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An Ecosystem Framework for use in Recovery and Management of the Puget Sound Ecosystem: Linking Assessments of Ecosystem Condition to Threats and Management Strategies

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Linking Assessments of Ecosystem Condition to Threats and Management Strategies

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Puget Sound Partnership

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Puget Sound Partnership is using environmental indicators to track the recovery of Puget Sound

Science Panel has legislative assignment "to identify environmental indicators measuring the health of Puget Sound" (RCW 90.71.280(3)). Approved vital sign in 2010.

Leader Council adopted vital sign in 2010/2011 as surrogates of the status of the ecosystem.

Environmental indicators are tools to manage ecosystems…

What's happening?
(condition)

↓

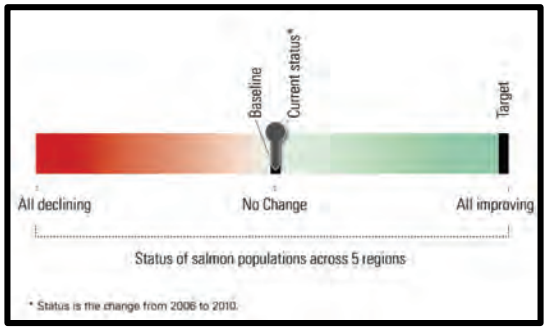
Why is it happening?
(pressures)

↓

What can be done?
(management response)

Did we fix it?

INDICATOR: **CHINOOK SALMON**

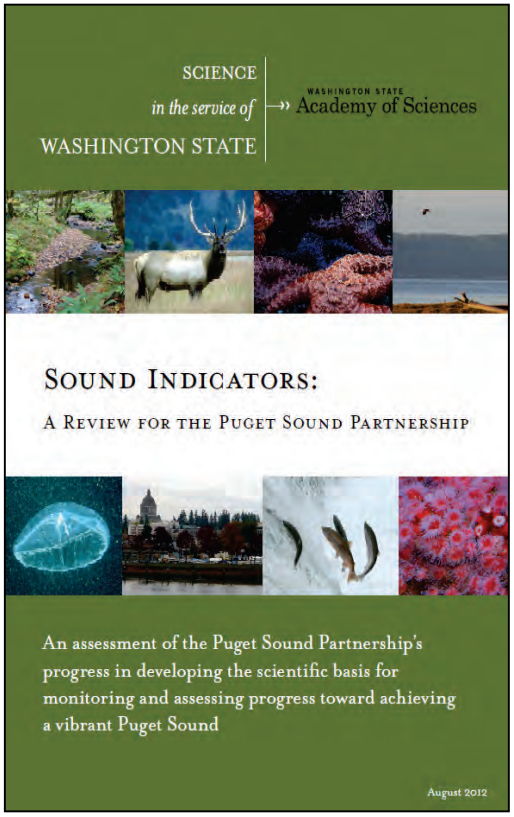


Vital Sign Indicators

- Includes indicators of condition, pressures, and management and societal responses
- Initially, intended for communication
- Now, also used for understanding and management

Recommendations to Improve Indicators

- Develop a conceptual framework of the ecosystem that summarizes its major attributes, both structural elements and processes.
- Develop new indicators for missing attributes of ecosystem condition.
- Refine existing indicators



WA State Academy of Science Review
Orians et al. 2012

Stepwise Procedure for Selecting Indicators

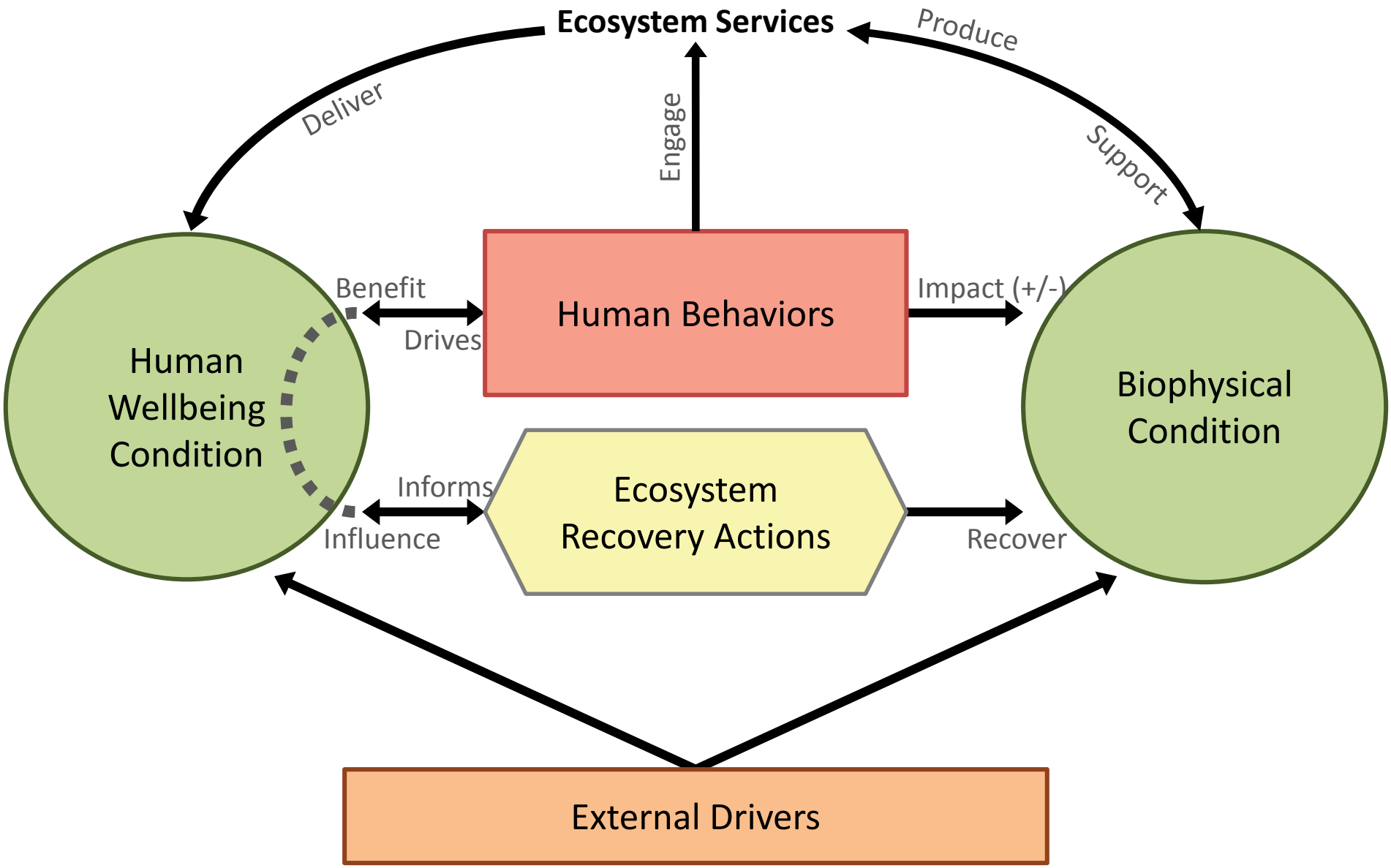
1. Develop ecosystem conceptual model and frameworks.
2. Select key ecological attributes (KEAs).
3. Identify candidate indicators that represent each KEA.
4. Evaluate reliability of each indicator & metric (criteria).
5. Select a balanced indicator portfolio.

Step 1

Develop ecosystem conceptual model & frameworks

Integrated Ecosystem Recovery Conceptual Model

DRAFT



For more information, contact Haley Harguth
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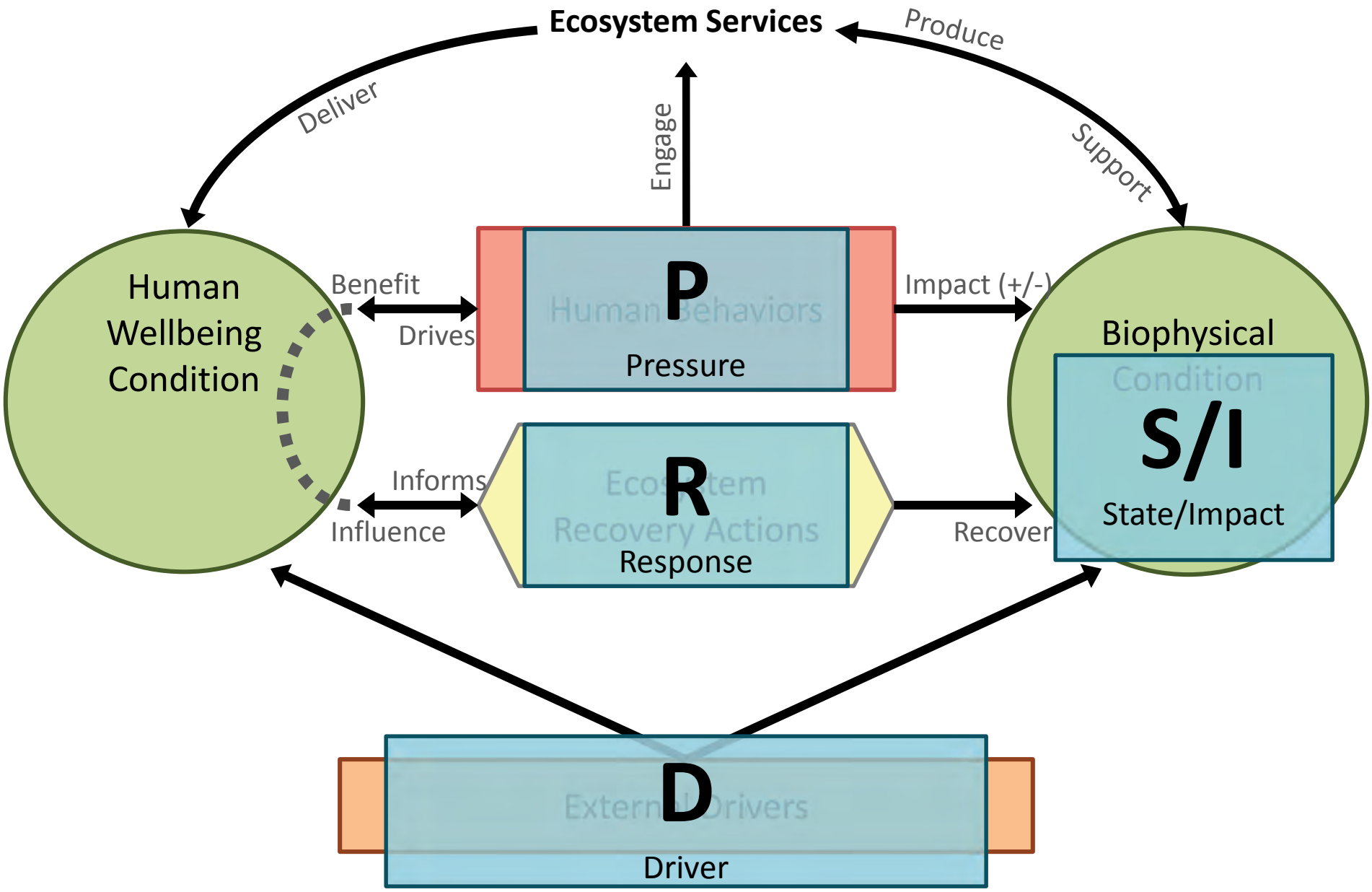
Integrated Ecosystem Recovery Conceptual Model + DPSIR

DRAFT



Integrated Ecosystem Recovery Conceptual Model

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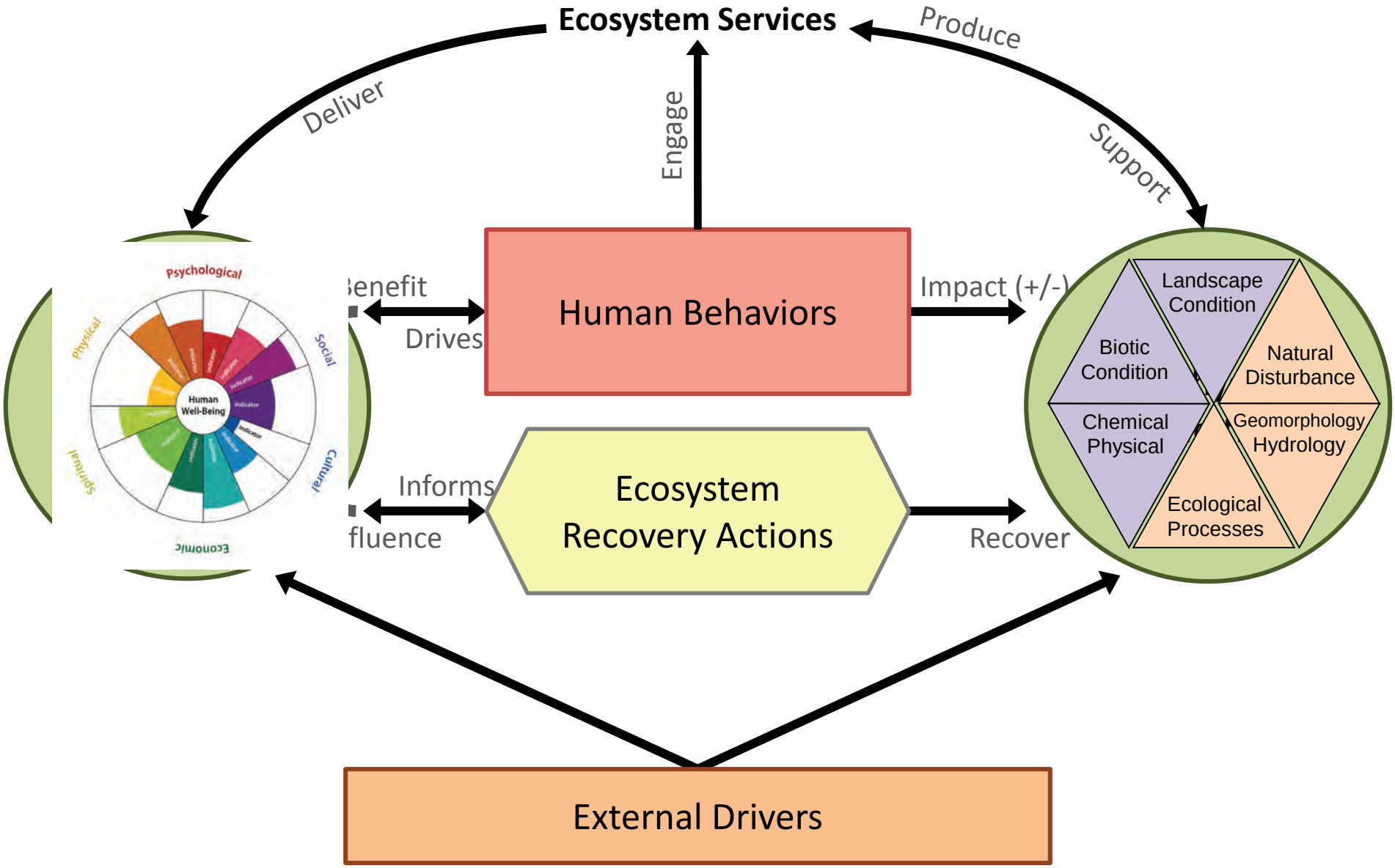

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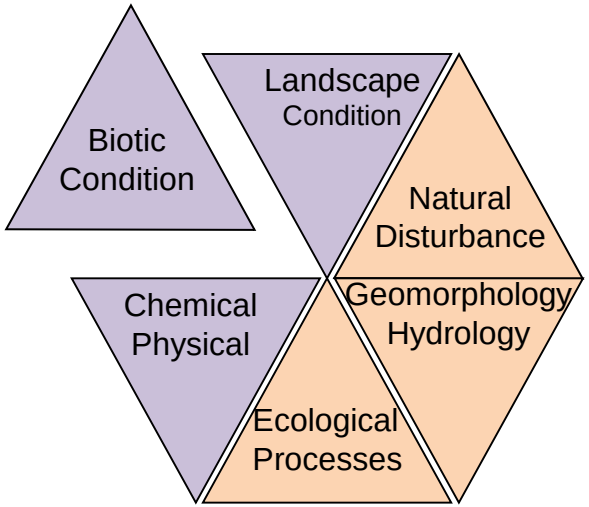
Step 2

Select key ecological attributes



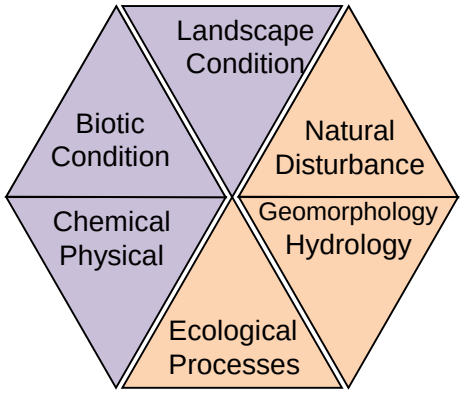
"Menu" for Evaluating Condition of Ecosystems

from EPA 2002

Biotic Condition "Menu"

- Ecosystems and Communities
  - Community Extent
  - Community Composition
  - Trophic Structure
  - Community Dynamics
  - Physical Structure
- Species and Populations
  - Population Size
  - Genetic Diversity
  - Population Structure
  - Population Dynamics
  - Habitat Suitability
- Organism Condition
  - Physiological Status
  - Symptoms of Disease or Trauma
  - Signs of disease

What are the key ecological attributes to track the condition and recovery of Puget Sound?



- Followed recommendations in the Puget Sound Science Update (2011)
- Added additional attributes recommended by the WSAS (2012)
- Confirmed proposed attributes using conceptual model and monitoring priorities identified by PSEMP work groups.

PSEMP

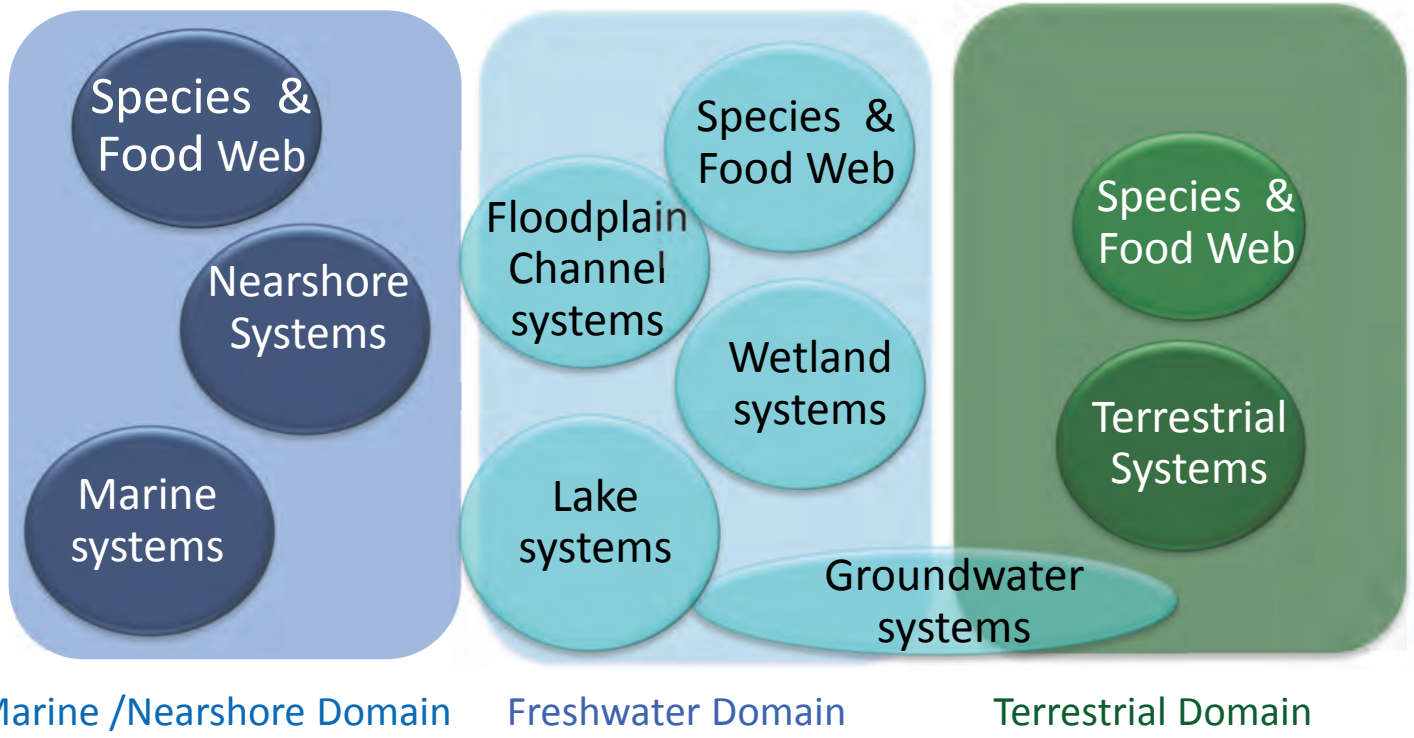
PUGET SOUND ECOSYSTEM MONITORING PROGRAM

Step 3

Identify candidate indicator for key ecological attributes

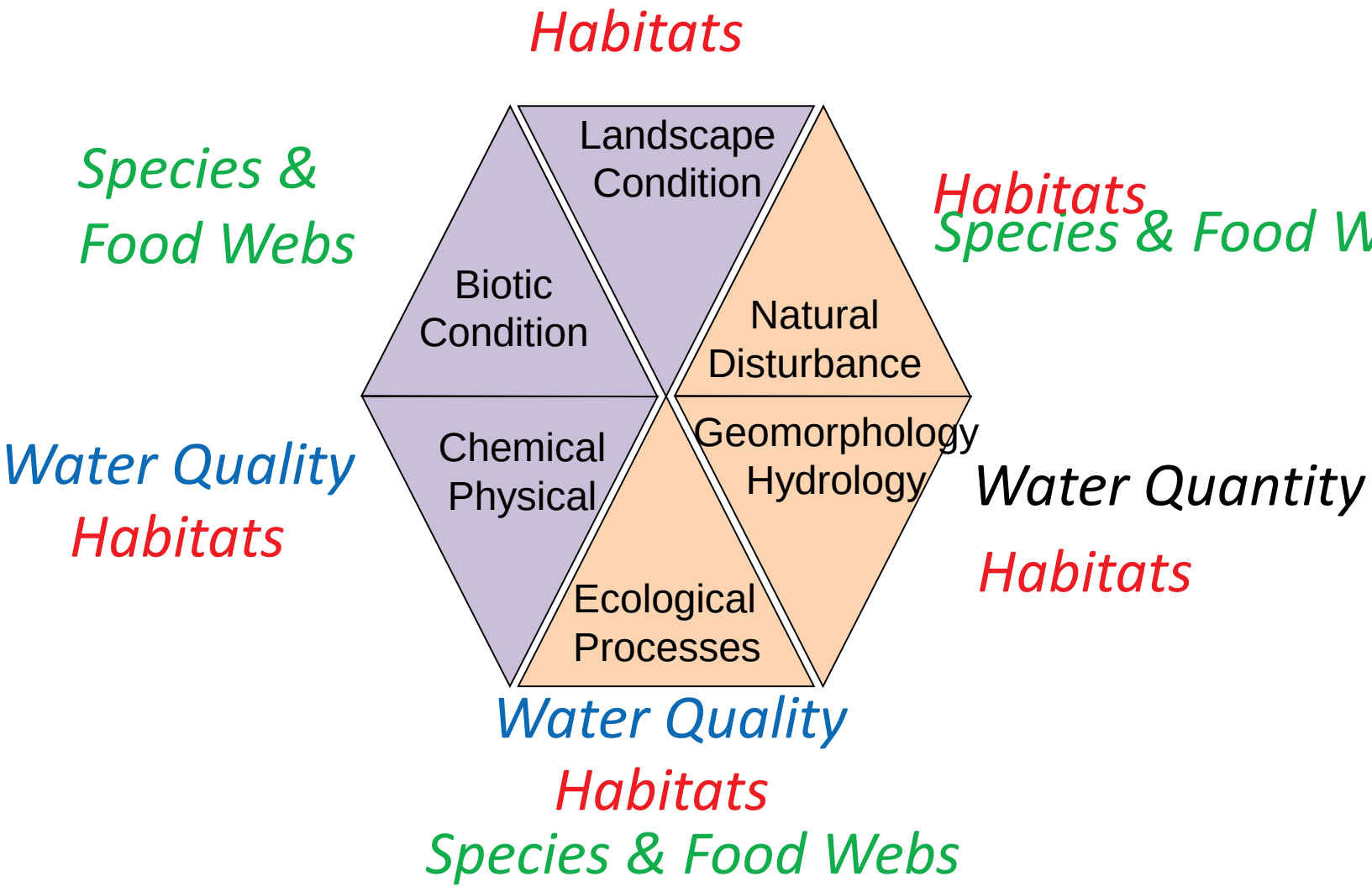
Biophysical Condition

Modified from Levin et al. 2010)



Candidate Indicator must reflect major ecosystem components

Candidate Indicator must reflect PSP Recovery Goals

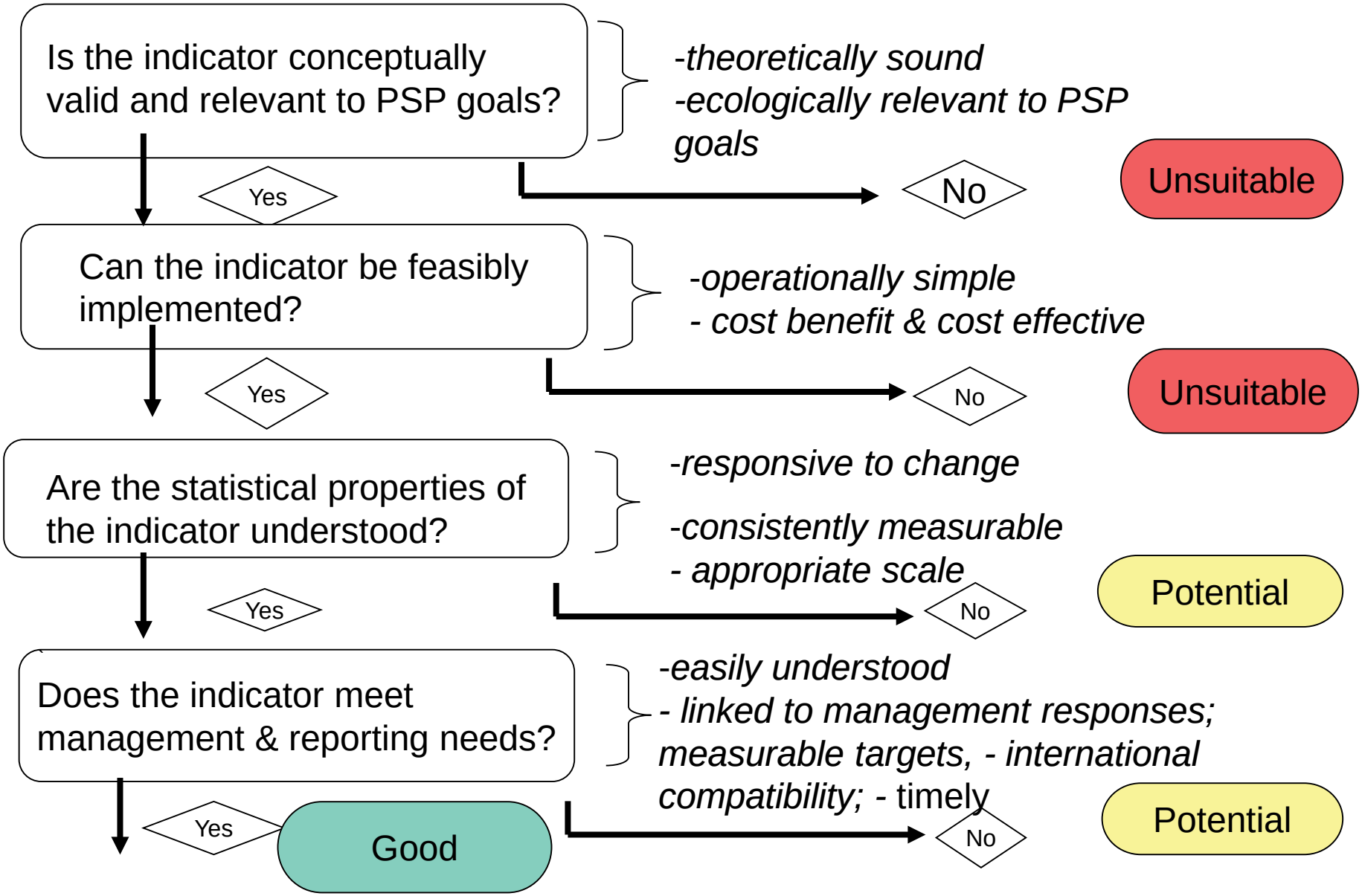


Step 4

Evaluate reliability of each indicator & metric (criteria).

Hierarchical Decision Tree for Indicator Selection

(modified from Kurtz et al. 2001)



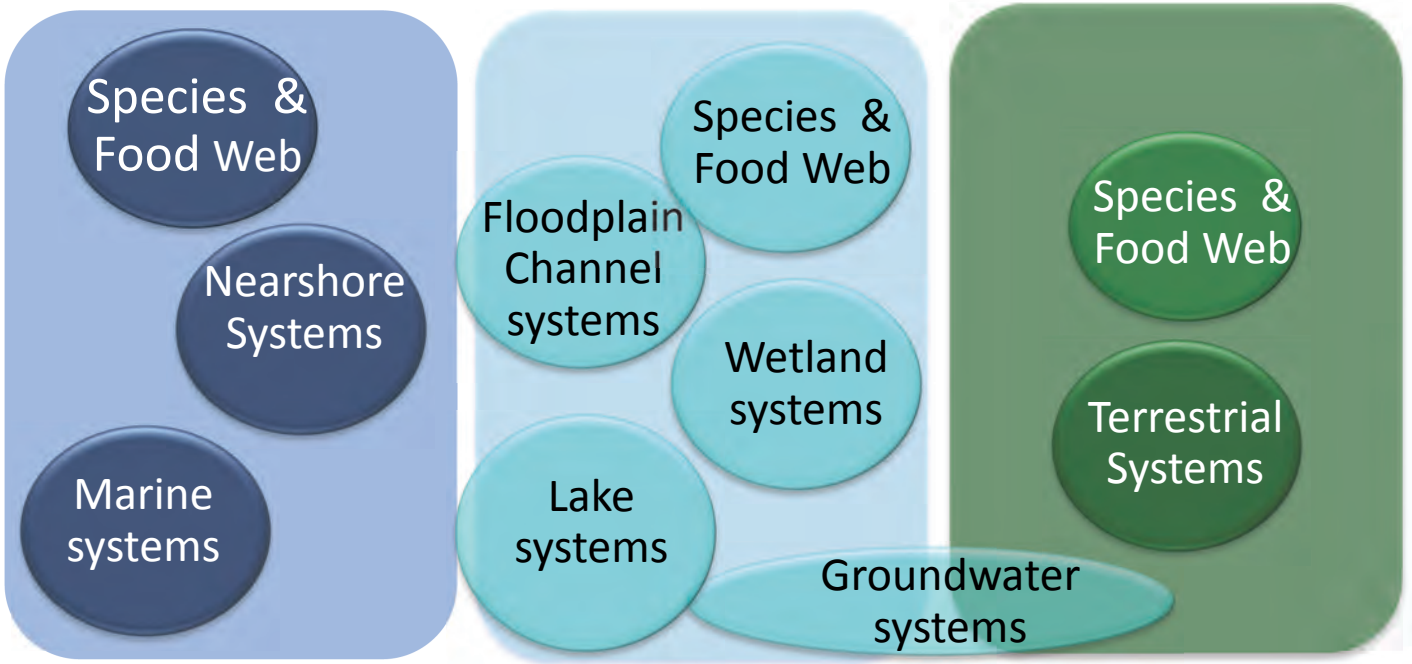
Step 5

Select a balanced indicator portfolio.

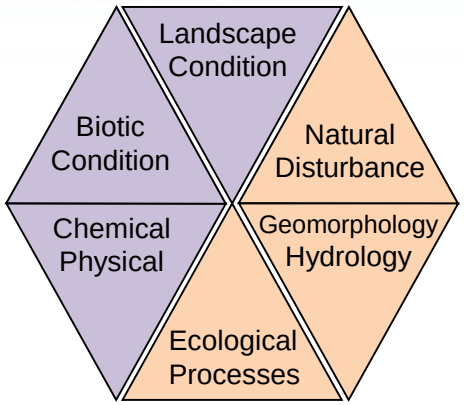
Final Portfolio must include 6 Major categories of Indicators

Biophysical Condition

Modified from Levin et al. 2010)



Essential Ecological Attributes



EPA 20002

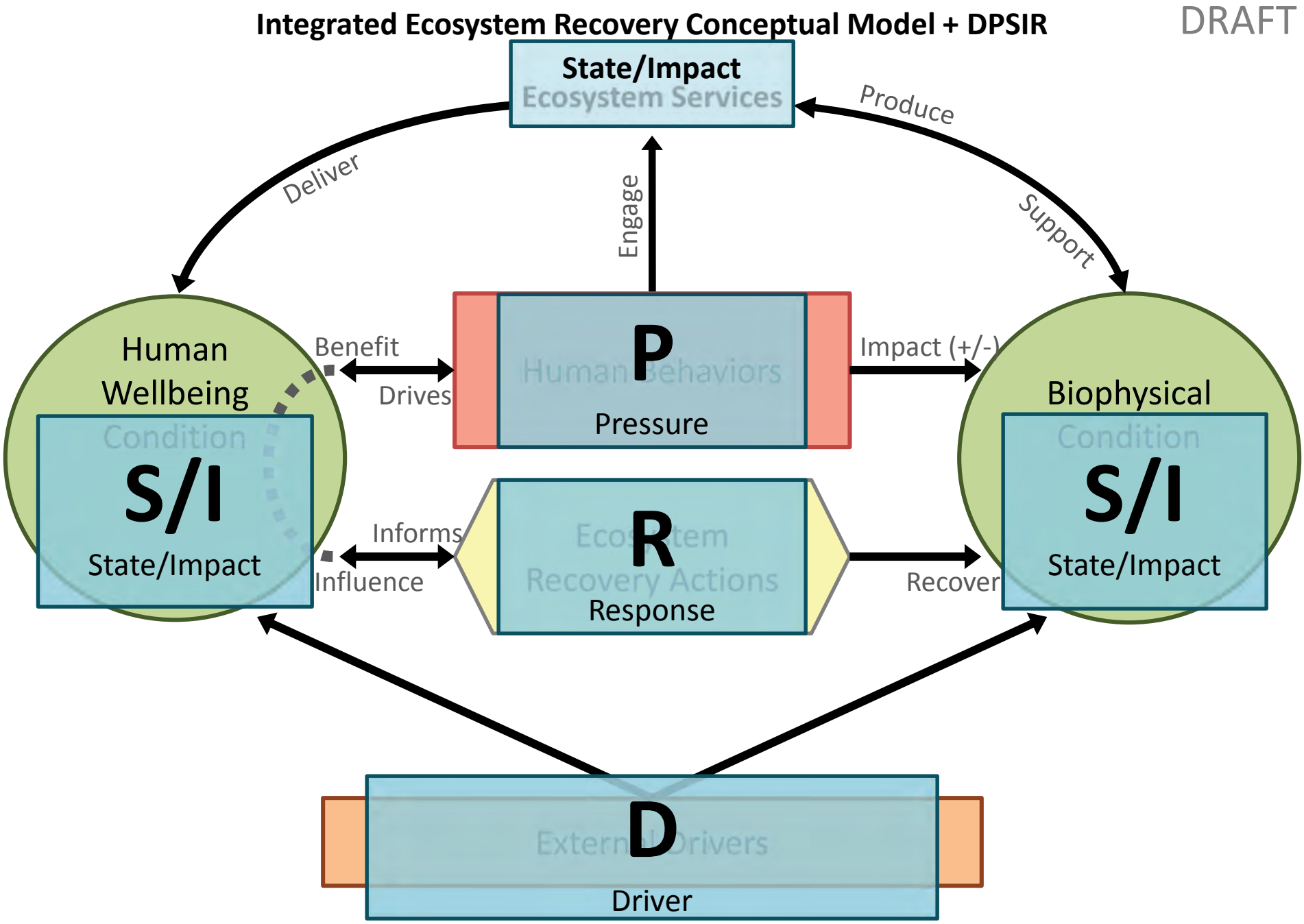
Attributes Assessed by Vital Signs

Attribute Category	Domain Marine/Nearshore	Freshwater	Terrestrial
Landscape Condition		*Floodplains*	*Land Cover (Forests)*
Biotic Condition	*Eelgrass; Pacific Herring; Chinook salmon; Birds Orcas; Toxics in Fish*	*Chinook salmon; B-IBI*	*Birds*
Physical & Chemical Characteristic	*Marine Water Quality; Marine Sediment Quality*	*Freshwater Quality*	
Hydrology & Geomorphology		*Summer Stream Slows; Floodplains*	
Ecological Processes			
Natural Disturbances			

Next Steps….

- Continue process for process of identifying candidate indicators.
- Evaluate the reliability of candidate indicators.
- Propose a more balanced portfolio of vital sign indicators.
- Peer review this summer.

END

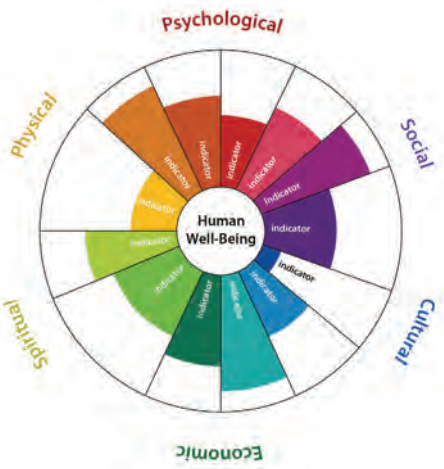

Integrated Ecosystem Recovery Conceptual Model + DPSIR
DRAFT
State/Impact
Ecosystem Services
Deliver
Produce
Engage
Support
Human
Wellbeing
Benefit
Drives
P
Human Behaviors
Pressure
Impact (+/-)
Biophysical
Condition
S/I
State/Impact
Informs
Influence
R
Ecosystem
Recovery Actions
Response
Recover
Condition
S/I
State/Impact
D
External Drivers
Driver

PSP Ecosystem Recovery Goals:

Species and Food Webs *Habitats* *Water Quality* *Water Quantity* *Human Health* *Human Well Being*

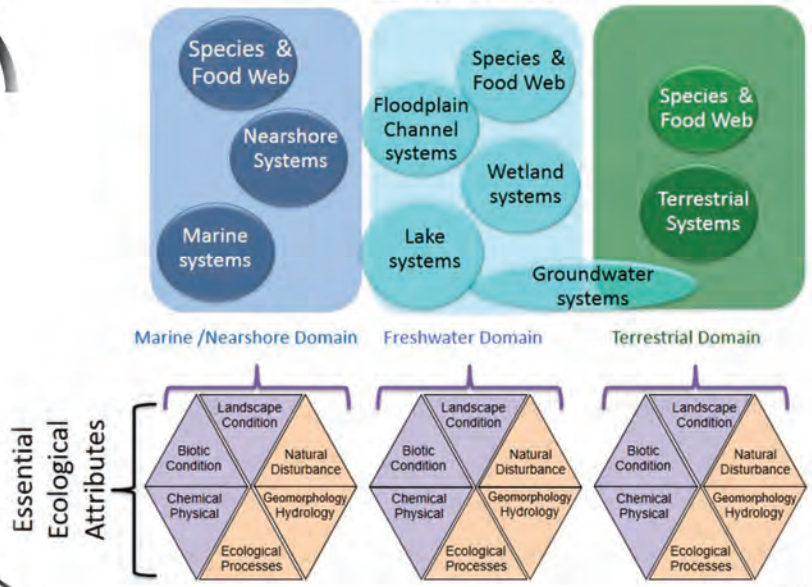
Human Well-Being Condition

(from Biedenweg et al. in press)



Biophysical Condition

(Modified from Levin et al. 2010)



Driver - Pressure - State - Impact - Response

(from Smeets & Wetering 1999)

PSP Recovery Goals & Ecological Attributes