

# Selecting and using environmental indicators to assess ecosystem state

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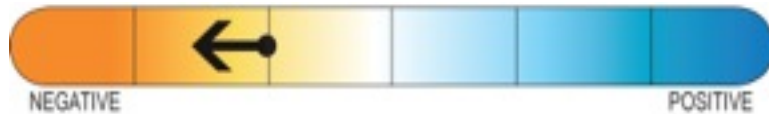
Cyberinfrastructure and Water Resources in the  
Lower Mekong Region

Hà Nội  
August 19, 2014



# The Puget Sound Partnership, by law, must use environmental indicators to track the recovery of Puget Sound

INDICATOR: **SALMON**



## Senate Bill 5272

“By July 31, 2008, the panel shall identify environmental indicators measuring the health of Puget Sound, and recommend environmental benchmarks that need to be achieved to meet the goals of the action agenda.”

Environmental indicators are tools to manage and report on ecosystems...



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# Environmental indicators are tools to manage and report on ecosystems...

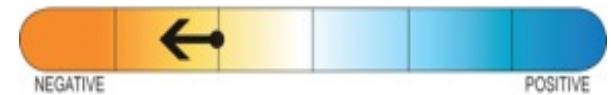
What's happening?  
(condition)



Why is it happening?  
(pressures)



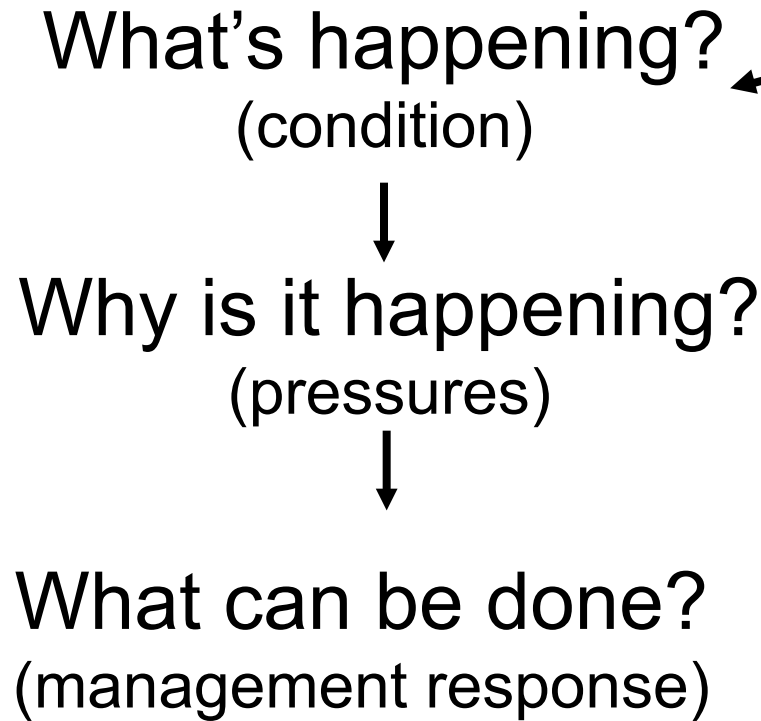
What can be done?  
(management response)



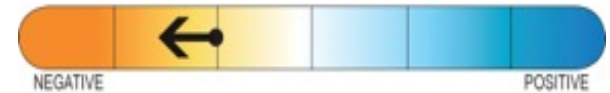
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# Environmental indicators are tools to manage and report on ecosystems...



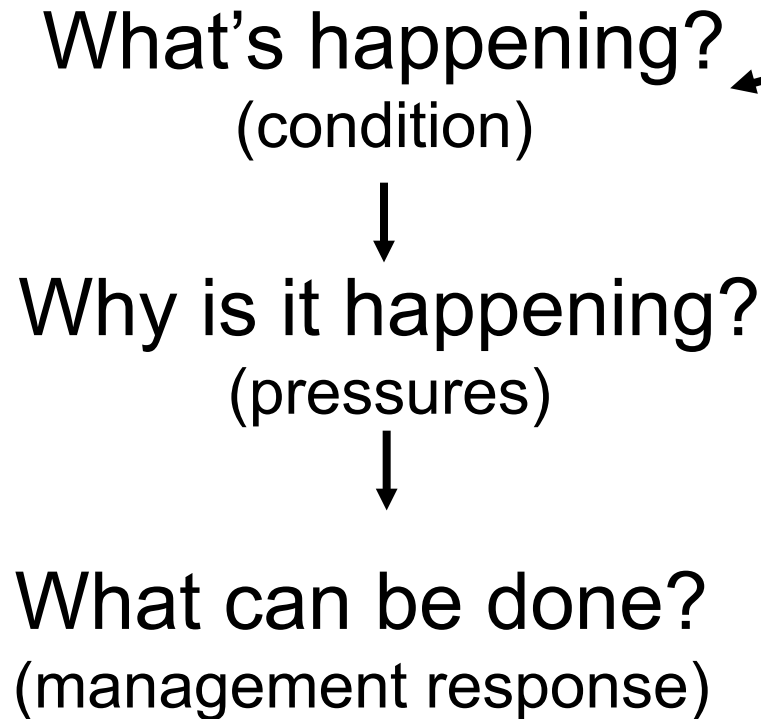
Did we fix it?



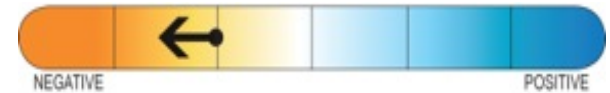
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# Environmental indicators are tools to manage and report on ecosystems...



Did we fix it?



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Environmental indicators can be used as a powerful tool to raise public awareness on environmental issues, and to strengthen support for policy measures.

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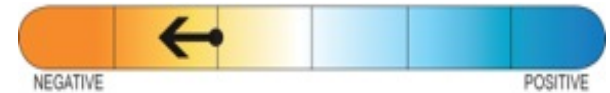


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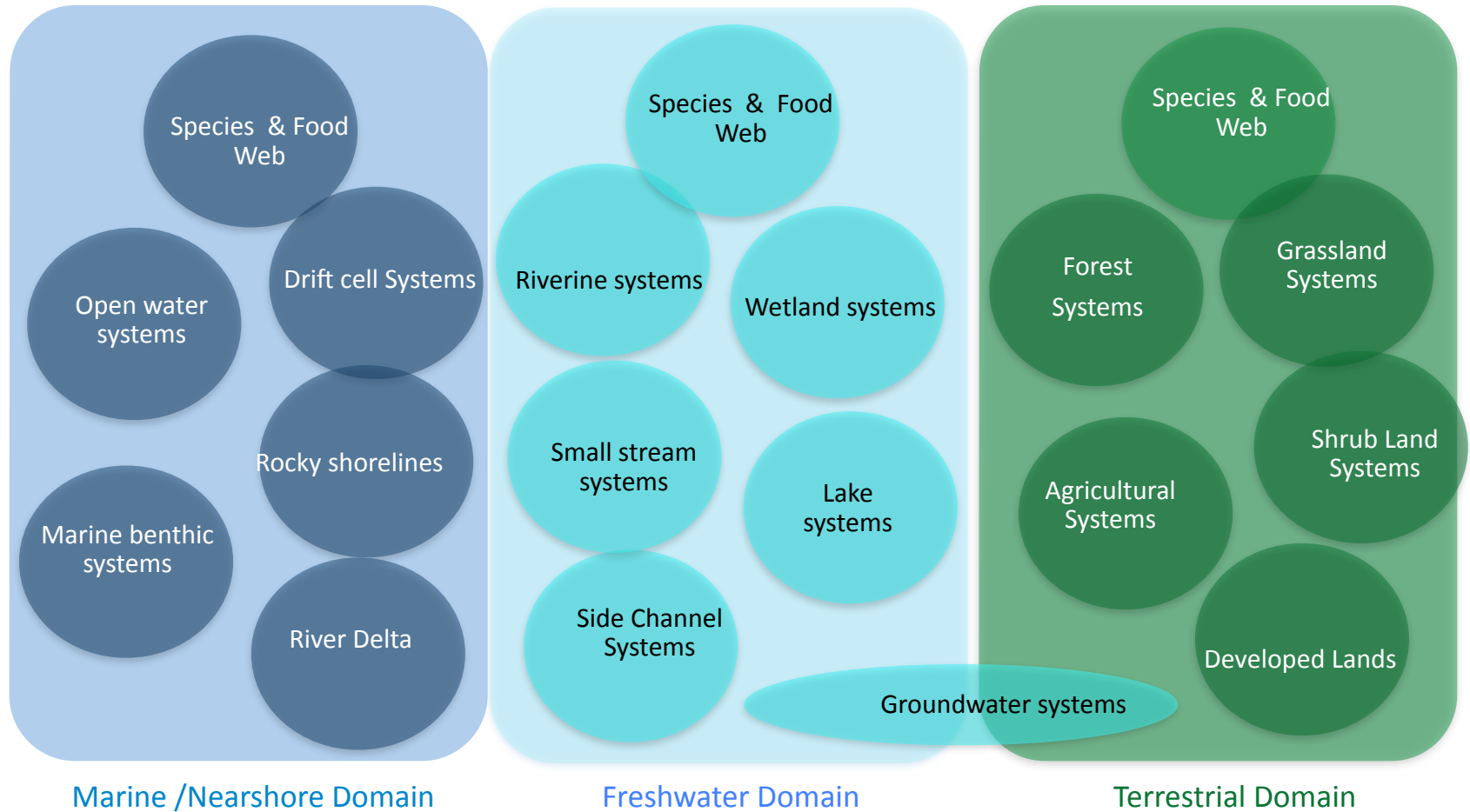
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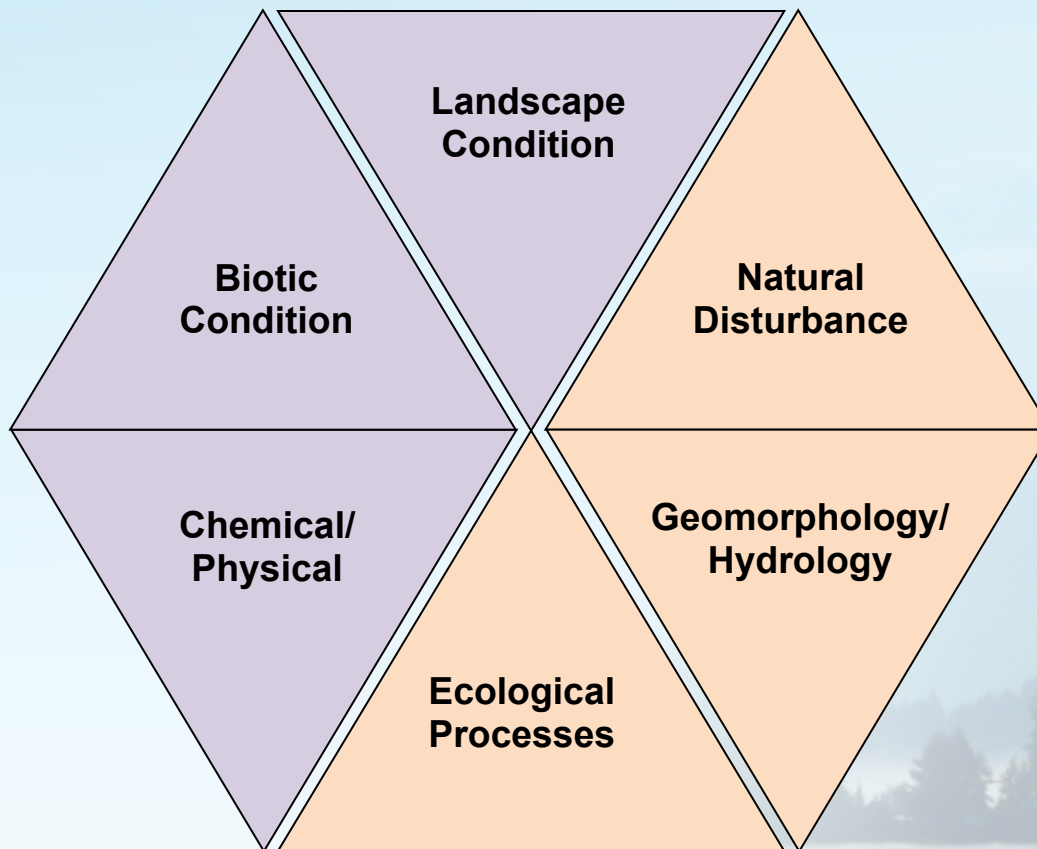
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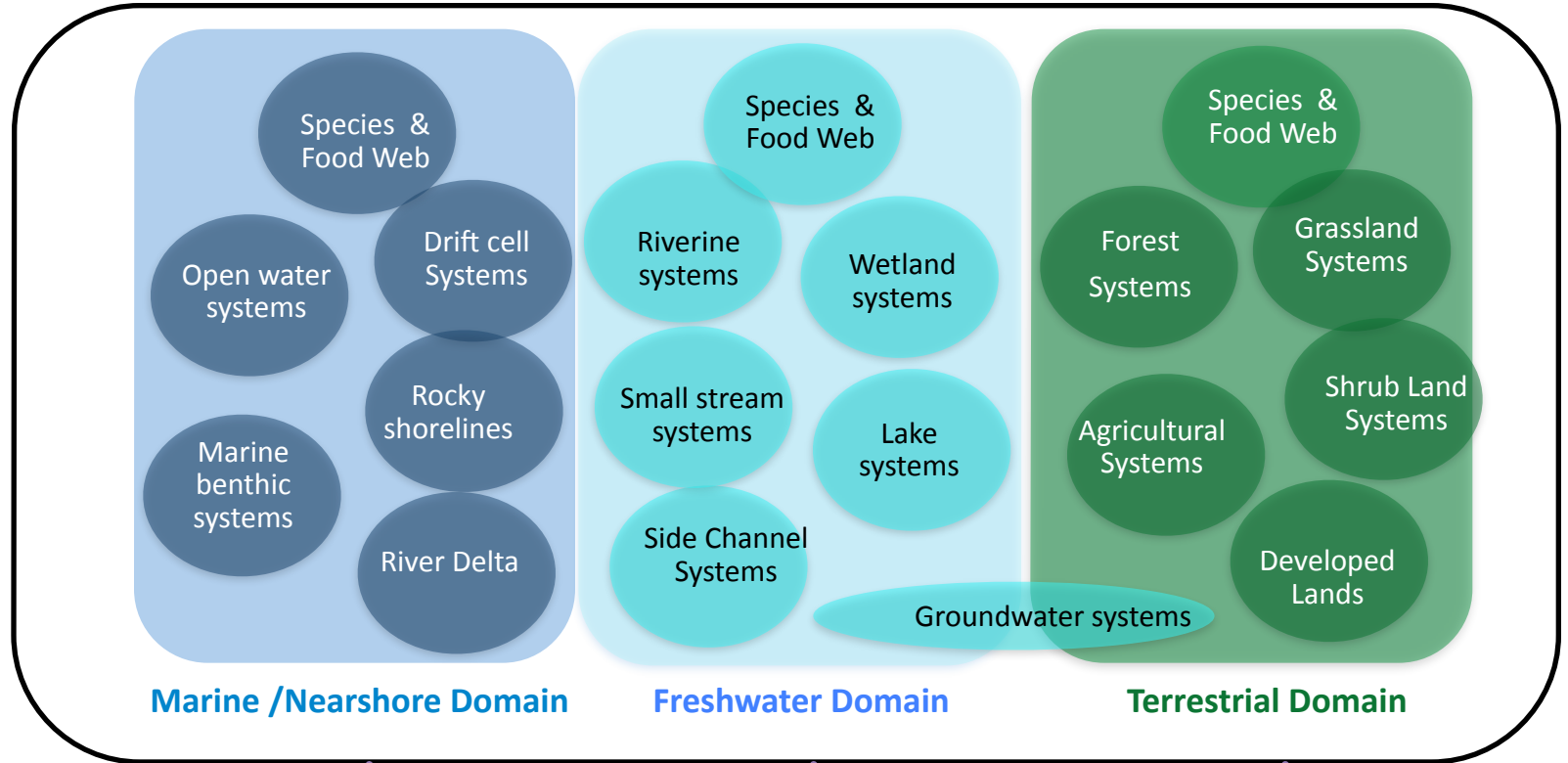
# Biophysical Condition of Ecosystems



## Essential Ecological Attributes for Assessing Biophysical Condition



# Biophysical Condition

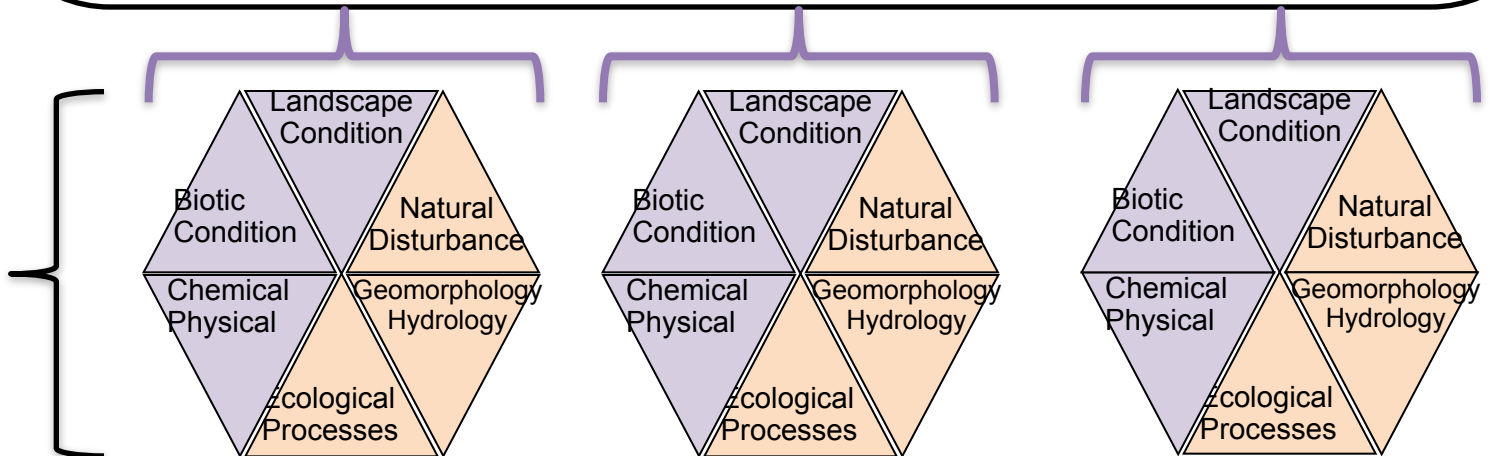


Marine /Nearshore Domain

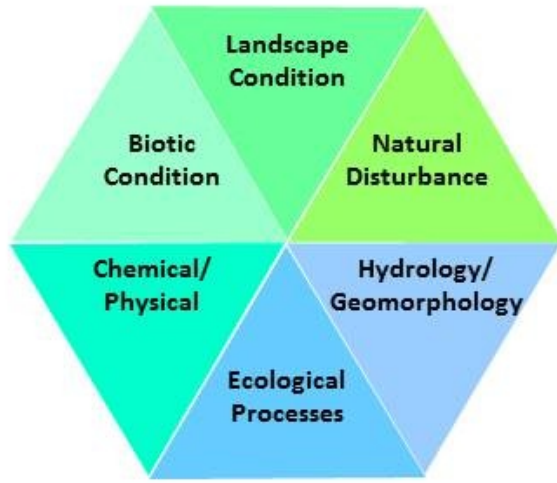
Freshwater Domain

Terrestrial Domain

Essential Ecological Attributes



## Essential Ecological Attributes (EPA 2002)



# “Menu” for Evaluating Condition of Ecosystems

### Landscape Condition

- Extent of Ecological System/Habitat Types
- Landscape Composition
- Landscape Pattern and Structure

### Biotic Condition

- 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

### Chemical & Physical Characteristics (Water, Air, Soil, and Sediment)

- Nutrient Concentrations
  - Nitrogen
  - Phosphorus
  - Other Nutrients
- Trace Inorganic and Organic Chemicals
  - Metals
  - Other Trace Elements
  - Organic Compounds
- Other Chemical Parameters
  - pH
  - Dissolved Oxygen
  - Salinity
  - Organic Matter
  - Other
- Physical Parameters

### Ecological Processes

- Energy Flow
  - Primary Production
  - Net Ecosystem Production
  - Growth Efficiency
- Material Flow
  - Organic Carbon Cycling
  - Nitrogen and Phosphorus Cycling
  - Other Nutrient Cycling

### Hydrology and Geomorphology

- Surface and Groundwater flows
  - Pattern of Surface Flows
  - Hydrodynamics
  - Pattern of Groundwater Flows
  - Salinity Patterns
  - Water Storage
- Dynamic Structural Characteristics
  - Channel/Shoreline Morphology Complexity
  - Extent/Distribution of Connected Floodplain
  - Aquatic Physical Habitat Complexity
- Sediment and Material Transport
  - Sediment Supply/Movement
  - Particle Size Distribution Patterns
  - Other Material Flux

### Natural Disturbance Regimes

- Frequency
- Intensity
- Extent
- Duration

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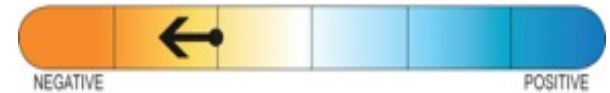


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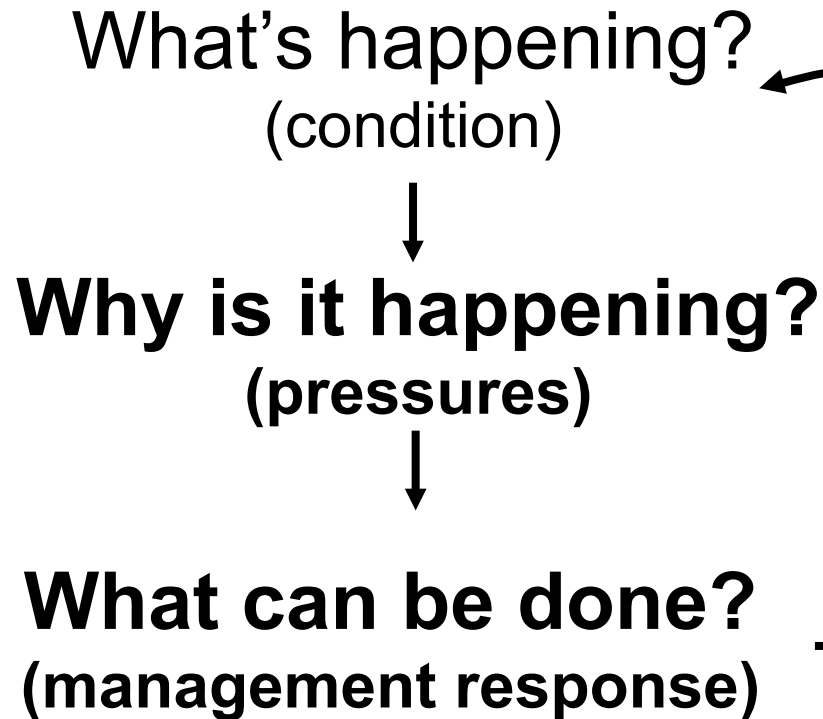


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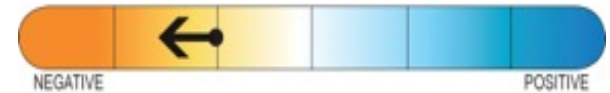


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# PSP has identified vital sign indicators to track the recovery of Puget Sound

- Some measure the condition of the system
- Some measures pressures on the system
- Some measure our management and societal responses



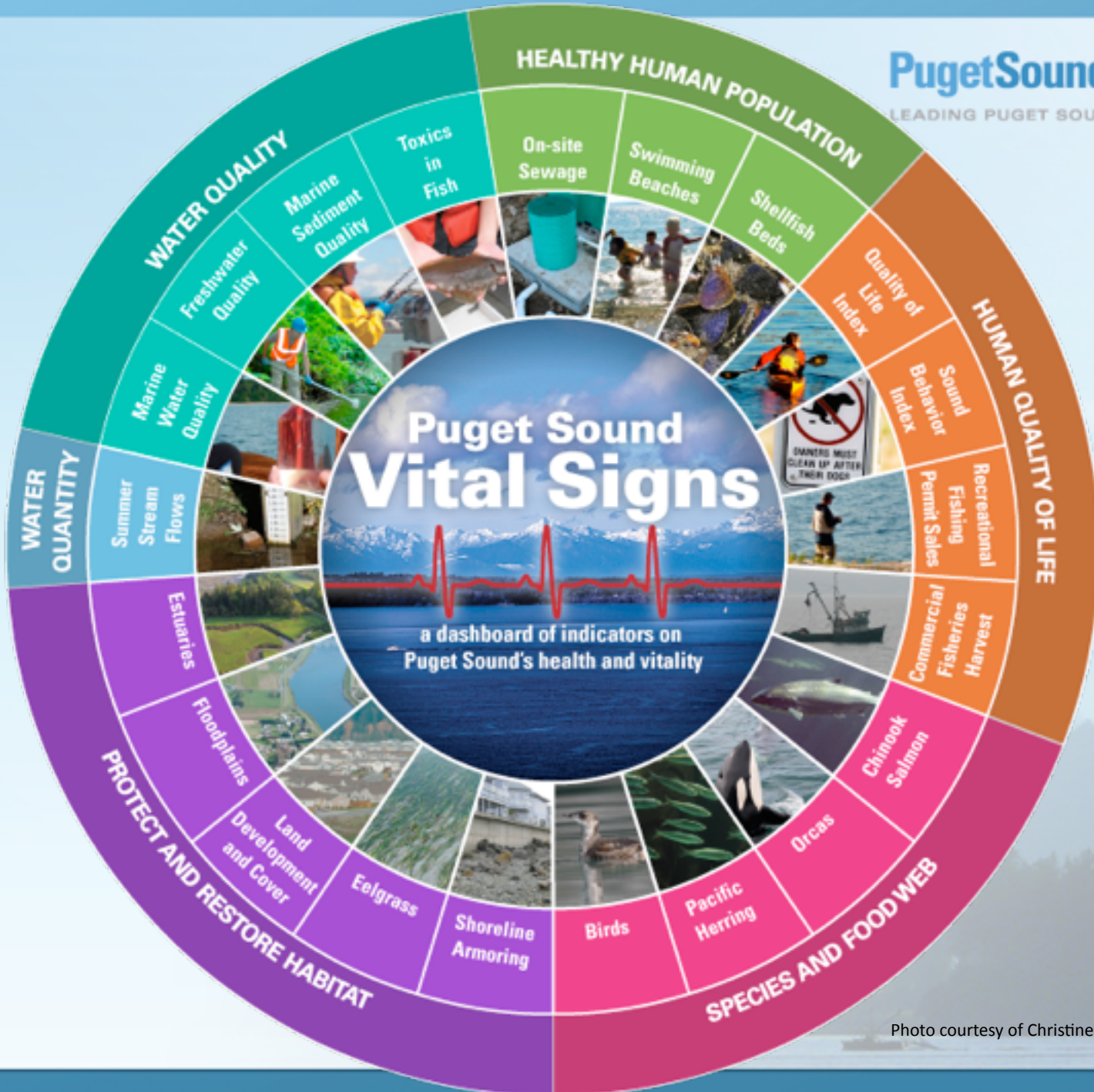
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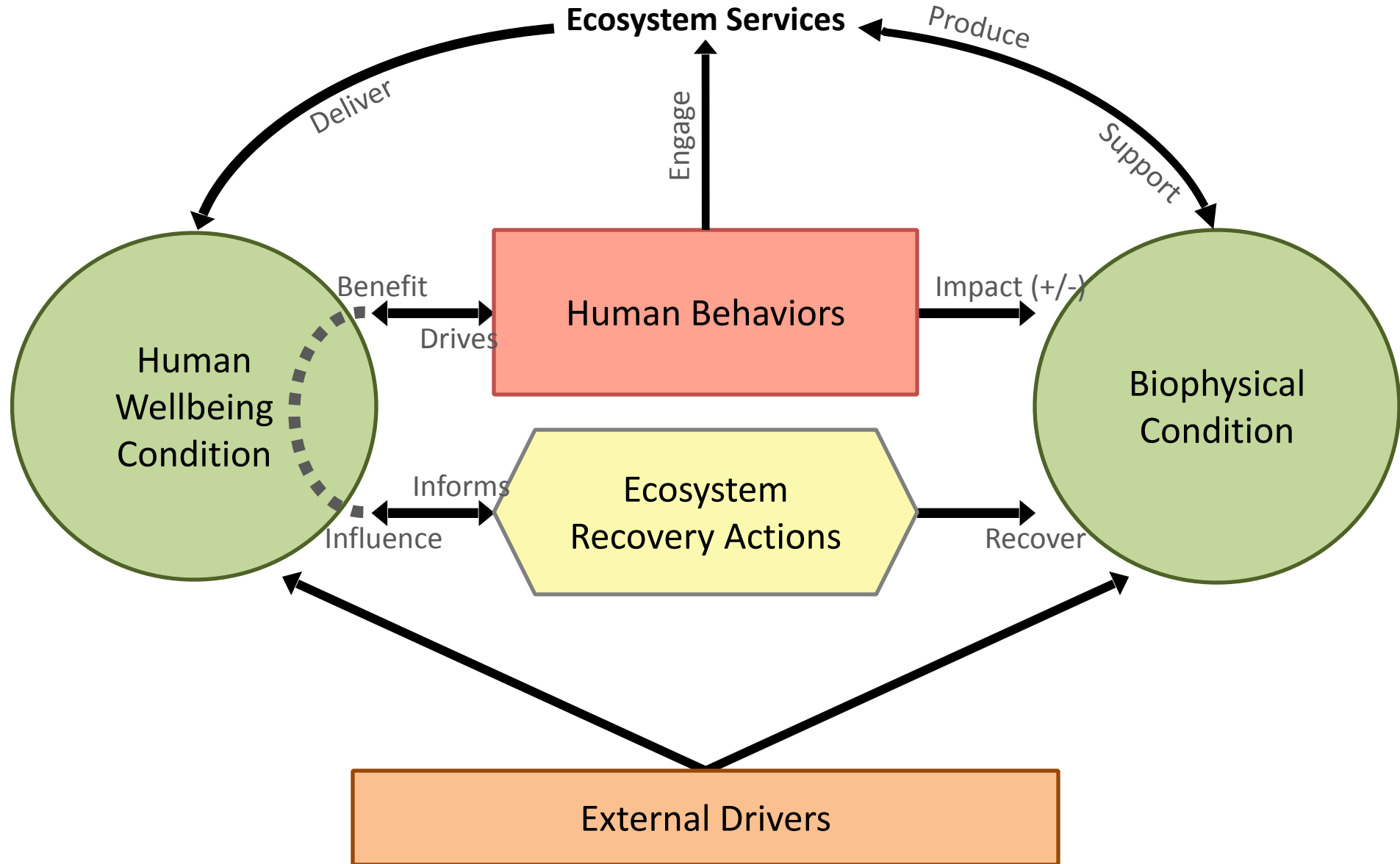
- These have become our highest priority monitoring needs, but they are not our **only** monitoring needs.





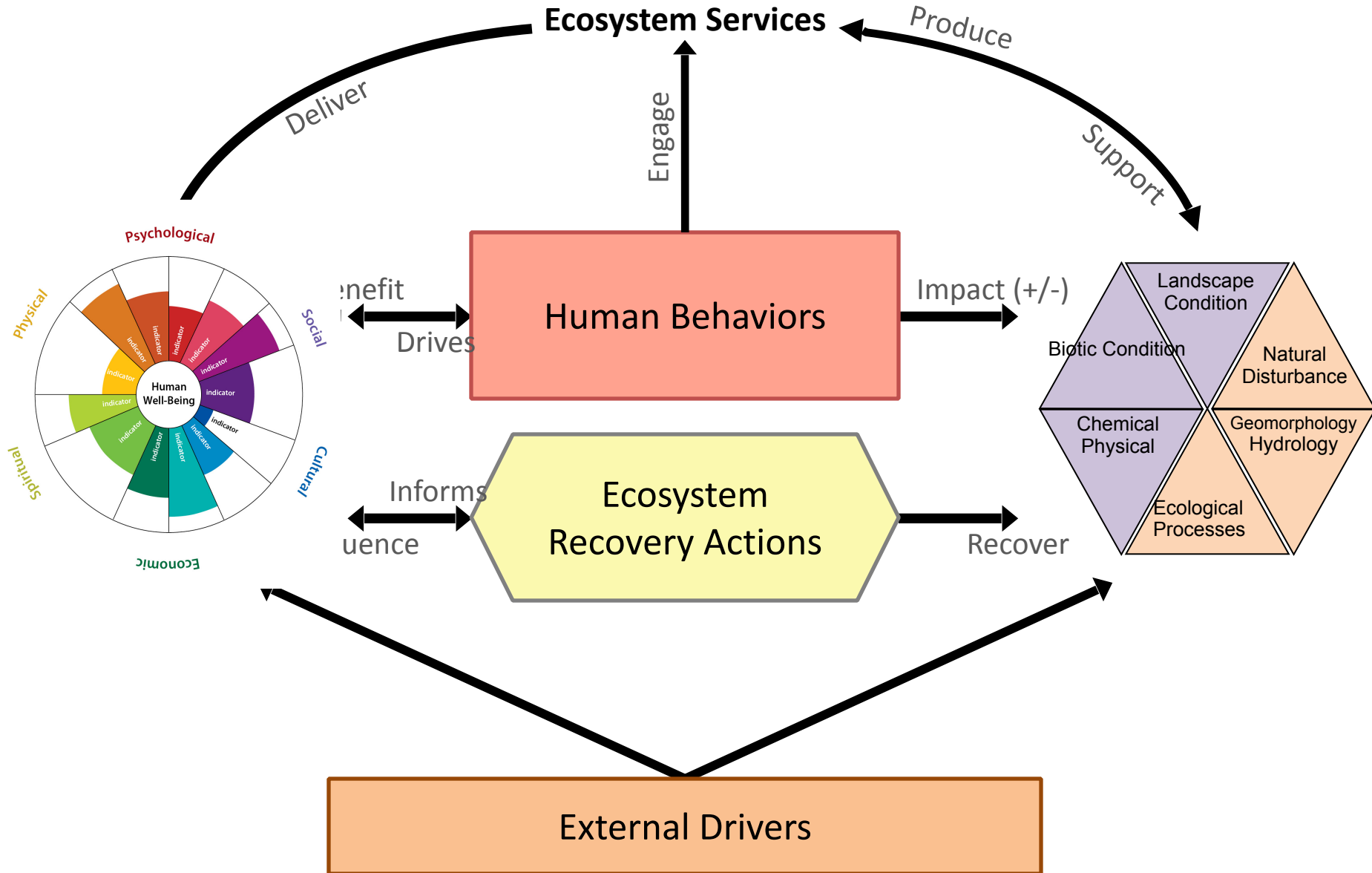
# Integrated Ecosystem Recovery Conceptual Model

DRAFT



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DRAFT



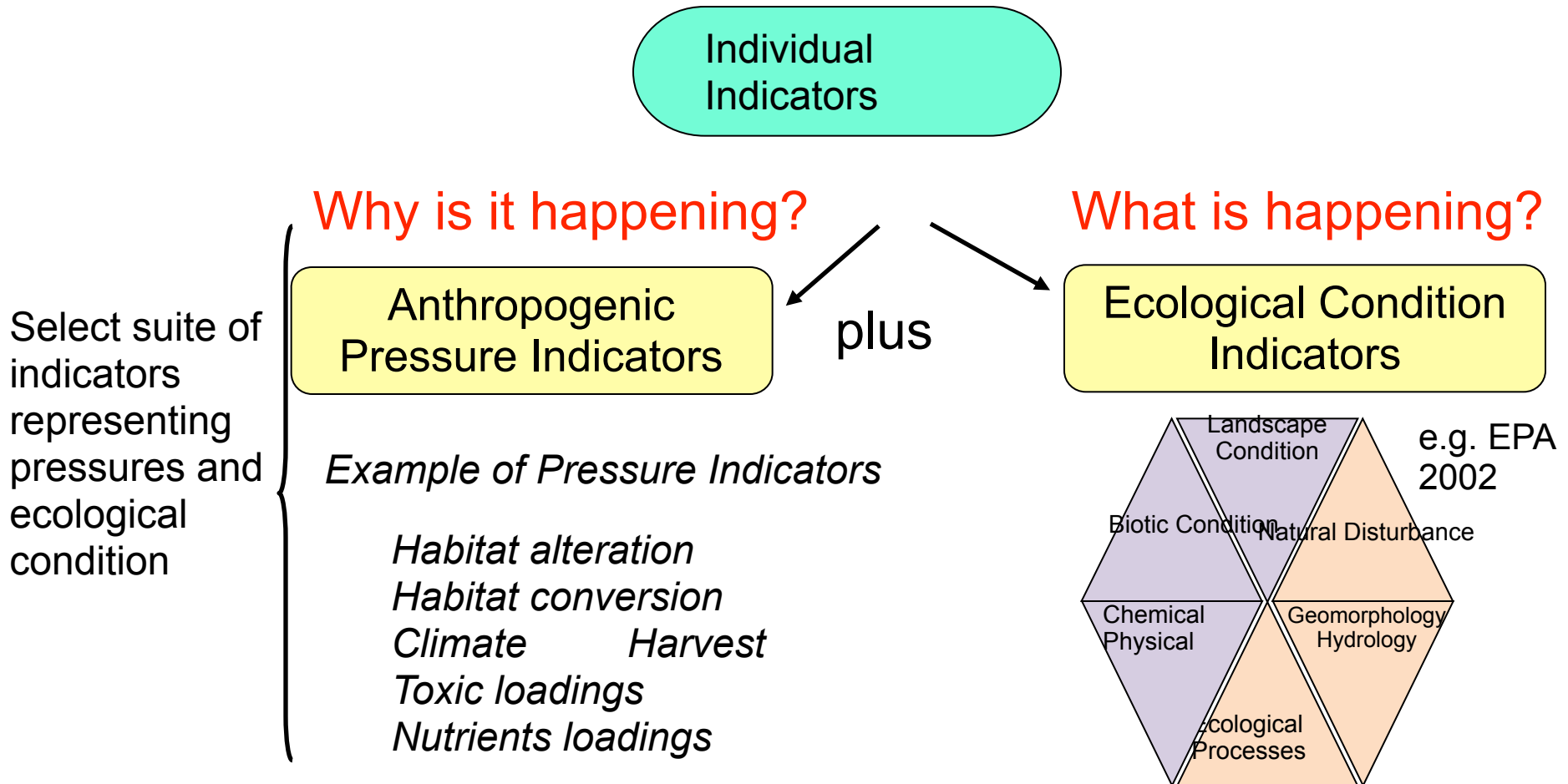


## Questions that may be relevant to this workshop:

- **What indicators, for what ecosystem attributes, are essential to monitor and report on for the LMR? Are there monitoring protocols in place across countries and institutions, that would facilitate data transfer?**
- **Is the human side of ecosystem protection being considered in the LMR, beyond disaster response? Are ecosystem services being measured, and is data shared?**
- **Have policy makers and managers been asked what 'decision critical' information they need from their science communities? How can improved cyberinfrastructure support 'decision critical' science?**

**Questions that may be relevant to this workshop:**

# What Types of Environmental Indicators Are Needed?



What can we do about it?