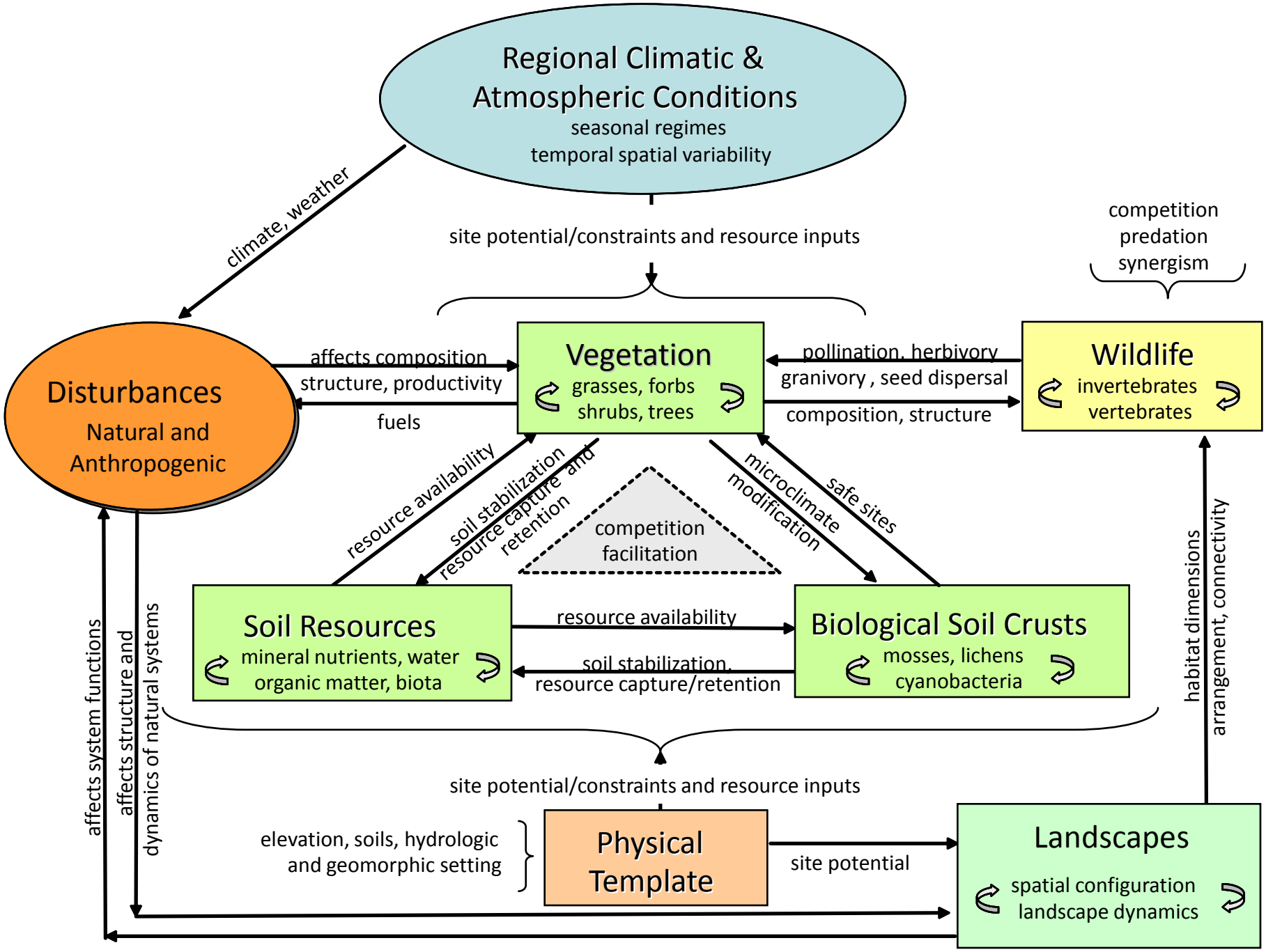
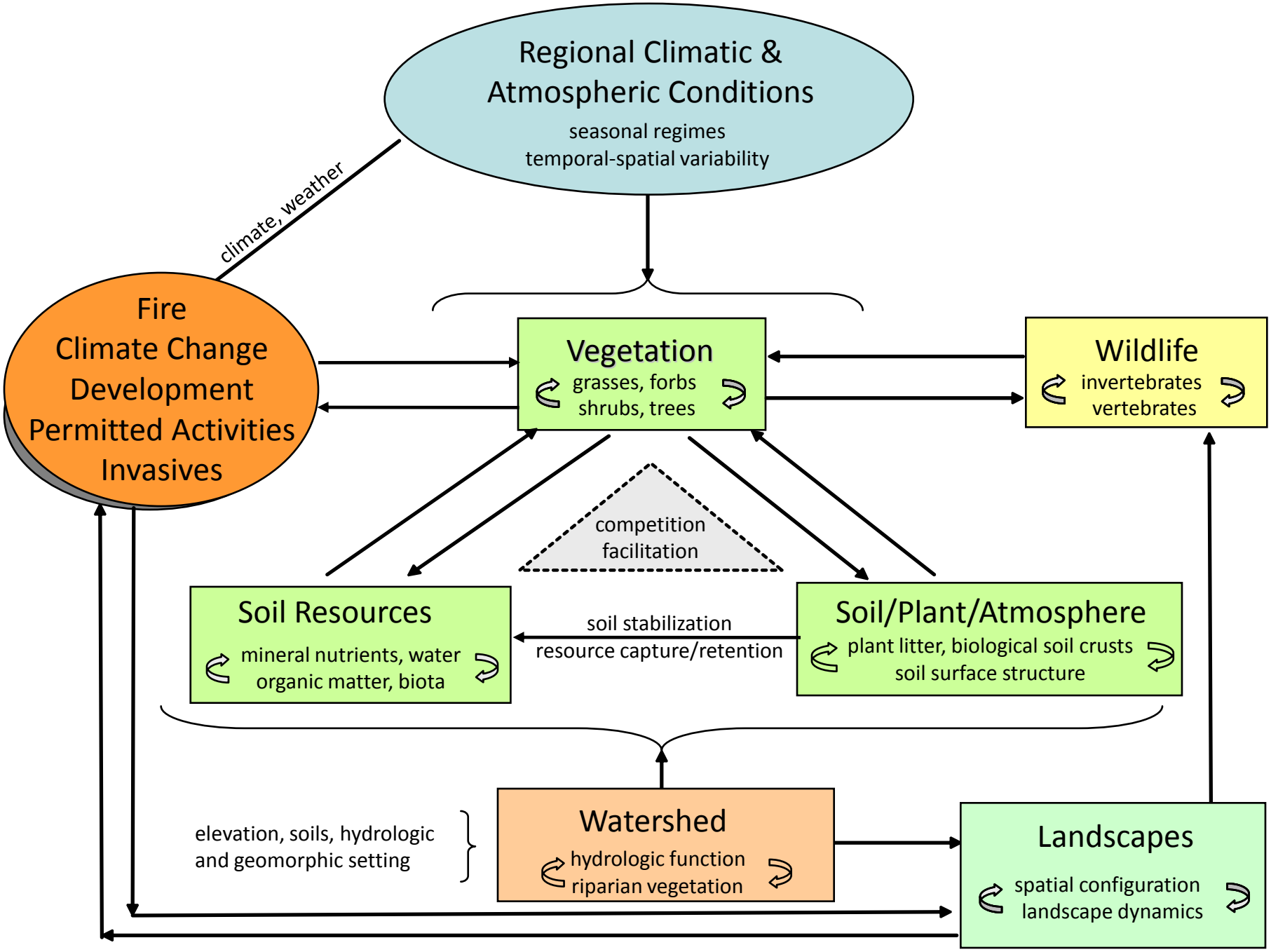
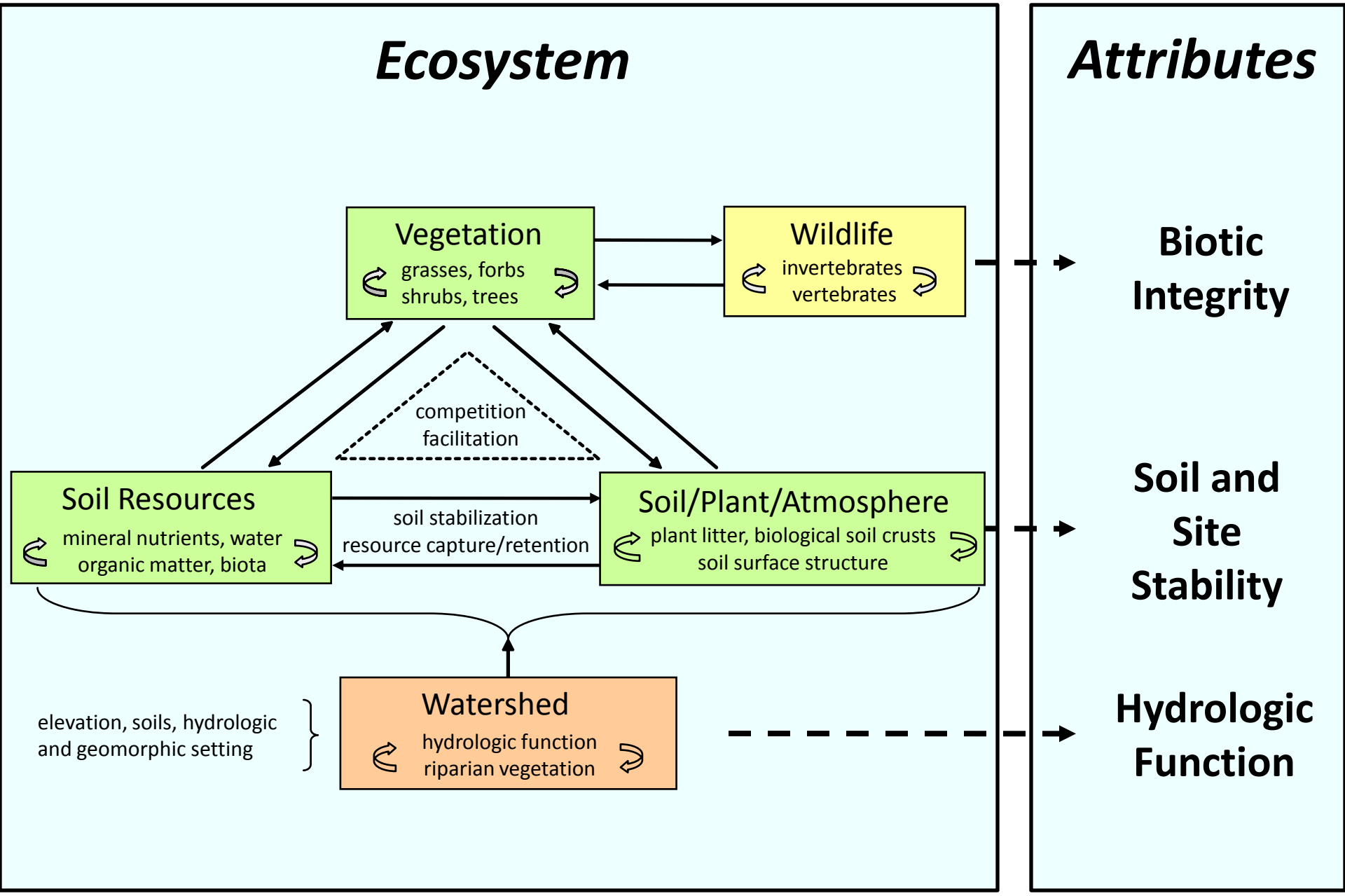
Ecosystem Processes and Key Attributes

(An Approach to Developing Core Indicators for Monitoring)


Regional Climatic & Atmospheric Conditions
seasonal regimes
temporal spatial variability
climate, weather
site potential/constraints and resource inputs
competition
predation
synergism
Disturbances
Natural and Anthropogenic
affects composition
structure, productivity
fuels
Vegetation
grasses, forbs
shrubs, trees
pollination, herbivory
granivory , seed dispersal
composition, structure
Wildlife
invertebrates
vertebrates
resource availability
soil stabilization
resource capture and retention
competition
facilitation
microclimate modification
safe sites
Soil Resources
mineral nutrients, water
organic matter, biota
resource availability
soil stabilization,
resource capture/retention
Biological Soil Crusts
mosses, lichens
cyanobacteria
habitat dimensions
arrangement, connectivity
affects system functions
affects structure and dynamics of natural systems
site potential/constraints and resource inputs
elevation, soils, hydrologic and geomorphic setting
Physical Template
site potential
Landscapes
spatial configuration
landscape dynamics


Regional Climatic & Atmospheric Conditions
seasonal regimes
temporal-spatial variability
climate, weather
Fire
Climate Change
Development
Permitted Activities
Invasives
Vegetation
grasses, forbs
shrubs, trees
Wildlife
invertebrates
vertebrates
competition
facilitation
Soil Resources
mineral nutrients, water
organic matter, biota
soil stabilization
resource capture/retention
Soil/Plant/Atmosphere
plant litter, biological soil crusts
soil surface structure
elevation, soils, hydrologic
and geomorphic setting
Watershed
hydrologic function
riparian vegetation
Landscapes
spatial configuration
landscape dynamics


Ecosystem
Attributes
Vegetation
grasses, forbs
shrubs, trees
Wildlife
invertebrates
vertebrates
competition
facilitation
Soil Resources
mineral nutrients, water
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plant litter, biological soil crusts
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elevation, soils, hydrologic
and geomorphic setting
Watershed
hydrologic function
riparian vegetation
Biotic Integrity
Soil and Site Stability
Hydrologic Function

Key Attributes of Ecosystem Sustainability

Biotic Integrity

The **capacity** of the biotic community to support ecological processes within the normal range of variability expected for the site, to resist a loss in the capacity to support these processes, and to recover this capacity when losses do occur. The biotic community includes plants, animals, and microorganisms occurring both above and below ground.

Soil and Site Stability

The **capacity** of an area to limit redistribution and loss of soil resources (including nutrients and organic matter) by wind and water.

Hydrologic Function

The **capacity** of an area to capture, store and safely release water from rainfall, run-on, and snowmelt (where relevant), to resist a reduction in this capacity, and to recover this capacity when a reduction does occur.

Core Indicators
(Evaluate Attributes)

What are Core Indicators?

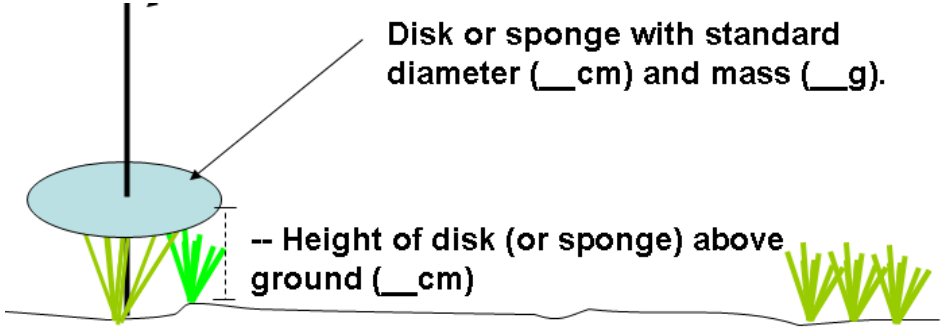
- Measurable or observable characteristics that, taken together, can give an **indication** of land health (status/condition).
- Some indicators can represent more than one property or process, for example
  - Increased bare ground often indicates increased erosion and reduced cover for wildlife
  - Increase in cheatgrass cover often indicates reduced biodiversity, a change in seasonal forage availability, and increased fire risk.

Why do we need Core Indicators?

They provide consistent, comparable data across the landscape for local/regional analysis and decision making.

Core Terrestrial Indicators (by Method)

- ***Line-point intercept + plot-level species inventory***
  1. Non-native invasive plant species
  2. Bare ground
  3. Special status (plant) species
  4. Vegetation composition by cover
- ***Vegetation height measurements (along transect)***
  5. Vegetation height



Core Indicators, contingent

6. Proportion of soil surface in large inter-canopy gaps

7. Soil aggregate stability

8. Stand Density Index

Recommended for Potential Future Inclusion as Core or Contingent Indicators

9. Fragmentation
   (index based on remote sensing to be developed or selected)

10. Soil carbon
    (new Office of Ecosystem Services and Markets expected to standardize?)

11. Area with significant soil erosion
    (models based on core indicators + soil map unit component under development)

12. Soil compaction (data required collected during carbon sampling)

What Other Indicators are Needed to Better Understand Wildlife Species Vulnerability and/or Habitat Requirements?

- The core terrestrial indicators do not provide enough specific information about wildlife species/populations/ habitats that can inform managers about their status and vulnerability. How will that be done? In 2010, State Wildlife Action Plans, with assistance from the Heinz Center, will identify conservation targets (ecosystems, natural communities, and species) and performance indicators to assess their status.

- Additionally, to address riparian/aquatic management BLM is developing a core set of aquatic indicators.

Systematic Sampling Designs

BLM needs to develop a scalable, and cost effective systematic sampling design for data collection of core indicators.

The Jornada Experimental Range, ARS – New Mexico State University, is working to develop a sampling design. We have requested that it incorporate BLMs existing monitoring studies into the design, where feasible, so BLM can continue to utilize its extensive legacy data.