<u>12 Basic Ecological Concepts for Natural Resource Management (in no particular order):</u>

- Ecology is that part of biology that examines the abundance and distribution of organisms, and the interrelationships between organisms and their environment. Ecologists seek to utilize existing and new information to understand and preserve the ability of Earth to sustain all forms of life (including humans). Ecological concepts change somewhat over time based on new findings and/or on new interpretations of old data.
- 2. In nature, a variety of biotic and abiotic factors act simultaneously to influence the ability of organisms to establish, survive, grow, and reproduce in any one place and time.
- 3. Different species respond to their environment in different ways, and this causes them to have different theoretical ranges (fundamental niche). A given species' actual presence (realized niche) on a particular site depends upon: (*i*) its ability to disperse onto that site; and its competitive ability to (*ii*) establish, (*iii*) survive, and (*iv*) reproduce.
- 4. Organisms of a given species that occur together comprise a population. Populations can grow, but a combination of environmental factors prevents populations from growing indefinitely. Populations can also decline due to a variety of factors (e.g. changes in the environment, human activities, etc.), sometimes to the point of extinction.
- 5. Species that have similar responses to their environment are typically found together in assemblages called communities. Within a community, differential use of resources (resource partitioning) allows multiple species to coexist. Each community is unique in some properties, but those occurring in similar environments tend to be structurally and functionally similar to one another.
- 6. On every site, the organisms that are present interact continually in a variety of ways. Some interactions are beneficial (e.g., mutualism and facilitation), some are harmful (e.g., competition and parasitism), and others have no net effect.

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- 7. All of the organisms present on a site, along with the physical environment, comprise an ecosystem. Ecosystem ecology considers biotic and abiotic components as an integrated system and, as such, is a common subdivision of ecology at which management occurs.
- 8. The distribution of ecosystems across Earth is largely a function of Earth's climate system which is driven primarily by solar radiation. Globally, temperature and moisture (i.e., precipitation) are the main climatic determinants of ecosystem distributions and process rates. Within the Earth's overall climate system, local and regional abiotic factors (topography and soils) are important determinants of ecosystem distributions and process rates.
- 9. All ecosystem functions ultimately depend upon energy, and carbon is the energy currency of almost all ecosystems. In any given ecosystem, organisms called primary producers (autotrophs) obtain energy (usually solar radiation) from the non-living environment and convert it into a biologically useful form (carbohydrates; usually via photosynthesis). Other organisms (heterotrophs) obtain their energy by "eating" primary producers and/or other heterotrophs (consumers) or by decomposing dead organic matter (decomposers).
- 10. The bodies of all organisms are built from chemical elements called nutrients (C, O, H, N, P, K, Ca, etc.). In all ecosystems, primary producers obtain the various essential nutrients primarily in inorganic form (gasses and minerals) from the air, soil, and/or parent material, and convert them into biologically-useful organic forms. Consumers obtain these nutrients by eating primary producers and/or other consumers. Decomposers convert the nutrients in dead organic matter back into their inorganic (non-biological) form. Microorganisms in the soil play critical roles in nutrient cycling by transforming organic forms of nutrients into inorganic forms that can be taken up and assimilated by primary producers. Ecosystems typically store a large quantity of energy and nutrients in the form of biomass (live and detrital (dead)) in plants and soil organic matter.

- 11. Ecosystems are in a constant state of flux (change), both rapid and slow, and over both short and long time scales. These changes can be due to: changes in abiotic factors; occurrence of disturbances; the arrival or local extinction of species; the natural progression of organisms through their life cycles; altered relationships between the species; and/or species changing and adapting via evolution. Natural disturbances and the resultant directional change in biotic communities following disturbance (ecological succession) are natural components of all ecosystems. The end result of succession ("climax" or steady state community) can vary depending on the prevailing environmental conditions, what organisms are available to recolonize an area, how these organisms interact with each other, and what resources are available.
- 12. Humans have drastically altered Earth's ecosystems. At present, ecologists are particularly concerned with preservation of biological diversity, the effects of global climate change, and the ability of ecosystems to sustain important life support functions (ecosystem services).

Adapted from:

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