

A FRAMEWORK FOR ECOLOGY
From Ecology, Dodson et al. 1998, Oxford U. Press, and
Toward a Unified Ecology, Allen and Hoekstra 1992, Columbia U. Press

FRAMEWORK: Ecologists need a framework that the scientist can use to organize experience. A common framework for linking kinds of ecology is the “conventional” ecological hierarchy ranking different levels of organization (bottom, over), with the assumption that these levels correspond to size scales in the observed biological system. Allen and Hoekstra (1992) developed a more comprehensive organization which emphasizes that a scale-ordered (size) framework is independent from the kind of ecology under consideration (Fig. 1.13, back page). Dodson et al. (1998) adopted the latter framework as well, and we use this framework for this course.

SCALE: Scale relates to size in both time and space; size is a matter of measurement, so scale does not exist independent of the scientists' measuring scheme. In our usage: 1) big, slow things are large-scale, while small, ephemeral things are small-scale; 2) scale-dependent entities require a certain scale of perception to make them appear a certain way; 3) we must treat biological systems as scale-dependent; 4) scale-independent entities do not change their qualities when perceived at different scales; and 5) names of classes (community, organism, etc.) and other conceptual devices are scale-independent.

ECOLOGY: The study of the relationships, distribution, and abundance of organisms, or groups of organisms, in an environment.

PEOPLE AND NATURE: All environments change, and people have been important forces shaping these changes for only a tiny fraction of Earth's history. In the last ten thousand years, however, human effects on ecosystems have often overwhelmed the ability of these ecosystems to respond to change. Historical ecology examines these environmental changes by focusing on questions about how humans have affected the environment, how our cultural attitudes affect how we do ecology, and the history of how humans have attempted to manage the environment.

KINDS OF ECOLOGY:

LANDSCAPE: A landscape can be thought of as being made up of different patches, characterized by different organisms and environments. Landscape ecology examines the interactions between this pattern of patches and ecological process -- that is, the biological causes and consequences of a patchy environment. Landscapes occupy a range of spatial and temporal scales comparable to ecosystems and communities.

ECOSYSTEM: Ecosystem ecology is the study of the interactions of organisms with the transport and flow of energy and matter. Ecosystem size and shape depends on the specific questions being asked about energy flow or chemical cycling. The “system” part of an ecosystem is a description of how energy or matter moves among organisms and parts of the environment.

PHYSIOLOGICAL (ORGANISM): Physiological ecology is the study of how individual organisms interact with their environment to carry out the biochemical processes and express the behavioral adaptations that accomplish homeostasis and survival. Homeostasis involves the maintenance of time, matter and energy budgets that allow for growth and reproduction by the individual.

BIOME: A biome is defined by the dominant biota - the vegetation physiognomy plus often a class of animal that plays a central role in giving the biome its particular structure. A biome has a set of critical climate and other characteristics to which the biota respond. Examples are the spruce-moose biome, or the grassland biome with its respective grazers.

POPULATION: A population is a collection of individuals of the same species (usually) that occupy some defined area. Population ecology focuses on how and why populations change in size and location (and substructure) over time.

COMMUNITY: Community ecologists examine the patterns and interactions seen in groups, or aggregations, of different species. The distributions of species are influenced both by biological interactions (such as predation and competition) and by environmental factors (such as temperature, water, and nutrient availability).

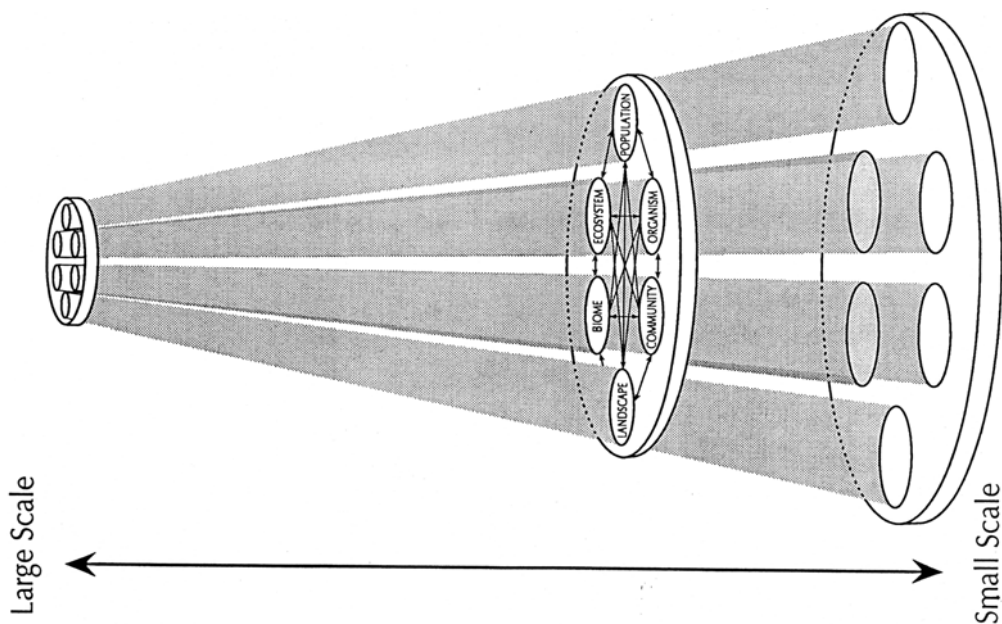
OTHER DEFINITIONS:

THE BIOSPHERE: The biosphere is the one ecological system where the scale is simply defined. Its scope being the entire globe, it occupies a level that is unambiguously above (i.e. larger and longer-lived than) all the other types of ecological system discussed so far. The biosphere is more often studied as a macro-level ecosystem, rather than as a large biome or landscape.

ECOLOGICAL GRAIN AND EXTENT: The ecological observer usually engages the world by measuring something. There are two aspects of measurement that are particularly important. One is the limit of the resolving power of individual measurements, the **GRAIN**, and the other is spatiotemporal **EXTENT** of the data. Both are considered aspects of **SCALE**.

ALLEN & HOEKSTRA 1992 ORGANIZATIONAL

SCHEME: CONE DIAGRAM



After Fig. 1.13 of Allen, T.F.H. and T. W. Hoekstra. 1992. *Toward a Unified Ecology*. Columbia University Press, NY

CONVENTIONAL

ORGANIZATIONAL SCHEME

WE DO NOT USE THIS

- Level 8Biosphere
- Level 7Biome
- Level 6Landscape
- Level 5Ecosystem
- Level 4Community
- Level 3Population
- Level 2Organism
- Level 1Cell

The conventional hierarchy of levels of organization from cell to biosphere.