for whom. **Produce platform ensuring tribal ECPs are identified and accommodated** - Most CSD categories. **Establish higher-quality salmonid recovery results platform** - Most CSD categories.

Use the key concepts data within each of these “theme-unique” categories to fulfill each of these listed blockade factor neutralization actions.

4.3.2.2 CSD “Quadrants” – Neutralize the Ambivalence, Disregard and Blockades Using “Theme-Shared” Categories

Use the “theme-shared” categories of a specific CSD realm to neutralize the adverse factors that are underlying mainstream ambivalence, disregard, and/or blockades (A-D-B) to tribal eco-cultural preferences (ECPs). Actively convert these A-D-B factors into CSD “neutralization goals” and then employ the key concepts of the CSD themes to eradicate these factors as being among the inhibitors that are obstructing the identification and/or accommodation of local tribal ECPs.

4.3.2.2(A) Neutralize Ambivalence - via Quadrant Based “Theme-Shared” Categories

Recognize the factors contributing to mainstream ambivalence of tribal ECPs as equating to a tangible CSD obliteration goal – for which the key concepts data underlying each of the “theme-

shared” categories’ might be used to neutralize the ambivalence factor that is obstructing local tribal ECPs.

The ambivalence neutralization goals which were targeted for this project – and corresponding “theme-shared” CSD categories selected to neutralize them - are as follows:

Highlight community preferences and eco-cultural well-being - Dimensions of relevance and use. **Foster adaptive co-management with resilient tribal community** - Cultural stability vs. social-spatial-temporal multidimensional change. **Promote community being equitably served via decisions** - Common vs. diverse needs and imperatives; What uses prevail. **Spotlight irreplaceable attributes of natural resources** - All CSD categories. **Identify array of aspects involved with sustenance needs** - All CSD categories.

Use the key concepts data within each of these “theme-shared” categories to fulfill each of these listed ambivalence factor neutralization actions.

4.3.2.2(B) Neutralize Disregard - via Quadrant Based “Theme-Shared” Categories

Recognize the factors contributing to mainstream disregard of tribal ECPs as equating to a tangible CSD obliteration goal – for which the key concepts data underlying each of the “theme-shared” categories’ might be used to neutralize the disregard factor that is obstructing local tribal ECPs.

The disregard neutralization goals which were targeted for this project – and corresponding “theme-shared” CSD categories selected to neutralize them - are as follows:

Centralize high-quality resource condition strategies - Social meaning and relevance of the biophysical environment. Using and respecting natural resource gifts. **Promote examination of**

temporal and spatial variability trends - All CSD categories. **Bolster strategies to eliminate factors blocking ECPs** - All CSD categories.

Use the key concepts data within each of these “theme-shared” categories to fulfill each of these listed disregard factor neutralization actions.

4.3.2.2(C) Neutralize Blockades - Via Quadrant Based “Theme-Shared” Categories

Recognize the factors contributing to mainstream blockades of tribal ECPs as equating to a tangible CSD neutralization goal – for which the key concepts data underlying each of the “theme-shared” categories’ might be used to neutralize the blockades factor that is obstructing local tribal ECPs.

The blockades neutralization goals which were targeted for this project – and corresponding “theme-shared” CSD categories selected to neutralize them - are as follows:

Foster tribal decision preference support mechanisms - Knowing how to respect, use and manage. **Institute meaningful collaboration with tribal community** - Accumulated knowledge. Common vs. diverse needs and imperatives. Knowing how to respect, use and manage. **Produce platform ensuring tribal ECPs identified and accommodated** - Most CSD categories. **Establish higher-quality salmonid recovery results platform** - Most CSD categories.

Use the key concepts data within each of these “theme-shared” categories to fulfill each of these listed blockade factor neutralization actions.

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APPENDIX A: THEMATIC ANALYSIS OF INITIAL TEXT AND MODEL QUALITATIVE DATA

A.1 Final Theme: Eco-Cultural Change Dynamics

The Eco-cultural Change Dynamics theme evolved through an inductive clumping of the categories developed from the initial set of in vivo data, and as such the theme is firmly grounded within the original, qualitative, scientific journal text data. The Eco-cultural Change Dynamics theme underscores that socio-cultural attributes of the biophysical template are key elements of coupled human and natural systems relationships, and spotlights in vivo data and/or aspects of the code categories pertaining to locally-coupled ecological and cultural changes in particular. Eco-cultural change dynamics is a general theme that can be used to underscore that each of the key concepts could be integrated into locally-relevant natural resource recovery (e.g. salmon habitat) approaches and decisions.

A.1.1 ECO-CULTURAL CHANGE DYNAMICS – CODE CATEGORIES (Shared and Unshared)

The Eco-cultural Change Dynamics theme was created to gather all of the categories involving in vivo data relating to eco-cultural change dynamics together so that their interrelated significance can be recognized and better accommodated as a part of local natural resource management work.

The eco-cultural change dynamics concept spotlights meaningful relationships between the ecological and culturally-significant elements of a local resource area and particular aspects that need considering when examining their mutual change. Eco-cultural change dynamics is used to highlight aspects of local ecological-cultural systems relationships that may need

including whenever the impacts of changes between local ecological and cultural systems relationships are being addressed. Eco-cultural change dynamics highlights changes to ecological systems operating on social (as well as spatial and temporal) scales.

This theme highlights that ecological and cultural systems relationships could be construed as being associations between key aspects of how accumulated knowledge is conveyed, how the social meaning and relevance of the biophysical environment is perceived, how using paradigms which foster using and natural resources as being gifts are used, knowing what is being used in what amounts, knowing what uses prevail, fulfilling common versus diverse needs and imperatives, committing to all natural resource stewardship duties, accepting who decides what amount of resource protection or restoration occur, and/or agreeing with who is actually responsible for ensuring what is being restored. Figure 1.

A.1.1.1 Code Categories Shared With Other Themes – The Eco-cultural Change Dynamics theme collects in vivo data under certain categories that other in vivo data from either the Socio-cultural Meaning and Stability or the Tribal Sustenance themes, were assigned to as well.

The specific categories of data codes the Eco-cultural Change Dynamics theme shares with the Socio-cultural Change Dynamics theme are:

- Accumulated knowledge,
- Social meaning and relevance of the biophysical environment, and
- Common vs. diverse needs and imperatives.

The specific categories of data codes the Eco-cultural Change Dynamics theme shares with the Tribal Sustenance Imperatives theme are:

- Using and respecting natural resource gifts,
- What is being used in what amounts, and

- What uses prevail.

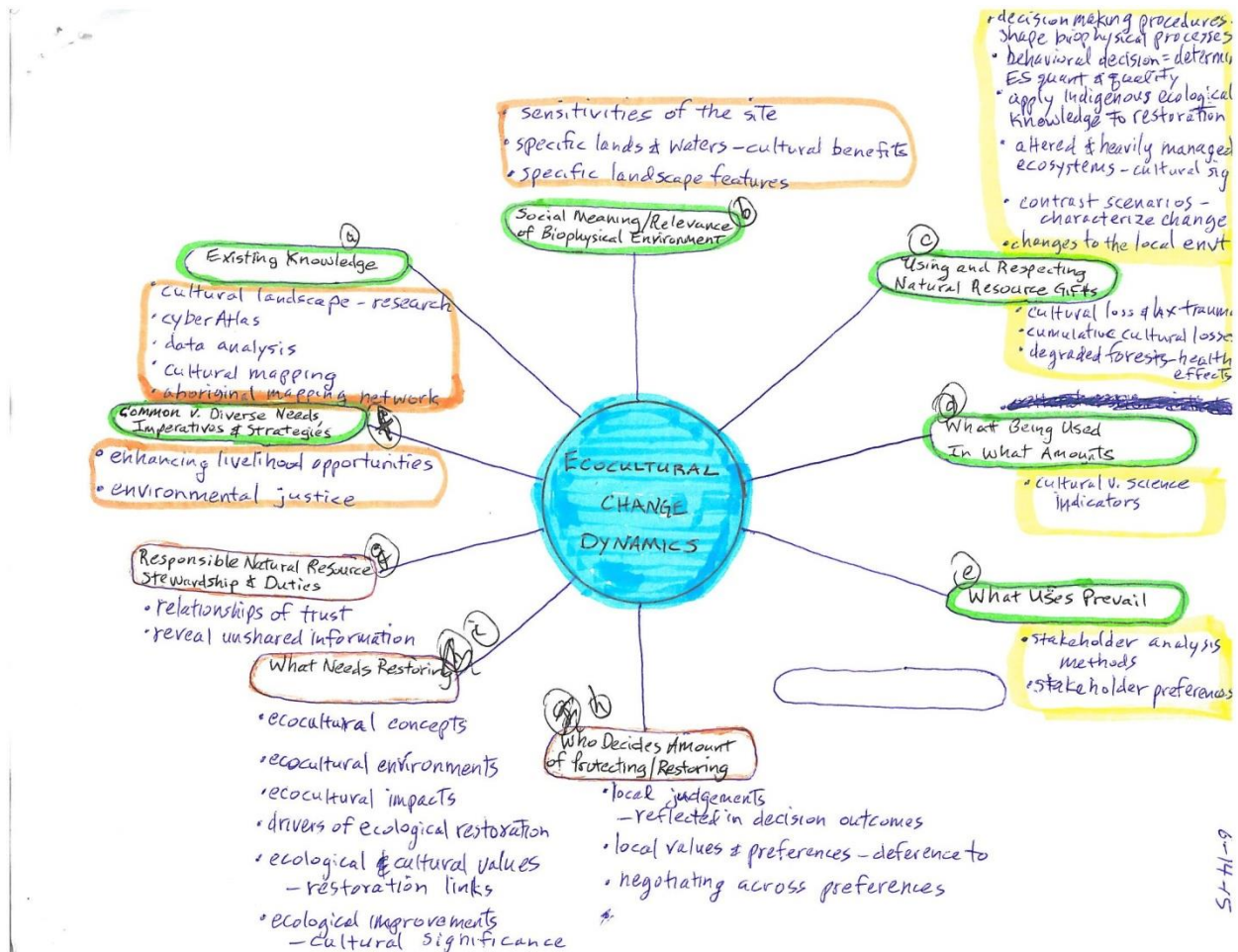


Figure A1. Eco-cultural Change Dynamics Theme – Thematic Map

A.1.1.2 Thematic Categories Not Shared With Other Themes – The specific categories of data codes the Eco-cultural Change Dynamics theme does not share with any of the other main themes are:

- Responsible natural resources stewardship and duties,
- Who decides what amount of protecting/restoring, and
- What needs restoring.

A.1.2 ECO-CULTURAL CHANGE DYNAMICS – ASSOCIATED “IN VIVO” DATA (per Category)

A.1.2.1 Accumulated Knowledge – This category is used to highlight that cyber-Atlas technologies, aboriginal mapping networks, cultural mapping, and cultural landscape research are each important when addressing issues involving local eco-cultural change dynamics.

A.1.2.2 Social Meaning and Relevance of the Biophysical Environment – This category is used to highlight that specific landscape features, the cultural benefits of specific land and waters, and the sensitivities of local sites are all pertinent concepts that should be recognized when addressing local eco-cultural change dynamics.

A.1.2.3 Using and Respecting Natural Resources As Gifts – This category highlights that changes to the local environment, characterizing change using contrast scenarios, addressing the cultural significance of altered or heavily managed ecosystems, decision-making procedures being what shapes biophysical processes, behavioral decisions determining ecosystem services quantity and quality, and applying indigenous ecological knowledge to restoration are each key concerns when addressing local eco-cultural change dynamics.

A.1.2.4 What Is Being Used In What Amounts – This category is used to spotlight the use of complementary cultural and scientific indicators measurements and their overall relevance when addressing local eco-cultural change dynamics.

A.1.2.5 What Uses Prevail – This category highlights stakeholder preferences and stakeholder analysis methods as needing to be accommodated when addressing local eco-cultural change dynamics.

A.1.2.6 Common vs. Diverse Needs and Imperatives – This category focuses on enhancing livelihood opportunities and environmental justice as being key outcomes of addressing local eco-cultural change dynamics.

A.1.2.7 Responsible Natural Resource Stewardship and Duties – This category underscores relationships of trust and revealing unshared information as being significant concepts to accommodate when addressing eco-cultural change dynamics concerns.

A.1.2.8 Who Decides Amount of Protecting/Restoring – This category focuses attention upon the negotiating across preferences, deferring to local values and preferences, and assuring that local judgments are actually reflected in decision outcomes, as needing to be included them when addressing eco-cultural change dynamics concerns.

A.1.2.9 What Needs Restoring – This category focuses upon eco-cultural environments, eco-cultural impacts, ecological and cultural values being linked to restoration, the drivers of ecological restoration, the cultural significance of ecological improvements, and eco-cultural concepts as all being critical components of addressing eco-cultural change dynamics concerns.

Table A1. Eco-cultural Change Dynamics Theme - New theme categories including relevant in vivo data (AKA “key concepts”).

Accumulated Knowledge

- Cyber-Atlas
- Aboriginal mapping network
- Cultural mapping
- Cultural landscape research
- Data analysis
- *Uncertainty of facts*

Social Meaning/Relevance of Biophysical Environment

- Specific landscape features
- Specific lands and waters – cultural benefits
- Sensitivities of site
- *re-envision ecosystem services*
-

Using and Respecting Natural Resources as Gifts

- Changes to the local environment
- Contrast scenarios – characterize change
- Altered and heavily managed ecosystems – cultural significance

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- Decision-making procedures shape biophysical processes
- Behavioral decisions determine ecosystem services quantity and quality
- Apply indigenous ecological knowledge to restoration
- *ongoing degradation of the environment*
- *knowledge as adaptive management*
- *successful adaptive co-management*

What Being Used in What Amounts

- Cultural vs. Science Indicators

What Uses Prevail

- Stakeholder preferences
- Stakeholder analysis methods

Common vs. Diverse Needs, Imperatives and Strategies

- Environmental justice

- Enhancing livelihood opportunities

Responsible Natural Resource Stewardship and Duties

- Relationships of trust
- Reveal unshared information

Who Decides Amount of Protecting/Restoring

- Negotiating across preferences
- Local values and preferences – deference to
- Local judgments – reflected in decision outcomes

What Needs Restoring

- Eco-cultural environments
- Eco-cultural impacts
- Ecological and cultural values – restoration links
- Drivers of ecological restoration
- Ecological improvements – cultural significance
- Eco-cultural concept

A.2 Final Theme: Socio-cultural Meaning and Stability

The Socio-cultural Meaning and Stability theme evolved through an inductive clumping of the categories developed from initial set of in vivo data and as such the theme is firmly grounded within the original, qualitative, scientific journal text data. The Socio-cultural Meaning and Stability theme offers a way to spotlight the key services a local biophysical template delivers to the social and cultural dimensions of a local tribal community, and for the integrated relationships occurring between the factors and/or categories serving as the basis of the Socio-cultural meaning and stability concept to be underscored as well. Socio-cultural meaning and stability is a general theme that can be used to underscore that each of the key concepts could be integrated into locally-relevant natural resource recovery (e.g. salmon habitat) assessment approaches and decisions.

A.2.1 SOCIO-CULTURAL MEANING AND STABILITY – THEME CATEGORIES (*Shared and Unshared*)

The Socio-cultural Meaning and Stability theme was created to gather all of the categories

involving key concepts relating to Socio-cultural meaning and stability together so that their interrelated significance can be recognized and better accommodated as a part of local natural resource management work. The Socio-cultural meaning and stability concept highlights that natural resource services do fulfill many vital Socio-cultural meaning and stability roles from a local community and/or cultural perspective.

This theme highlights that natural resource service assessments could consist of a mix of key concepts related to: how accumulated knowledge is collected or refined, the means by which social meaning and relevance of the biophysical environment is conveyed, versatile means of fulfilling common and diverse needs together, balancing cultural stability with continuing social-spatial-temporal multidimensional change, community Well-Being-based social-ecological foundations and expressions, systemically-based social/spatial/temporal scales and distinctions, cultural embodiments and expressions of local natural resource meanings, and local community, culturally-specific environmental relationships and components. Figure 2.

A.2.1.1 Code Categories Shared With Other Themes – The Socio-cultural Meaning and Stability theme collects in vivo data under certain categories that other in vivo data from either the Eco-cultural Change Dynamics or the Personal Well-Being themes were assigned to, as well.

The specific categories of data codes the Socio-cultural Meaning and Stability theme shares with the Eco-cultural Change dynamics theme are:

- Accumulated knowledge,
- Social meaning and relevance of the biophysical environment, and
- Common vs. diverse needs and imperatives.

The specific category of data codes that the Socio-cultural Meaning and Stability theme

shares with the Personal Well-Being theme is:

- Cultural stability vs. social-spatial-temporal multidimensional change.

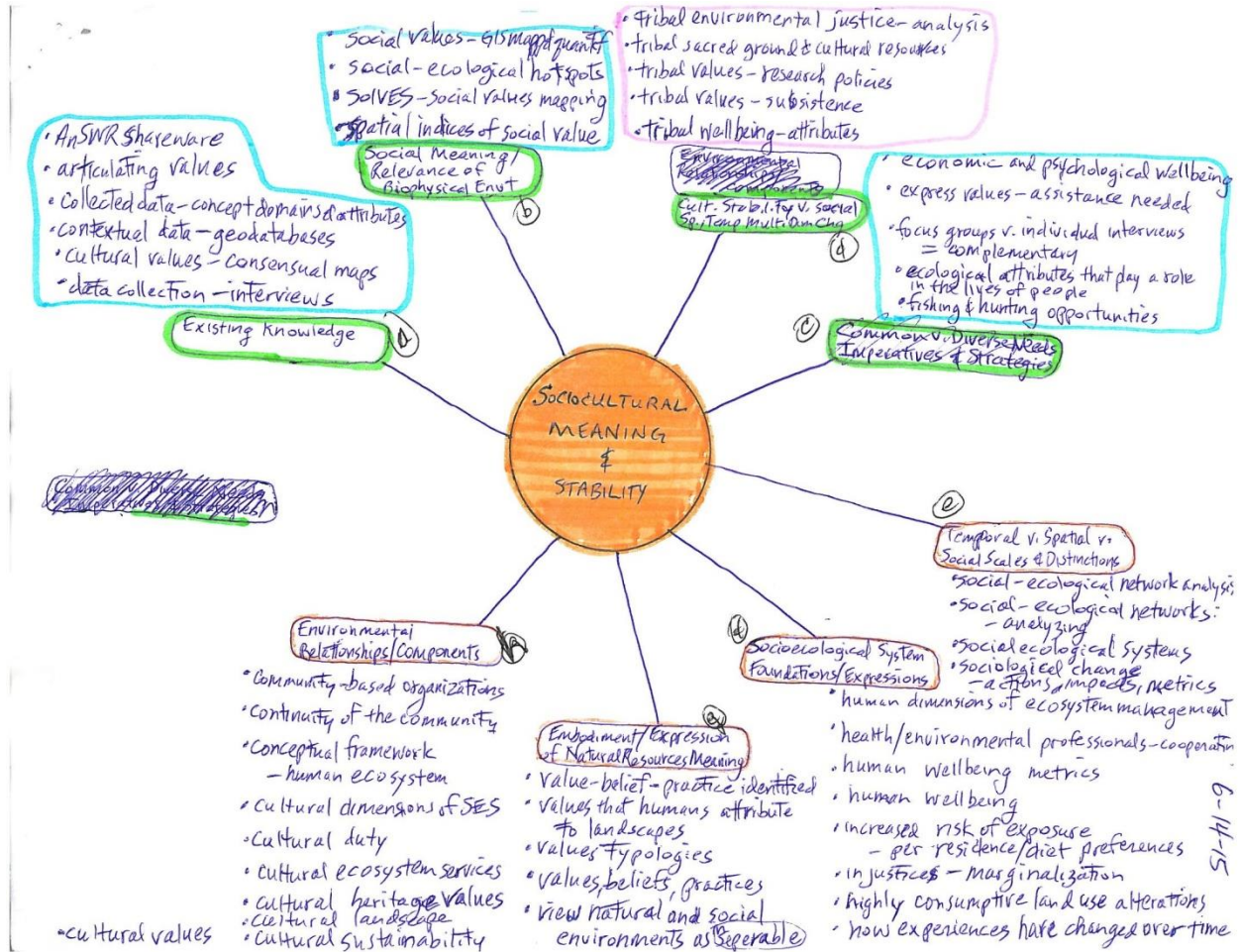


Figure A2. Socio-cultural Meaning and Stability Theme – Thematic Map

A.2.1.2 Thematic Categories Not Shared With Other Themes - The specific categories of data

codes the Socio-cultural Meaning and Stability theme does not share with any of the other main

themes are:

- Socio-ecological foundations and expressions,
- Temporal vs. spatial vs. social scales and distinctions,
- Embodiment and expression of natural resources meaning, and
- Environmental relationships and components.

A.2.2 SOCIO-CULTURAL MEANING AND STABILITY – KEY CONCEPTS EXCERPTED FROM THE DATA

A.2.3.1 Accumulated Knowledge – This category focuses attention upon geodatabase contextual data, the conceptual domains and attributes of collected data, using interviews to collect data, the importance of articulating values, creating consensual maps to portray cultural values, and using computer- assisted qualitative data analysis software programs as all being relevant for addressing Socio-cultural meaning and stability concerns.

A.2.2.2 Social Meaning and Relevance of the Biophysical Environment - This category highlights mapping and quantifying social values using geographic information systems, spatial indices of social value, social values mapping using computer software programs, and social-ecological hotspots as being key concepts that should be accommodated when addressing Socio-cultural meaning and stability concerns.

A.2.2.3 Common vs. Diverse Needs and Imperatives - This category is used for conveying that ecological attributes that play a role in the lives of people, the importance of fishing and hunting opportunities, the significance of economic and psychological Well-Being, the need to conduct individual versus focus group interviews as being complementary, and the need to assist informants express their values are all key concepts that must be accommodated when addressing Socio-cultural meaning and stability concerns.

A.2.2.4 Cultural Stability vs. Social-Spatial-Temporal Multidimensional Change - This category focuses attention upon the attributes of tribal Well-Being, the relevance of tribal subsistence values, tribal sacred ground and cultural resources, tribal values regarding research policies, and tribal environmental justice analysis as all being key concepts to include while

addressing Socio-cultural meaning and stability topics.

A.2.2.5 Socio-ecological Foundations and Expressions - This category highlights key concepts involving the human dimensions of ecosystem management, highly consumptive land use alterations, how experiences have changed over time, the importance of health and environmental professionals cooperating, the relevance of human Well-Being, human Well-Being metrics, increased risks of exposure due to residence or diet preferences, and the need for curtailing and overcoming injustice and/or marginalization as all being relevant when addressing Socio-cultural meaning and stability concerns.

A.2.2.6 Temporal vs. Spatial vs. Social Scales and Distinctions - This category focuses upon the key concepts of social-ecological systems, the need for analyzing social-ecological networks, methods to analyze social-ecological networks, and the relevance of sociological change actions, impacts, and metrics as all being important for addressing Socio-cultural meaning and stability concerns.

Table A2. Socio-cultural Meaning and Stability Theme - New theme categories including relevant in vivo data.

<p>Accumulated Knowledge</p> <ul style="list-style-type: none"> • Contextual data – geodatabases • Collected data – concept domains and attributes • Data collection – interviews • Articulating values • Cultural values – consensual maps • AnSWR shareware • <i>interview questions</i> • <i>place based information</i> • <i>theme v. dimension v. elements v. indicator</i> 	<ul style="list-style-type: none"> • SolVES – social values mapping • Social-ecological hotspots
<p>Social Meaning/Relevance of Biophysical Environment</p> <ul style="list-style-type: none"> • Social values - GIS mapping and quantification • Spatial indices of social value 	<p>Common vs. Diverse Needs, Imperatives and Strategies</p> <ul style="list-style-type: none"> • Ecological attributes that play a role in the lives of people • Fishing and hunting opportunities • Economic and psychological Well-Being • Focus groups vs. individual interviews are complementary • Express values – assistance needed <p>Cultural Stability vs. Social-Spatial-Temporal Multidimensional Change</p> <ul style="list-style-type: none"> • Tribal Well-Being – attributes

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- Tribal values – subsistence
- Tribal sacred ground and cultural resources
- Tribal values – research policies
- Tribal environmental justice – analysis
- *religious and/or sacred activities*
- *community Well-Being indicators (e.g. Swinomish)*

Socio-ecological Foundation/Expressions

- Human dimensions of ecosystem management
- How experiences have changed over time
- Health and environmental professionals cooperating
- Human Well-Being
- Human Well-Being metrics
- Increased risk of exposure – per residence/diet preferences
- Injustice-marginalization
- Highly consumptive land use alterations

Temporal vs. Spatial vs. Social Scales and Distinctions

- Socio-ecological systems
- Social-ecological networks: analyzing

- Social-ecological network analysis
- Sociological change – actions, impacts, metrics
- *integrated conceptual framework*

Embodiment/Expression of Natural Resources Meaning

- Values that humans attribute to landscapes
- Values typologies
- Values, beliefs, practices
- Value-belief-practice identified
- View natural and social environments as inseparable

Environmental Relationships/Components

- Conceptual framework – human ecosystem
- Continuity of the community
- Community-based organizations
- Cultural dimension of social-ecological systems
- Cultural values
- Cultural heritage values
- Cultural landscape
- Cultural ecosystem services
- Cultural sustainability
- Cultural duty

A.3 Final Theme: Personal Well-Being

The Personal Well-Being theme evolved through an inductive clumping of the categories developed from the initial set of in vivo data, and as such the theme is firmly grounded within the original, qualitative, scientific journal text data. The Personal Well-Being theme provides a way for the values and experiences of tribal community individuals to be spotlighted during local natural resource and/or biophysical template monitoring, evaluation and/or basic research decisions, and provides a way for integrated relationships occurring between the factors and/or categories serving as the basis of the personal Well-Being concept to be underscored as well.

Personal Well-Being is a general theme that can be used to underscore that each of the key concepts should be integrated into locally-relevant natural resource recovery (e.g. salmon habitat) assessment approaches and decisions.

A.3.1 PERSONAL WELL-BEING – CODE CATEGORIES (Shared and Unshared)

The Personal Well-Being theme was created to gather all of the categories involving key concepts relating to personal Well-Being together so their interrelated significance can be recognized and better accommodated as a part of local natural resource management work.

The personal Well-Being concept spotlights unique health benefits that natural resource areas and their relative conditions conceivably offer from a local individual and/or family group perspective. Personal Well-Being is used to highlight aspects of local ecological-cultural systems relationships that may need including whenever the ability to access natural resources or influence the quality of their conditions is an issue from a relatively individual or family group perspective.

This theme focuses upon construing the personal and family-level health benefits of stewarding and accessing high-quality natural resources as being associated with key elements involving: community health links to cultural stability and resilience, personal dimensions of relevance and use, health-beneficial landscape values and mapping techniques, natural resource-associated psychological factors and indicators, personal health reinforcing social benefits depending on biophysical conditions and use, the impacts environmental degradation has upon natural food resources or cultural ecosystem services and the ways restoration depends on sustainable social-ecological systems, and efforts to link ecological conditions to tribal Well-Being indicators (especially in urban areas). Figure 3.

A.3.1.1 Code Categories Shared With Other Themes – The Personal Well-Being theme collects in vivo data under certain categories that other data from either the Socio-cultural Change Dynamics or the Tribal Sustenance Imperatives themes were assigned to, as well.

The specific category of data codes the Personal Well-Being theme shares with the Socio-cultural Meaning and Stability theme is:

- Cultural stability vs. social-spatial-temporal multidimensional change.

The specific categories of data codes that the Personal Well-Being theme shares with the Tribal Sustenance Imperatives theme are:

- Dimensions of relevance and use, and
- Knowing how to respect, use and manage.

A.3.1.2 Thematic Categories Not Shared With Other Themes - The specific categories of data codes the Personal Well-Being theme does not share with any of the other main themes are:

- Importance of use,
- Dependence on biophysical conditions and use,
- Arrays vs. specific service categories,
- Standards and expectations, and
- Essential conditions at-risk.

A.3.2 PERSONAL WELL-BEING – KEY CONCEPTS EXCERPTED FROM THE DATA

A.3.2.1 Cultural Stability vs. Social, Spatial, and Temporal Multidimensional Change - this category highlights that key concepts to nourish the soul and adhere to traditional tribal community health frameworks may be essential to include when addressing personal Well-Being concerns.

A.3.2.2 Dimensions of Relevance and Use - This category highlights key concepts regarding the significance of natural resource Socio-cultural values and ensuring that natural resource values are included as entry points when conducting interviews as being relevant when comprehending or addressing personal Well-Being concerns.

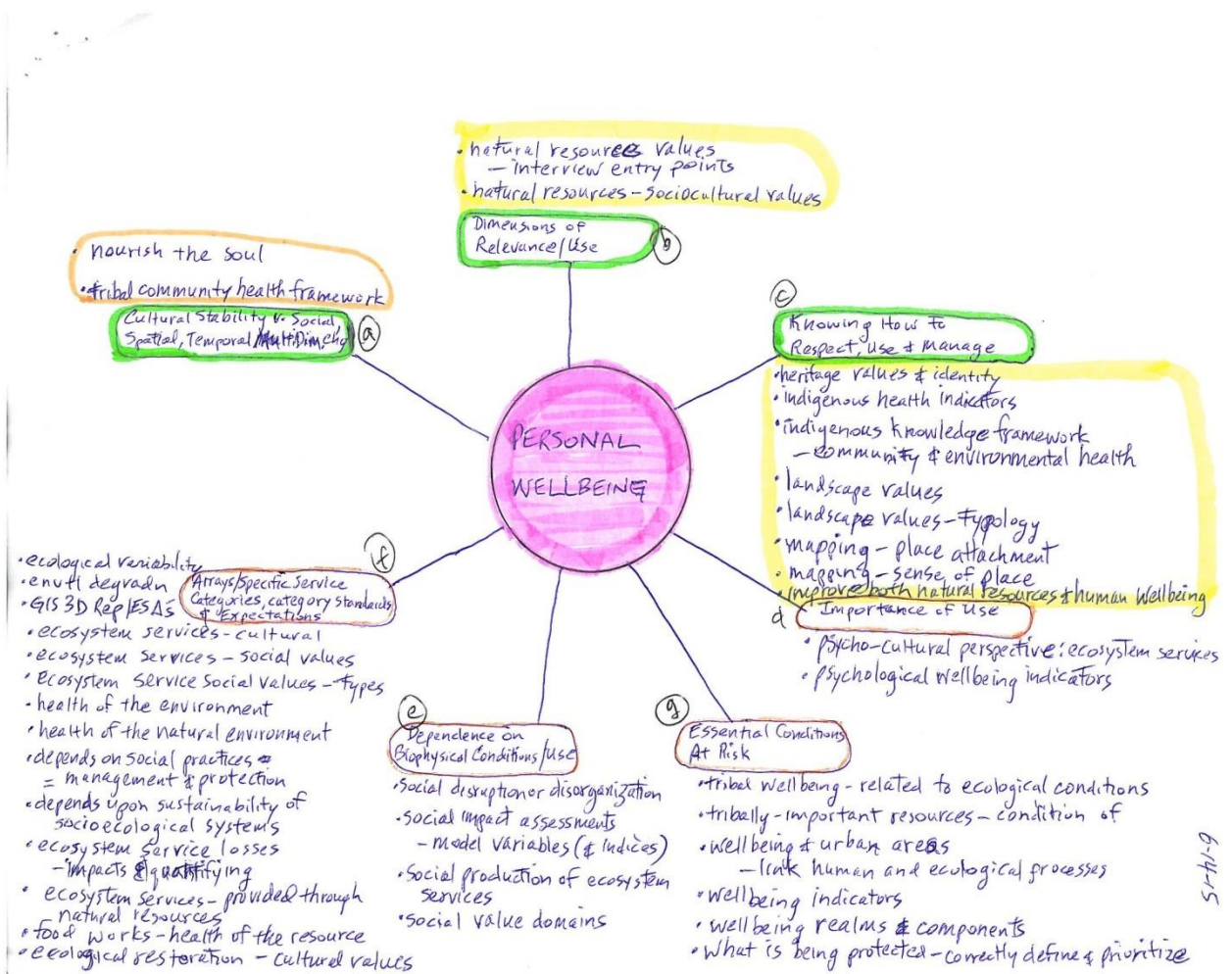


Figure A8. Personal Well-Being – Thematic Map

A.3.2.3 Knowing How to Respect, Use and Manage - This category is used to highlight key concepts involving landscape values, landscape values typologies, heritage values and identity, place attachment mapping, sense of place mapping, indigenous community and environmental

health knowledge frameworks, indigenous health indicators, and actively improving both natural resources and human Well-Being as all being vital to include when addressing personal Well-Being concerns.

A.3.2.4 Importance of Use - This category is used to focus attention upon the psycho-cultural perspectives of ecosystem services, and psychological Well-Being indicators as being key concepts that need to be accommodated when addressing personal Well-Being concerns.

A.3.2.5 Dependence on Biophysical Conditions and Use - This category highlights that social value domains, the social orientation of ecosystem services, countering social disruption or disorganization, and the diligent use of social impact assessments (and relevant model indices/variables) are all key concepts which should be included when addressing personal Well-Being concerns.

A.3.2.6 Arrays vs. Specific Service Categories, Standards and Expectations - This category highlights the key concepts of ecosystem services provided through natural resources, ecological variability, representing ecosystem service changes via GIS-3D, environmental degradation, quantifying ecosystem service impacts and losses, the health of food resources, the social values of ecosystem services, ecosystem service social value typologies, cultural ecosystem services, health of the environment, health of the natural environment, the cultural values of ecological restoration, resource management and protection relying on social practices, and resource protection and management depends on the sustainability of social-ecological systems as all being relevant when addressing personal Well-Being concerns.

Table A3. Personal Well-Being Theme - New theme categories including relevant in vivo data.

Cultural Stability vs. Social, Spatial, Temporal Multidimensional Change

- Nourish the soul
- Tribal community health framework

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- *spiritual and religious values*

- *satisfaction with life in the community (predictors)*

Dimensions of Relevance/Use

- Natural resources – Socio-cultural values
- Natural resource values – interview entry points
- *community leaders' values interviewing methodologies*

Knowing How to Respect, Use and Manage

- Landscape values
- Landscape values – typology
- Heritage values and identity
- Mapping – place attachment
- Mapping – sense of place
- Indigenous knowledge framework – community and environmental health
- Indigenous health indicators
- Improve both natural resources and human Well-Being

Importance of Use

- Psycho-cultural perspective – ecosystem services
- Psychological Well-Being indicators

Dependence on Biophysical Conditions/Use

- Social value domains
- Social production of ecosystem services
- Social disruption or disorganization
- Social impact assessments – model variables (and indices)

Arrays/Specific Service Categories, Standards and Expectations

- Ecosystem services – provided through natural resources
- Ecological variability
- GIS 3D representations - ecosystem service changes
- Environmental degradation
- Ecosystem service losses – impacts and quantifying
- Food works – health of the resource
- Ecosystem services – social values
- Ecosystem service – social value types
- Ecosystem services – cultural
- Health of the environment
- Health of the natural environment
- Ecological restoration – cultural values
- Depends on social practices = management and protection
- Depends on sustainability of social-ecological systems

Essential Conditions At-Risk

- What is being protected – correctly define and prioritize
- Tribally-important resources – condition of
- Tribal Well-Being – related to ecological conditions
- Well-Being realms and components
- Well-Being indicators
- Well-Being and urban areas – link human and ecological processes

A.3.2.7 Essential Conditions At-Risk - This category spotlights key concepts involving the need to correctly define and prioritize what is being protected, optimize tribally-important resource conditions, link tribal Well-Being to ecological conditions, identify tribal Well-Being realms and components, Well-Being indicators, and linking human Well-Being in urban areas to ecological processes as all being invaluable when addressing personal Well-Being concerns.

A.4 Final Theme: Tribal Sustenance Imperatives

The Tribal Sustenance Imperatives theme evolved through an inductive clumping of the categories developed from the initial set of in vivo data, and as such the theme is firmly

grounded within the original, qualitative, scientific journal text data. The Tribal Sustenance Imperatives theme provides a way for the values and experiences prioritized by tribal community individuals to be spotlighted during local natural resource and/or biophysical template protection and/or restoration decision-making endeavors, and provides a way for relationships occurring between the factors and/or categories serving as the basis of the tribal sustenance imperatives concept to be underscored as well. Tribal Sustenance Imperatives is a general theme that can be used to underscore that each of the key concepts could be integrated into locally-relevant natural resource recovery (e.g. salmon habitat) participatory planning and/or final decision-making actions.

A.4.1 TRIBAL SUSTENANCE IMPERATIVES – CODE CATEGORIES (Shared and Unshared)

The Tribal Sustenance Imperatives theme was created to gather all of the categories involving key concepts relating to tribal sustenance imperatives together so their interrelated significance can be recognized and better accommodated as a part of local natural resource management work.

The tribal sustenance imperatives concept focuses on ways natural resources provide for community or cultural sustenance needs via cultural services and opportunities and underscores stakeholders need for empowering and should strive to integrate social and biophysical data and to guide the varying levels of impacts upon cultural opportunities. Tribal sustenance imperatives is used to highlight local aspects of sustaining local ecological-cultural systems – especially the ability to optimize culturally-preferred natural resource stewardship outcomes, manage resources in accordance with religious or cultural practices, and/or minimize human emotional or psychological losses (including overall despair).

This theme is used to highlight tribal sustenance imperatives as being related to key concepts involving: natural resources being managed as cultural resources where distinct cultural preferences can apply, natural resources values being distinctive while intangible (and some form of metrics may still apply), stakeholders needing their preferences being realized as outcomes from local decisions, the relevance of local plant and animal resource changes and key resource units at stake, respecting landscape ecological knowledge and the irreplaceability of local intergenerational knowledge exchange, unwanted discrepancies between those requiring resource benefits and those deciding who receives them, and who decides what natural resource changes will affect what individuals or family groups and their specific natural resource-related emotional, psychological and/or livelihood satisfaction-related needs. Figure 4.

A.4.1.1 Code Categories Shared With Other Themes - The Tribal Sustenance Imperatives theme collects in vivo data under certain categories that other in vivo data from either the Personal Well-Being or the Eco-cultural Change Dynamics themes were assigned to, as well.

The specific categories of data codes the Tribal Sustenance Imperatives theme shares with the Personal Well-Being theme are:

- Dimensions of relevance and use, and
- Knowing how to respect, use and manage.

The specific categories of data codes that the Tribal Sustenance Imperatives theme shares with the Eco-cultural Change Dynamics theme are:

- Using and respecting natural resource gifts,
- What being used in what amounts, and
- What uses prevail.

A.4.1.2 Code Categories Not Shared With Other Themes - The specific categories of data

codes the Tribal Sustenance Imperatives theme does not share with any of the other main themes are:

- What kinds of uses by whom, and
- What available for use.

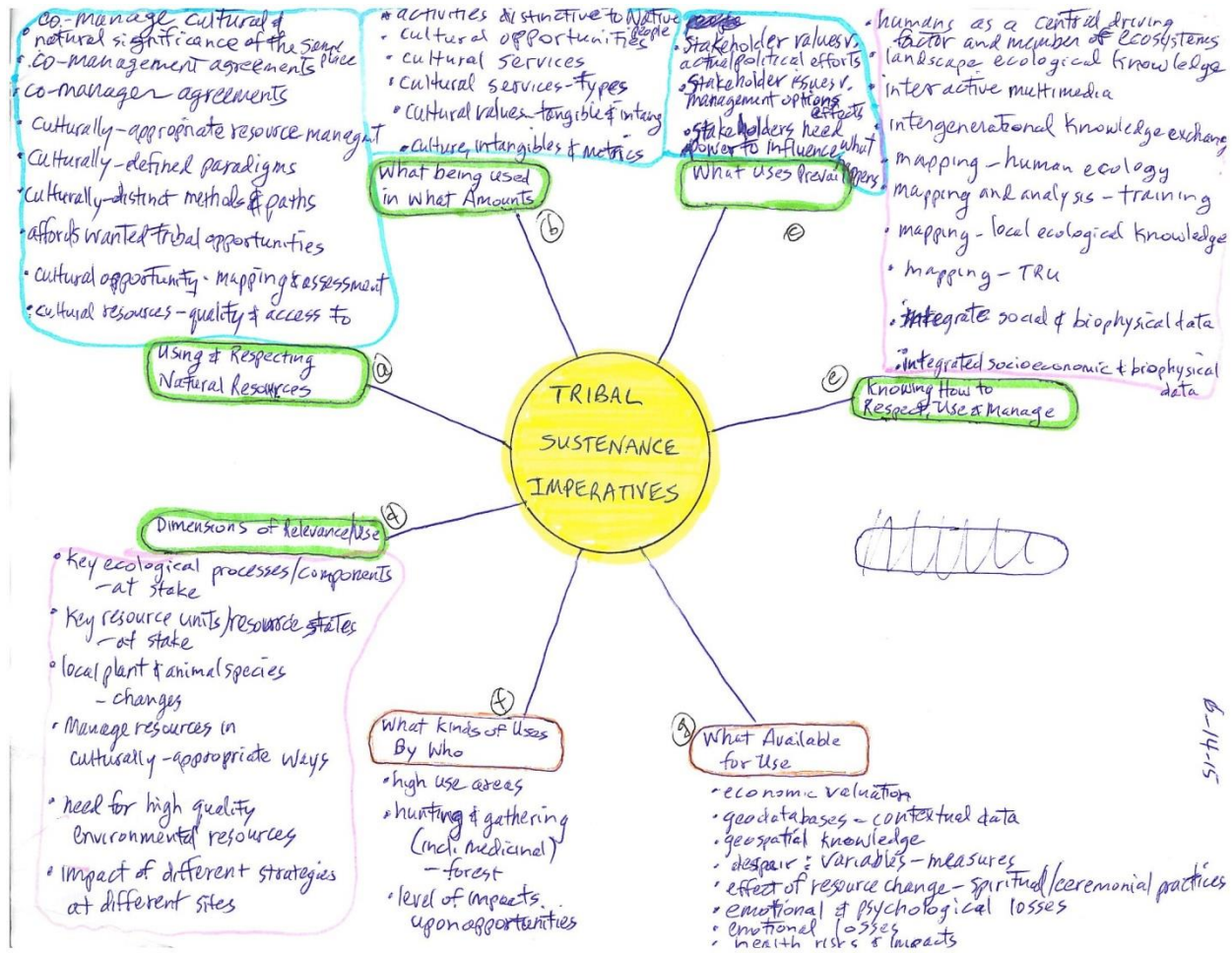


Figure A4. Tribal Sustenance Imperatives – Thematic Map

A.4.2 TRIBAL SUSTENANCE IMPERATIVES – KEY CONCEPTS EXCERPTED FROM THE DATA

A.4.2.1 Using and Respecting Natural Resources As Gifts - This category is used to spotlight

key concepts involving access to and the quality of cultural resources, affording wanted tribal

opportunities, mapping and assessing cultural opportunities, culturally-distinct stewardship methods and paths, culturally-defined paradigms, culturally-appropriate resource management, co-management agreements, and co-managing cultural and natural significance of the same place as all needing to be included when accommodating tribal sustenance imperatives concerns.

A.4.2.2 What Being Used in What Amounts - This category highlights the key concepts of cultural services, types of cultural services, tangible and intangible cultural values, metrics for intangible cultural values, cultural opportunities, and activities distinctive to native people as being critical to include when accommodating tribal sustenance imperatives concerns.

A.4.2.3 The What Uses Prevail - This category underscores that comparing stakeholder values to actual political efforts, comparing stakeholder issues to management options effects, and optimizing stakeholders power to influence what happens are all key concepts that should be included when addressing tribal sustenance imperatives concerns.

A.4.2.4 Dimensions of Relevance and Use - This category highlights that key concepts involving the need for high quality environmental resources, local plant and animal species changes, the state of key resource units at-stake, key ecological processes or components at stake, managing resources in culturally-appropriate ways, and the impact of different strategies at different sites should all be accommodated when addressing tribal sustenance imperatives concerns.

A.4.2.5 Knowing How to Respect, Use and Manage - This category highlights the key concepts of integrated socioeconomic and biophysical data, humans as a central driving factor and

member of ecosystems, landscape ecological knowledge, human ecology mapping, local ecological knowledge mapping, tenure and resource unit mappings, mapping and analysis training, interactive multimedia, and intergenerational knowledge exchange as all being vital to include when accommodating tribal sustenance imperatives concerns.

A.4.2.6 What Kind of Uses By Whom - This category focuses attention upon key concepts involving hunting and gathering (including medicinal) within forests, high use areas, and varying levels of impacts upon wanted opportunities as each needing to be considered when addressing tribal sustenance imperatives concerns.

A.4.2.7 What Available for Use - This category underscores that key concepts involving geospatial knowledge, geodatabase contextual data, the effects of resource changes upon spiritual or ceremonial practices, economic valuation, health risks and impacts, emotional losses, emotional and psychological losses, and individual despair variables and measures are all vital to accommodate when addressing tribal sustenance imperatives.

Table A4. Tribal Sustenance Imperatives Theme - New theme categories including relevant in vivo data.

Using and Respecting Natural Resources as Gifts

- Cultural resources – quality and access to
- Affords wanted tribal opportunities
- Cultural opportunity – mapping and assessment
- Culturally-distinct methods and paths
- Culturally-defined paradigms
- Culturally-appropriate resource management
- Co-management agreements
- Co-manage cultural and natural significance of the same place

What Being Used in What Amounts

- Cultural services
- Cultural services – types
- Cultural values – tangible and intangible
- Culture, intangibles and metrics

- Cultural opportunities
- Activities distinctive to Native People
- *sustain tribal cultural interests*

What Uses Prevail

- Stakeholder values vs. actual political efforts
- Stakeholder issues vs. management options effects
- Stakeholders need power to influence what happens
- *strengthen policy framework*

Dimensions of Relevance and Use

- Need for high quality environmental resources
- Local plant and animal species – changes
- Key resource units/resource states – at stake
- Key ecological processes/components – at stake
- Manage resources in culturally-appropriate ways

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- Impact of different strategies at different sites

Knowing How to Respect, Use and Manage

- Integrate social and biophysical data
- Integrated socioeconomic and biophysical data
- Humans as a central driving factor and member of ecosystems
- Landscape ecological knowledge
- Mapping – human ecology
- Mapping – local ecological knowledge
- Mapping – traditional resource units
- Mapping and analysis – training
- Interactive multimedia
- Intergenerational knowledge exchange

Table 5 (cont.)

- *research gaps*

What Kind of Uses by Whom

- Hunting and gathering (including medicinal) – forest
- High use areas
- Level of impacts upon opportunities
- *tribal commitments/guiding principles (Puget sound)*

What Available for Use

- Geospatial knowledge
- Geodatabases – contextual data
- Effect of resource change – spiritual/ceremonial practices
- Economic valuation
- Health risks and impacts
- Emotional losses
- Emotional and psychological losses
- Despair - variables and measures

Who Decides What for Whom

- *Environmental deliberations*
- *Community discourse*
- *Discursive ethics*
- *Discourse-based valuation*
- *Ecological identity*
- *Ecological complexity*
- *Ecologic costs and benefits*
- *Environmental management options*
- *Tribally-derived/Regulatory-cultural approaches*
- *Indigenous resource management*
- *Public participation*
- *Productive collaborations*

APPENDIX B: NATURAL RESOURCE-RELATED TRIBAL WELL-BEING INDICATORS (Potential)

B.1 Human Values and Potential Well-Being Indicators

Consider using the following alternative categories of landscape values for mapping social space - aesthetic, biological, cultural, economic future, historic, intrinsic, learning, life sustaining, recreational, spiritual, subsistence, therapeutic, and wilderness values - as based upon Rolston and Coufal/1991 (Alessa et al, 2007).

Only three (spiritual and religious values, aesthetic values, and recreation and ecotourism) of the ten services defined as cultural services could be assessed. The remaining cultural services – cultural diversity, knowledge systems, educational values, inspiration, social relations, sense of place, and cultural heritage values – the pattern of human use and the status of the service could not be assessed from the information available. (Schaich et al. 2010)

The social value types included in the analysis were reduced from the total of twelve to six. Aesthetic, Biodiversity, Future, Life Sustaining, Recreation, and Therapeutic – others were Cultural, Economic, Historic, Intrinsic, Learning, and Spiritual. (Sherrouse et al. 2011)

The material landscape services are captured as food, raw materials, geological resources, fuel, and medicinal and ornamental resources consisting of 14 indicators (Fig. 2). For the part of cultural landscape services, the typology includes five indicators for aesthetics, social relations, and spiritual, religious, cultural heritage and intrinsic values. (Fagerholm et al. 2011)

Eight dimensions of values – e.g. Preferences vs. Principle vs. Virtues, Market-mediated vs. Non-market-mediated, Self-oriented vs. Other-oriented, Individual vs. Holistic group, Experiential vs. Meta-physical, Supporting vs. Final (instrumental vs. inherent), Transformative vs. Non-transformative, Anthropocentric vs. Biocentric. (Chan et al. 2012)

See supporting online information for a description of nine prominent categories of cultural benefits. (Chan et al. 2012)

Examples of values included in typologies include: aesthetic, biological, cultural, **economic, future**, historic, intrinsic, learning, life sustaining, recreation, spiritual, subsistence, therapeutic, and wilderness. (McLain et al. 2013)

B.1.1 Human Values Typologies

- **Cultural diversity** (Mill, Schaich)
- **Spiritual and religious values** (Mill, Alessa, Schaich, McLain)
- **Knowledge systems** (Mill, Schaich)
- **Educational values** (Mill, Schaich)
- **Inspiration** (Mill, Schaich)
- **AESTHETIC VALUES** (Mill, Alessa, Schaich, SHERROUSE, Fagerholm, McLain)
- **Social relations** (Mill, Schaich, Fagerholm)
- **Sense of place** (Mill, Schaich)
- **Cultural heritage values** (Mill, Schaich, Fagerholm)
- **RECREATION and tourism** (Mill, Alessa, Schaich, SHERROUSE, McLain)

- Biological (Alessa, McLain)
- Cultural (Alessa, McLain)
- Economic future (Alessa, McLain)
- Historic (Alessa, McLain)
- **Intrinsic** (Alessa, Fagerholm, McLain)

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- Learning (Alessa, McLain)
- LIFE SUSTAINING (Alessa, SHERROUSE, McLain)
- *Subsistence* (Alessa, McLain)
- *Therapeutic* (Alessa, McLain)
- *Wilderness* (Alessa, McLain)

- ✓ BIODIVERSITY (SHERROUSE)
- ✓ FUTURE (SHERROUSE)

- *Food* (Fagerholm)
- *Raw materials* (Fagerholm)
- *Geological resources* (Fagerholm)
- *Fuel resources* (Fagerholm)
- *Medicinal resources* (Fagerholm)
- *Ornamental resources* (Fagerholm)
- *Indicators = #1 - #14.* (Fagerholm)

- *Preferences vs. Principle vs. Virtues* (Chan)
- *Market-mediated vs. Non-market –mediated* (Chan)
- *Self-oriented vs. Other-oriented* (Chan)
- *Individual vs. Holistic group* (Chan)
- *Experiential vs. Meta-physical* (Chan)
- *Supporting vs. Final (instrumental vs. inherent)* (Chan)
- *Transformative vs. Non-transformative* (Chan)
- *Anthropocentric vs. Biocentric* (Chan)

Six dimensions of loss were identified by elders and council members. Employment values (e.g. jobs for settlement members, improved self-esteem), Community improvement values (e.g. land planning opportunities), Community revenues, Social values (e.g. health and safety, privacy), Traditional values (protection of traditional sites, practicing traditional skills), and Bush environmental values (e.g. fish and water habitat, environmental services). (Gregory and Trousdale, 2009)

B.2 Tribal Well-Being Attributes and Potential Indicators

Intertribal researchers identified six Indigenous Health Indicators (IHIs): Community Connection, Natural Resources Security, Cultural Use, Education, Self Determination, and Well-being. (Donatuto et al, 2014)

B.2.1 GOVERNANCE DOMAIN Attributes:

- ***Including Potential Parameters/Indicators to Measure***

Access to natural areas

- Connectivity between the parks, trails, open space upon the Reservation.
- Acres of farmland protected from development
- Acres of protected forested green space

Stewardship

- Number of gardens and gardeners participating in or on the wait list for city/county community garden program
- Percentage of private landowners' willing to participate in county restoration programs
- Number of students involved in stewardship activities through school-govt. partnerships
- % of total population engaged in food production
- Percent of residents who feel that individual actions to protect the Puget Sound make a difference
- Percent of residents who feel a responsibility to protect the environment
- Number of City/County sponsored Low Impact Development or green infrastructure projects

Environmental management

- Percent of land where a high amount of conflicting uses may be transpiring
- Number of places having high amount of conflicting uses within the Reservation
- Number of marine or agricultural or upland natural or cultural resource areas within the Reservation
- Areas on Reservation holding an abundant amount of social values
- Areas on Reservation holding a diverse range of social values
- Areas on Reservation holding rare social values
- Areas on Reservation whose social values are at-risk

Neighborhoods

- Number of tribal residents on Reservation living within 1/2 mile of neighborhood components (public transit, grocery store, library, school, park, etc.)

Safety

- Percent of mapped floodplain on Reservation that is undeveloped

Sustainable infrastructure

- Percent or acres of natural areas, resource lands and environmentally-sensitive areas on Reservation that are protected-maintained-restored-created through innovative means (such as "transfer of development rights, and conservation easements)

Sustainable policy

- Number of programs that support local farming industry (incentives, outreach, etc.) within the Reservation

Tribal co-management

- Number of tribal/non-tribal natural resources mutual agreements
- Number of projects within Reservation where natural/cultural resource assessments or planning is integrated
- Number of NEPA or SEPA projects reviewed or resolved within the Reservation

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- Number of draft EIS reviews received and/or resolved within the Reservation
- Number of Puyallup community social impact assessments completed for natural resource-related projects (that affect the Puyallup Reservation)

Community engagement and equity

- Number Puyallup elders per tribal committee (or leaders, or decision-makers)
- Number of youth councils, natural resource clubs, outdoor field trainings, established for Puyallup tribal youth
- Number of Reservation project review opportunities provided to Puyallup community

Democratic engagement

- Percent of tribal Reservation residents who feel they are able to influence resource management decisions

Informed citizens

- Percent of Puyallup members receiving Reservation and/or watershed environmental education
- Percent of Puyallup members who are aware of where food comes from
- Percent of Reservation residents who understand the connection of salmon recovery to greater ecological values and human Well-Being

Areas Where Values are Abundant, Diverse, Rare, and at Risk. (Bryan et al, 2010). **Process and Outcome Criteria.** (Brown and Kytta, 2013). **High Use Areas - Identifying and Mitigating Conflict.** (McLain et al, 2013). **Co-Management of Cultural and Natural Significance.** (Tengberg et al, 2012). **Co-Management Agreements and Land Use Plans.** (McLain et al, 2013). **People Participate in the Management of Their Environment.** (Reed et al, 2009).

B.2.2 ECONOMIC DOMAIN Attributes

- ***Including Potential Parameters/Indicators to Measure***

Agriculture

- Acres of Reservation open space converted to development uses
- Total protected/preserved farmland acres; total farmland loss (acres)
- Acres of farms in certified organic production upon Reservation
- Average farm size (acreage)
- Food production per acre

Forestry

- Rate of conversion of forest land (area converted; type of conversion)
- Acres of working forest lands in watershed
- Number of small forest landowners and outside investor owners
- Change in forest area ownership (% forest area/number of properties)

Expressing tribal culture

- Amount of traditional foods or medicines being gathered upon the Reservation
- Number of tribal hunting opportunities upon Reservation per specie
- Number of tribal shell-fishing opportunities upon Reservation per specie
- Number of tribal fishing opportunities per specie

Transmitting tribal culture

- Number hours or sessions of environmental skills training, or field, or practice sessions for Puyallup tribal youth.
- Number Puyallup tribal youth taught per skill (per age group).
- Number Puyallup community adults teaching Puyallup youth (per topic).

Gathering Forest Foods and Medicinal Plant Species. (Karjalainen et al. 2010). Opportunities for Hunting and Fishing. (Burger, 2011). Youth Ecology Camps - Collaborations with Local Schools - Tribal Member Adults Teach Youths How to Care for Their Land. (Long, 2003).

B.2.3 PHYSICAL DOMAIN Attributes

- ***Including Potential Parameters/Indicators to Measure***

Access to healthy food

- 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 and WIC)
- Food resources produced in the communities where they are consumed
- Number of community gardens and local farms, including usage and output

Clean air

- Number of days per year over federal fine particulate matter standard

Clean water

- Populations served by Group A and Group B public water systems that do not meet drinking water standards
- Percent of streams and lakes with improved/passing surface water grades

Climate control

- Percent tree cover by city/town

Safety

- Natural flood protection and reduction of flood risk from natural floodplains
- Percent of residents who feel safe for family and children while in the natural environment

Relative conditions

- Number of Reservation landscape features degrading per Time
- Number and percent coverage of Reservation landscape features changing per Time
- Loss of Reservation environmental or habitat features (per Time)
- Total acre size of Reservation landscape features per Time
- Number acres of Reservation that were deforested
- Intensity of deforestation upon Reservation
- Percent Reservation selective vs. clear cut per Time.
- Number acres open space per Reservation sub-watershed

Access to natural areas

- Percent of households within a half mile of parks, urban plazas, public courtyards, community gardens or trailheads
- Percent of parks accessible by foot and bike; or percent of parks with off-street trails connected to on-street trails
- Ratio of miles of bike facilities per miles of roadway

Exercise

- Percent of residents who utilize trails as form of alternative transportation

Specific opportunities

- Number Puyallup tribal cultural opportunities sought vs. afforded
- Number environmental types upon Reservation (per Time)
- Number plant or animal species upon Reservation per location (per Time)

Overall environmental health

- Reservation environmental health impact index (air and water quality, waste management, etc. by jurisdiction)

Ecosystem service places

- Number of Puyallup tribal member Reservation place attachment statements.
- Number of Puyallup Reservation places identified by tribal members.
- Number of dependencies upon Reservation identified by Puyallup community members.
- Number of material landscape services (e.g. foods) within Reservation per type.
- Number of cultural landscape services (e.g. vision quest, sacred sites) within Reservation per type.
- Number of consumptive activities of tribal members within Puyallup Reservation per type or per Time.
- Number of non-consumptive activities (bird watching, hiking) within Puyallup Reservation per type or per Time.
- Number of religious activities (e.g. ceremonial, canoe family) of within Puyallup Reservation per type.

Place-Based Information. (Brown and Kyttä, 2013). **Place Attachment Statements - Place Identity and/or Place Dependence - Special Places.?? Material and Cultural Landscape Service Indicators.** (Fagerholm, 2011). **Resource Uses, Frequency of Consumptive, Non-Consumptive and Religious Activities.** (Burger, 2011). **Specific**

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Ecologically Based Landscape Features - How Changes In These Features Would Affect Those Values. (Daniel et al, 2012). **Deforestation, Ecosystem Alterations as Well as Diminishing Green Spaces.** (Karjalainen et al, 2010). **Indicators of Local Ecosystem Health.** (Tipa, 2009). **Those who are Geographically Located in Areas of Greatest Change.** (Myers et al, 2013??). **How Their Experiences Have Changed Over Time.** (Tipa and Nelson, 2008). **Opportunities Afforded - Opportunities Sought.** (Tipa and Nelson, 2008). **Particular Types of Forests, Heaths, Prairies, or Deserts; Particular Species; Individual Plants or Animals.** ??

B.2.4 SOCIAL-CULTURAL-PSYCHOLOGICAL DOMAIN Attributes

- ***Including Potential Parameters/Indicators to Measure***

Cultural events

- Total attendance at salmon-related events per year

Cultural heritage

- Percent of residents who feel responsibility to preserve land to honor heritage
- Percent of residents who know the watershed's history (Native American populations, pioneers and settlers)
- Percent of residents who desire to preserve a rural landscape

Spiritual

- Percent of residents who feel that farming connects them to the environment

Cultural (incl. archaeology)

- Number tribal members engaging land via consumptive, nonconsumptive or religious activities upon the Reservation
- Percent Puyallup tribal members engaging with their Reservation lands or waters
- Prevalence of cultural practices on Reservation per person (per Time)
- Number of Puyallup community historic settlements or trails identified on Reservation
- Number Puyallup community traditional place names on Reservation
- Number Puyallup community or Reservation myth themes.
- Total vs. potential high-quality riparian areas within Reservation?
- Percent acres of natural vs. anthropogenic land uses within Reservation
- Wildlife habitat distribution within Reservation per specie (or per type).
- Total acres of Reservation accessible to Puyallup tribal community.
- Diversity of Puyallup tribal cultural activities within Reservation
- Percent built vs.natural-viewscape-Development-Impervious surface area on Reservation per subwatershed (per Time).

Aesthetic

- Percent of residents who are able to experience natural aesthetic beauty on a daily basis

Sense of place

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- Percent of residents who express a sense of ownership or stewardship for natural areas
- Percent of residents who express a strong connection to nature
- Percent of residents who feel connected to their food supply

Psychological

- Amount and percent of funds allocated-spent on protection or restoration of the Reservation environment
- Amount of personal natural resource-based incomes of Puyallup tribal community
- Number of Puyallup tribal member behavioral health visits per Time
- Number of Puyallup tribal member psychological health self-treatments
- Number Puyallup tribal member behavioral health informal/home treatments
- Number of Puyallup tribal member individual behavioral health concerns (parents, professionals, practitioners)
- Percent of Puyallup community engaging in Puyallup traditional life ways (per hour-day-week-month-year-decadal-lifetime, or generation-social-personal)

Community cohesion

- Percent of residents who feel that interconnected parks and trails facilitate community connectedness

Safety

- Percent of residents who feel safe in their neighborhood, countywide average and by race/ethnicity, income, and geography

Social

- Rates of environmentally-related morbidity or mortality conditions (individual-family-community) occurring within the Puyallup tribal community.
- Amount of Puyallup community social reinforcement and reciprocity mechanisms used (e.g. giveaways, intergenerational residents, and average household income distributions).
- Range or amount of Puyallup tribal livelihood options per type (per time).
- Percent Puyallup community benefiting from Puyallup livelihood options
- Number of Puyallup members training-practicing Puyallup livelihood options
- Percent Puyallup community benefiting or affected from Puyallup livelihood options
- Number or percent of Puyallup members of community benefiting from intergenerational exchanges

Altered or Even Heavily Managed Ecosystems. (Daniel et al. 2012). **Self-Evaluation of Health Condition, Strength of Family Ties, and Solidarity of Extended Family.** (Edouard and Duhaime, 2012). **Health Condition, Solidarity of the Nuclear Family, Solidarity of the Extended Family, Existence of Strong Family Ties, Solidarity of the Social Network.** ?? **Intergenerational Knowledge Exchange and Livelihood Opportunities.** (McLain et al. 2013). **Tribal Engagement with the Land.** (Slack and Whitt, 1992). **Belief, Value or Cultural Practice – “Food Works”, Trails, Settlements, Water Quality; Songs, Place names and Myths.** (Tipa, 2009). **Aesthetic, Local Culture and Existence Value Indicators.** (Fagerholm, 2011). **Economic and Psychological Well-Being.** (Amberson, 2013). **The Practice of a Traditional Activity, Level of Psychological Distress, Self-Evaluation of the State of Health.** (Edouard and Duhaime, 2012).

APPENDIX C: CULTURAL PROGRAM SCREENING EXAMPLE – SOURCE INFORMATION

C.1 Puget Sound Partnership Salmon Recovery Program

Terrestrial and marine resources are adequate to sustain the treaty rights, as well as the cultural, spiritual, subsistence, ceremonial, medicinal needs, and economic endeavors of the tribal communities of Puget Sound (Partnership, 2006).

Increasing the capacity of...tribes to manage protection and restoration efforts is critical to success (PSP Draft recommendations. 10-30-06).

Tribal ceremonial and subsistence fisheries for salmon and other species, as well as clam, oyster, crab and other shellfish harvests...A similar set of services are provided by the freshwater ecosystems that are linked to Puget Sound (Ruckleshaus & McClure, 2007).

Ethical and Existence Values (Tier I). Types of benefits cited: Traditional tribal ways of life.

Tribal government's perspective: Locally grown food, gathering of wild foods, fisheries, and shellfish – those services that support tribal cultures – are of utmost importance. Capture

Fisheries (Tier II). Types of benefits cited: Sustainable livelihoods for tribal nations. Fishing and

aquaculture sector perspective: Tribal communities harvest salmon for the sustainability of their

livelihoods. Aquaculture (Tier II). Types of benefits: Particularly important component of tribal

economies and livelihoods. Tribal government's perspective: Shellfish are very important for

providing for our people and for the economy (Iceland, Hanson, & Lewis, 2008).

IMPLICATIONS OF INTERVIEW FINDINGS – 1. Defining a “healthy Puget Sound”. Table

3/Defining what a health Puget Sound Is. Ethical and existence values: Support traditional tribal

ways of life. Capture fisheries: Sustainable livelihoods for Tribes. Aquaculture: Sustainable

livelihoods for Tribes (Iceland et al., 2008).

Ethical/existence values will no doubt benefit from efforts... Little reference is directly made to these ecosystem services in the policy and strategy discussions, however, raising the concern that these services may not *optimally* benefit from the Partnership's efforts (Iceland et al., 2008).

APPENDIX A – Cultural Services: Recreation and Tourism/Examples = fishing, clamming and hunting. Existence Values/Examples = belief that all species are worth protecting, no matter their direct value to humans. Ethical values/Definition = spiritual, religious, aesthetic, intrinsic, or other values people attach to ecosystems, landscapes, or species. Examples = spiritual fulfillment derived from mountains, lands, rivers, lakes, streams, and the Sound itself (Iceland et al., 2008).

Near shore areas are critical Puget Sound environments supporting... tribal trust resources. (Panel, 2008).

Four types of services: provisioning, regulating, cultural and supporting – e.g. Cultural: Recreation and tourism, existence and ethical values, and traditional values and lifestyles; examples = spiritual fulfillment from the direct contact with nature, protection of traditional and religious cultures associated with nature (tribal beliefs, arts and traditions associated with salmon, cedar, and other native species)... Cultural-aesthetic-spiritual values through the enjoyment of natural landscapes, sense of place, and recreational opportunities. Cultural Services – Puget Sound ecosystems provide a wealth of cultural ecosystem services such as... cultural identity and livelihood... Many of the less tangible attributes of HWB are closely associated with cultural services. For example, some evidence support the suggestion contact with nature and natural landscapes relieves stress, reduces mental fatigue... and increases a person's overall sense of well-being. (Cassin, Knauer, & Wellman, 2008).

Findings/Additional HWB-ecosystem health themes emerged from the Topic Forum Papers as presented below. Loss of habitat leads to...impacts to cultural resources(Cassin et al., 2008).

Quantify where possible or qualify the impact of various resource management approaches on other aspects of the HWB – besides the economy – such as sense of place and community, cultural identity, respect for other cultures and good social relations.

Human Well-Being/There is a large body of research covering the subject of human well-being, also commonly referred to as quality of life, life satisfaction, happiness, or life fulfillment.

Examples of attributes include items such as traditional activities and cultural responsibilities. (Schneidler & Plummer).

Table 1/HWB Indicator Categories – Population (Special) Subcategory = Subsistence communities, Tribal populations. Social/Cultural Subcategory = Sense of place. Possible HWB Indicators for the PSP/Social and Cultural: This category covers indicators of social and cultural elements of human well-being (Schneidler & Plummer).

Lastly, we note that one of the Partnership’s human well-being goals (“Upland and marine resources are adequate to sustain the treaty rights, as well as the cultural, spiritual, subsistence, ceremonial, medicinal needs, and economic endeavors of the tribal communities of Puget Sound.”) is poorly represented in the set of indicators gathered to date. We recommend that this be addressed by consulting with tribal representatives on the leadership council or through other forms of direct contact with the tribes (Schneidler & Plummer).

RECOMMENDED HWB INDICATORS FOR THE PSP: Outcome HWB 2: Upland and marine

resources are adequate to sustain the treaty rights, as well as the cultural, spiritual, subsistence, ceremonial, medicinal needs, and economic endeavors of the tribal communities of Puget Sound.

b. Other indicators are needed for this outcome (Schneidler & Plummer).

Human Well-Being/Indicator = Resources sustain tribal rights and needs. Recommended Good for PSP = Commercial tribal finfish and shellfish harvests (PSP Science Panel. 05-07-09).

Cluster = Human Dimensions/Focal Component = Tribal Values and Resources/Key Attribute = Addressing abundance and intrinsic value of cultural resources and practices, including tribal sites, cultural traditions, and areas of significance (Partnership, 2009b).

Working Resource Lands and Industries. Indicator: Puget Sound commercial finfish and shellfish harvest, wild and aquaculture. Fish and shellfish harvest provide both a commercial industry as well as cultural, traditional and spiritual values to local tribal nations. (Partnership, 2009b)

What Do We Still Need to Know About Monitoring Human Well-Being in Puget Sound? What Are Our Plans for Future reports? Additional human well-being elements under consideration for future reporting include the following: indicators addressing tribal communities' cultural, spiritual, subsistence, ceremonial and medicinal needs, as well as the economic endeavors of the tribal communities of Puget Sound (Partnership, 2009a).

Research Objectives for Determining Socioeconomic Impacts on Restoration Activities. 6) Characterize and provide the science needed to protect cultural heritage and resources (historical and traditional artifacts) of the Puget Sound nearshore ecosystem. 7) Understand the role of the Puget Sound nearshore ecosystem in both historic and contemporary cultural heritage of Native Americans and non-Native American communities.

Institution/Tribal Rights/Examples = Fishing rights, Prior water use rights. Institutional Analyses of Restoration Issues – Several authors have focused on the comanagement of salmon by tribes in the Pacific Northwest (e.g. Boldt decision implementation impacts/Boxberger; Collaborative watershed management institutions/Ryan and Bidwell; Forests and Fish Report effectiveness/Day). Summary of Institutions and Restoration in the Puget Sound and the PNW – Among the most important legal mandates affecting restoration are the Endangered Species Act, tribal rights, and water rights (Stinchfield, Koontz, & Sexton, 2009).

While many aspects of human well-being are not covered by the indicators below, we believe those chosen reflect important priorities established by the Partnership. The one exception is the goal of meeting tribal treaty rights and other tribal needs and interests. While the indicators include a measure of tribal commercial marine harvests, they do not include other elements of tribal interests and needs such as sustaining their cultural, spiritual subsistence, ceremonial, and medicinal needs, or the economic endeavors of the tribal communities of Puget Sound (2009 State of the Sound Report. January 2010).

Ecological Components Related to the 2020 Statutory Goals. Ecological Systems = Terrestrial Systems/Species and Food Webs = Marine, Freshwater, Terrestrial/Human Dimensions = Tribal values and resources. (2009 State of the Sound Report. January 2010).

Examples of additional information required to meet this goal include: Perceptions and Values – Understanding the relationship among social, economic, and cultural perceptions and values and their influence on nearshore ecosystems. Specific questions include: How do specific changes in Puget Sound health affect specific quality of life attributes (e.g. water quality changes affect cultural attributes of human well-being?) (PSP Strategic Science Plan. 2010).

Hagerty ET. al. (2001) found the following seven domains to be broad enough to encompass most research frameworks: relationships with family and friends; emotional well-being; material well-being; health; work and productive activity; feeling part of one's community; and personal safety. (Partnership, 2011).

Using alternative futures and visioning tools, evaluation of traditional knowledge, and tribal relationships to western science and practice(Wellman et al., 2011).

Nine indicators were added to the final recommendations to more fully represent the Swinomish attributes and increase the representation of tribal values in the list (Biedenweg, 2014).

Gaps in Social Science Research for Puget Sound. Tribal psychological and spiritual health specific to the natural environment. An analysis of meaning for different PS populations, to better understand how to motivate people to adopt behaviors (tied to spiritual) (Biennial Science Work Plan 2014-2016. December 2014).

APPENDIX D – ADDITIONAL PRELIMINARY TESTING

D.1 Cultural Program Quality Screening (Matrix Approach)

E.g. Washington State Timber/Fish/Wildlife Agreement – Cultural Program Elements

D.1.1 TFW Comparison – Matrix Screening Procedure:

- TFW excerpts - selected.
- Main topic of TFW excerpt - identified (w/ bulleted main points).
- Matrix of TFW topics compared to CSD categories – Candidate PSP-to-CSD combinations identified (using dichotomous choices).
- TFW topic main points vs. CSD category concepts – compared for relative matches.
- TFW topic vs. CSD category – final match selected (per main points vs. concepts matching).
- TFW topics/main points vs. CSD category/concepts comparison – identify qualitative similarities and differences.
- TFW topics/main points vs. CSD category/concepts comparison – rank qualitative differences using relative scale.

D.1.2 Model Categories and Concepts vs. TFW Program Topics and Main Points – Matrix Comparison Factors:

TFW Agreement (1987)

- Archaeological and cultural goals
- Archaeological resources definition
- Cultural resources definition
- Archaeological and cultural commitment
- Archaeological and cultural resource information
- Private landowner meeting
- Agreed upon process (FPA issues)

WAC 222-20-120 (1987)

- Cultural resources- notify tribes
- Private landowner meeting
- Private landowner plan - completed
- DNR “may” condition FPA (per plan)

Forests and Fish Report (1999)

- Watershed assessment – cultural module
- Funding – state agency
- Miscellaneous – cultural resources

TFW-FFR “Cultural Resources Protection and Management Plan (CRPMP)”

- Plan purpose
- Implementation principles
- Cultural resources definition
- Confidentiality
- Small forest landowners
- Memorandum of understanding
- Educational program
- DNR role and program
- DAHP role and program

- Biannual reviews
- Cultural module
- Forest Practices Application – questions/instructions
- WAC 222-20-120 guidance
- Forest practices rule adjustment/revision
- FPA evaluation/inventory obligations
- Tribal access assurances
- DNR authority – limitability (clarity)
- DNR decisions and programs consistency
- SEPA guidance
- SEPA “off-ramp”

**TFW Cultural Resources Roundtable
FY2016 Work Plan**

- WAC 222-20-120 – variable interpretations
- DNR: FPA conditioning authority
- FPB-Roundtable relationship
- Government-to-Government correspondence
- FPA processing – DNR v DAHP (flowcharts)
- Operational consensus-communications
- FPA conditioning issues – resolution
- DNR authority – limitability (legal)
- TFW Agreement – recommitment
- Cultural resource: public resource elements (and legislation)
- Forest Practices Board manual – cultural resources section
- Cross-training opportunities
- TFW stakeholder training – tribal “cultural resources contact for forest practices” endorsed/delivered.
- WAC 222-20-120 survey
- CRPMP survey
- CRPMP biennial review
- TFW-FFR cultural programs – evaluation
- TFW-FFR cultural programs – funding adequacy/options

D.2 Cultural Program Planning or Design Screening via CSD Categories

E.g. PROGRAM PRE-PLANNING – Using CSD Categories (incl. suggested order)

- 1) Accumulated knowledge
- 2) Who decides amount of protecting or restoring
- 3) Who decides what for who
- 4) Arrays vs. specific service categories, standards and expectations
- 5) Common vs. diverse needs, imperatives and strategies
- 6) Socioecologic system foundations and expressions
- 7) Social meaning and relevance of the biophysical environment
- 8) Knowing how to respect, use and manage
- 9) Responsible natural resource stewardship and duties
- 10) Environmental relationships and components
- 11) Dependence on biophysical conditions and use
- 12) Dimensions of relevance and use

- 13) Importance of use
- 14) Embodiment and expression of natural resources meaning
- 15) Cultural stability vs. social-spatial-temporal multidimensional changes
- 16) Essential conditions at-risk
- 17) Using and respecting natural resources as gifts
- 18) What available for use
- 19) What being used in what amounts
- 20) What kind of uses by who
- 21) What uses prevail
- 22) What needs restoring

D.3 Cultural Program Planning or Design Screening via CSD Key Concepts

D.3.1 PROGRAM PRE-PLANNING – Using CSD Key Concepts

Accumulated Knowledge

- Cultural mapping (Nicholas, 2012, p. 317).
- Creating consensual maps to portray cultural values (McLain et al., 2013, p. 660).
- Cultural landscape research (Schaich et al., 2010, p. 272).
- Using interviews to collect data (Amberson, 2013, p. 8).

Social Meaning and Relevance of the Biophysical Environment

- Cultural benefits of specific lands and waters (Nelson, 2008, p. 323) (J. P. Thomas, 1995a).
- Spatial indices of social value (Bryan et al., 2010, p. 119).
- Sensitivities of local sites (Nelson, 2008, p. 327).
- Social-ecological hotspots (Gregory & Trousdale, 2011); (Sherrouse et al., 2011, p. 751).

Common vs. Diverse Needs and Imperatives

- Enhancing livelihood opportunities (McLain et al., 2013, p. 654).
- Fishing and hunting opportunities (Burger, 2010, p. 141).
- Environmental justice (Ernstson, 2013, p. 9).
- Conduct individual vs. focus group interviews as being complementary (M. D. Kaplowitz & Hoehn, 2001, pp. 237, 243 and 245).

Cultural Stability vs. Social-Spatial-Temporal Multidimensional Change

- Attributes of tribal Well-Being (Amberson, 2013, p. 28).
- Nourish the soul (Donatuto et al., 2011, p. 103).
- Tribal sacred ground and cultural resources (Burger, 2008, pp. 1262-1263).
- Tribal community health frameworks (Viles, 2013, p. 2).

Dimensions of Relevance and Use

- Natural resource values are included as entry points when conducting interviews (MacDonald et al., 2013, p. 4).
- Local plant and animal species/health changes (Gregory & Trousdale, 2011, p. 2474).
- Significance of natural resource Socio-cultural values (Daniel et al., 2012, p. 8814).
- Managing resources in culturally-appropriate ways (Ranco, O'Neill, Donatuto, & Harper, 2011, p. 221).

Knowing how to respect-use-manage

- Indigenous community and environmental health knowledge frameworks (Viles, 2013, pp. 1-2).
- Integrated socioeconomic and biophysical data (Sherrouse et al., 2011, p. 756).
- Indigenous health indicators (Donatuto et al., 2011, p. 111).
- Landscape ecological knowledge (Opdam, 2009, p. 1039).
- Landscape values typologies (Fagerholm et al., 2011).
- Intergenerational knowledge exchange (McLain et al., 2013, p. 654).
- Sense of place mapping (McLain et al., 2013, p. 652).
- Mapping and analysis training (McLain et al., 2013, p. 662).

Using and Respecting Natural Resources as Gifts

- Co-managing cultural and natural significance of the same place (Tengberg et al., 2012, p. 17).
- Changes to the local environment (Gregory & Trousdale, 2011, p. 2472).
- Access to and quality of cultural resources³² (Thomas 2015?).
- Addressing the cultural significance of altered or heavily managed ecosystems (Daniel et al., 2012, p. 8814).
- Culturally-distinct stewardship methods and paths (Ranco et al., 2011, p. 226).
- Decision-making procedures being what shapes biophysical processes (Ernstson, 2013, p. 8).
- Affording wanted tribal opportunities (Nelson, 2008, p. 327).
- Applying indigenous ecological knowledge to restoration (Sangha et al., 2011, p. 939).

What Being Used in What Amounts

- Cultural services (Schaich et al., 2010, p. 269).
- Cultural as compared to scientific indicator measurements (Tipa, 2009, p. 105).
- Types of cultural services (Schaich et al., 2010, p. 270).
- Cultural opportunities (Nelson, 2008, p. 326).
- Activities distinctive to native people (Gregory & Trousdale, 2011, p. 2472).

What Uses Prevail

- Comparing stakeholder issues to management options effects (K. A. Chan et al., 2012b, p. 745).
- Stakeholder preferences (Daniel et al., 2012, p. 8816).
- Optimizing stakeholders power to influence what happens (Reed et al., 2009, p. 1947).
- Stakeholder analysis methods (Reed et al., 2009, p. 1933 and 1936).

D.3.2 Using CSD Key Concepts – Scientific Journal Sources

1. Brown and Nicholas (2012) **Protecting indigenous cultural property in the age of digital democracy: institutional and communal responses to Canadian first nations and Maori heritage concerns.** *Journal of Material Culture.* **17**(3): 307-324. Cultural mapping.
2. McLain, Rebecca et al. (2013) **Making sense of human ecology mapping: an overview of approaches to integrating socio-spatial data into environmental planning.** *Hum Ecol.* **41**: 651-665. Creating consensual maps to portray cultural values.
3. Schaich, Harald et al. (2010) **Linking ecosystem services with cultural landscape research.** *GAIA.* **19**(4): 269-277. Cultural landscape research.
4. Amberson, Sophia (2013) **The heartbeat of our people: how blueback sockeye salmon influences tribal well-being.** University of Washington/School of Marine Affairs – Master’s Thesis. 2013. Using interviews to collect data.
5. Tipa and Nelson (2008) **Introducing cultural opportunities: a framework for incorporating cultural perspectives in contemporary resource management.** *Journal of Environmental Policy and Planning.* **10**(4): 313-337. Cultural benefits of specific lands and waters.
6. Bryan, Brett et al. (2010) **Targeting the management of ecosystem services based on social values: where, what and how?** *Landscape and Urban Planning.* **97**: 111-122. Spatial indices of social value.
7. Tipa and Nelson (2008) **Introducing cultural opportunities: a framework for incorporating cultural perspectives in contemporary resource management.** *Journal of Environmental Policy and Planning.* **10**(4): 313-337. Sensitivities of local sites.
8. Alessa Lilian et al. (2008) **Social-ecological hotspots mapping: a spatial approach for identifying coupled social-ecological space.** *Landscape and Urban Planning.* **85**: 27-39. Social-ecological hotspots
9. Sherrouse, Benson C. et al. (2011) **A GIS application for assessing, mapping and quantifying the social values of ecosystem services.** *Applied Geography.* **31**: 748-760. Social-ecological hotspots.
10. McLain, Rebecca et al. (2013) **Making sense of human ecology mapping: an overview of approaches to integrating socio-spatial data into environmental planning.** *Hum Ecol.* **41**: 651-665. Enhancing livelihood opportunities.
11. Burger, Joanna (2010) **Valuation of environmental quality and eco-cultural attributes in northwestern Idaho: native Americans are more concerned than Caucasians.** *Environmental Research.* **111**: 136-142. Fishing and hunting opportunities.
12. Ernstson, Henrik (2013) **The social production of ecosystem services: a framework for studying environmental justice and ecological complexity in urbanized landscapes.** *Landscape and Urban Planning.* **109**: 7-17. Environmental justice opportunities.
13. Kaplowitz and Hoehn (2001) **Do focus groups and individual interviews reveal the same information for natural resource valuation?** *Ecological Economics.* **36**: 237-247. Conduct individual vs. focus groups as being complementary.
14. Amberson, Sophia (2013) **The heartbeat of our people: how blueback sockeye salmon influences tribal well-being.** University of Washington/School of Marine Affairs – Master’s Thesis. 2013. Attributes of tribal Well-Being.
15. Donatuto, Jaime et al. (2011) **Poisoning the body to nourish the soul: prioritizing health risks and impacts in a Native American community.** *Health, Risk and Society.* **13**(2): 103-127. Nourish the Soul.
16. Burger?? (??) Tribal sacred ground and cultural resources.
17. Viles, Carson (2013) **Correlation and climate sensitivity of human health and environmental indicators in the Salish Sea.** Tribal community health frameworks.
18. MacDonald, Darla Hatton et al. (2013) **An interview methodology for exploring the values that community leaders assign to multiple landscapes.** *Ecology and Society.* **18**(1): 29. Natural resource values are included as entry points when conducting interviews.
19. Gregory and Trousdale (2009) **Compensating aboriginal cultural losses: an alternative approach to assessing environmental damages.** *Journal of Environmental Management.* **90**: 2469-2479. Local plant and animal species/health changes.
20. Daniel, Terry C. et al. (2012) **Contributions of cultural services to the ecosystem services agenda.**

- PNAS*. **109**(23): 8812-8819. Significance of natural resource Socio-cultural values.
21. Ranco, Darren J. et al. (2011) **Environmental justice, American Indians and the cultural dilemma: developing environmental management for tribal health and Well-Being**. *Environmental Justice*. **4**(4): 221-230. Managing resources in culturally-appropriate ways.
 22. Viles, Carson (2013) **Correlation and climate sensitivity of human health and environmental indicators in the Salish Sea**. Indigenous community and environmental health knowledge frameworks.
 23. Sherrouse, Benson C. et al. (2011) **A GIS application for assessing, mapping and quantifying the social values of ecosystem services**. *Applied Geography*. **31**: 748-760. Integrated socioeconomic and biophysical data.
 24. Donatuto?? (??) Indigenous health indicators.
 25. Termorshuizen and Opdam (2009) **Landscape services as a bridge between landscape ecology and sustainable development**. *Landscape Ecol*. **24**: 1037-1052. Landscape ecological knowledge.
 26. Fagerholm, Nora et al. (2012) **Community stakeholder's knowledge in landscape assessments: mapping indicators for landscape services**. *Ecological Indicators*. **18**: 421-433. Landscape values typologies.
 27. McLain, Rebecca et al. (2013) **Making sense of human ecology mapping: an overview of approaches to integrating socio-spatial data into environmental planning**. *Hum Ecol*. **41**: 651-665. Intergenerational knowledge exchange.
 28. McLain, Rebecca et al. (2013) **Making sense of human ecology mapping: an overview of approaches to integrating socio-spatial data into environmental planning**. *Hum Ecol*. **41**: 651-665. Sense of place mapping.
 29. McLain, Rebecca et al. (2013) **Making sense of human ecology mapping: an overview of approaches to integrating socio-spatial data into environmental planning**. *Hum Ecol*. **41**: 651-665. Mapping and analysis training.
 30. Tengberg, Anna et al. (2012) **Cultural ecosystem services provided by landscapes: assessment of heritage values and identity**. *Ecosystem Services*. **2**: 14-26. Co-managing cultural and natural significance of the same place.
 31. Gregory and Trousdale (2009) **Compensating aboriginal cultural losses: an alternative approach to assessing environmental damages**. *Journal of Environmental Management*. **90**: 2469-2479. Changes to the local environment.
 32. Thomas (2015??). Access to and quality of cultural resources.
 33. Daniel, Terry C. et al. (2012) **Contributions of cultural services to the ecosystem services agenda**. *PNAS*. **109**(23): 8812-8819. Addressing the cultural significance of altered or heavily managed ecosystems.
 34. Ranco, Darren J. et al. (2011) **Environmental justice, American Indians and the cultural dilemma: developing environmental management for tribal health and Well-Being**. *Environmental Justice*. **4**(4): 221-230. Culturally-distinct stewardship methods and paths.
 35. Ernstson, Henrik (2013) **The social production of ecosystem services: a framework for studying environmental justice and ecological complexity in urbanized landscapes**. *Landscape and Urban Planning*. **109**: 7-17. Decision-making procedures being what shapes biophysical processes.
 36. Tipa and Nelson (2008) **Introducing cultural opportunities: a framework for incorporating cultural perspectives in contemporary resource management**. *Journal of Environmental Policy and Planning*. **10**(4): 313-337. Affording wanted tribal opportunities.
 37. Sangha, K.K. et al. (2011) **Identifying links between ecosystem services and aboriginal well-being and livelihoods in north Australia: applying the millennium ecosystem assessment framework**. *Journal of Environmental Science and Engineering*. **5**: 931-946. Applying indigenous ecological knowledge to restoration.
 38. Schaich, Harald et al. (2010) **Linking ecosystem services with cultural landscape research**. *GAIA*. **19**(4): 269-277. Cultural services.
 39. Tipa, Gail (2009) **Exploring indigenous understandings of river dynamics and river flows: a case from New Zealand**. *Environmental Communication*. **3**(1): 95-120. Cultural as compared to scientific indicator measurements.
 40. Schaich, Harald et al. (2010) **Linking ecosystem services with cultural landscape research**. *GAIA*. **19**(4): 269-277. Types of cultural services.
 41. Tipa and Nelson (2008) **Introducing cultural opportunities: a framework for incorporating cultural perspectives in contemporary resource management**. *Journal of Environmental Policy and Planning*. **10**(4): 313-337. Cultural opportunities.
 42. Gregory and Trousdale (2009) **Compensating aboriginal cultural losses: an alternative approach to assessing environmental damages**. *Journal of Environmental Management*. **90**: 2469-2479. Activities distinctive to native people.
 43. Chan, Kai et al. (2012) **Where are cultural and social in ecosystem services? a framework for constructive engagement**. *BioScience*. **62**(8): 744-756. Comparing stakeholder issues to management options effects.
 44. Daniel, Terry C. et al. (2012) **Contributions of cultural services to the ecosystem services agenda**. *PNAS*. **109**(23): 8812-8819. Stakeholder preferences.
 45. Reed, Mark S. et al. (2009) **Who's in and why? a typology of stakeholder analysis methods for natural resource management**. *Journal of Environmental Management*. **90**: 1933-1949. Optimizing stakeholder's power to influence what happens.
 46. Reed, Mark S. et al. (2009) **Who's in and why? a typology of stakeholder analysis methods for natural resource management**. *Journal of Environmental Management*. **90**: 1933-1949. Stakeholder analysis methods.