What is Panarchy?



Panarchy is a conceptual framework to account for the dual, and seemingly contradictory, characteristics of all **complex systems** – stability and change. It is the study of how economic growth and human development depend on ecosystems and institutions, and how they interact. It is an integrative framework, bringing together ecological, economic and social models of change and stability, to account for the complex interactions among both these different areas, and different scale levels.

Panarchy's focus is on management of regional ecosystems, defined in terms of catchments, but it deals with the impact of lower, smaller, faster changing scale levels, as well as the larger, slower supra-regional and global levels. Its goal is to develop the simplest conceptual framework necessary to describe the twin dynamics of change and stability across both disciplines and scale levels.

The development of the panarchy framework evolved out of experiences where "expert" attempts to manage regional ecosystems often resulted in considerable degradation of those ecosystems (Gunderson and Holling, 2002). Regional management efforts are generally linear in nature, targeting the maintenance of certain variables – forest growth rates, river clarity, fish harvest rates, etc.

It was noted that focusing on managing a single variable, usually one of economic interest, generally resulted in other variables in the system changing, sometimes abruptly, and eventually degrading the entire ecosystem. It was also noted that the changes triggered by attempting to sustain a particular variable were changes that occurred so slowly (over decades or more), that they often went unnoticed until they in turn triggered an abrupt change (e.g. the forest became infested, the river became polluted, or the fish stock collapsed).

Basic Concepts in Panarchy

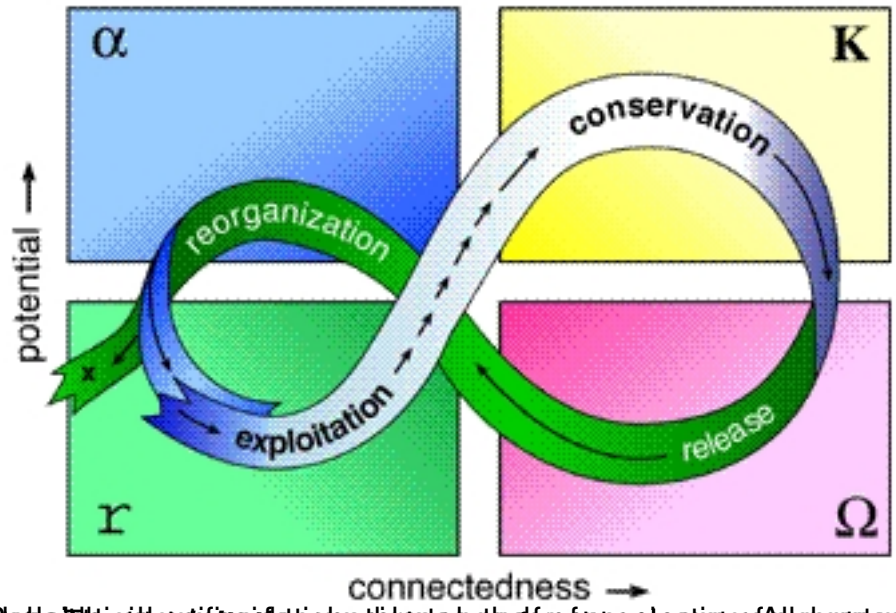
Ecosystem Characteristics

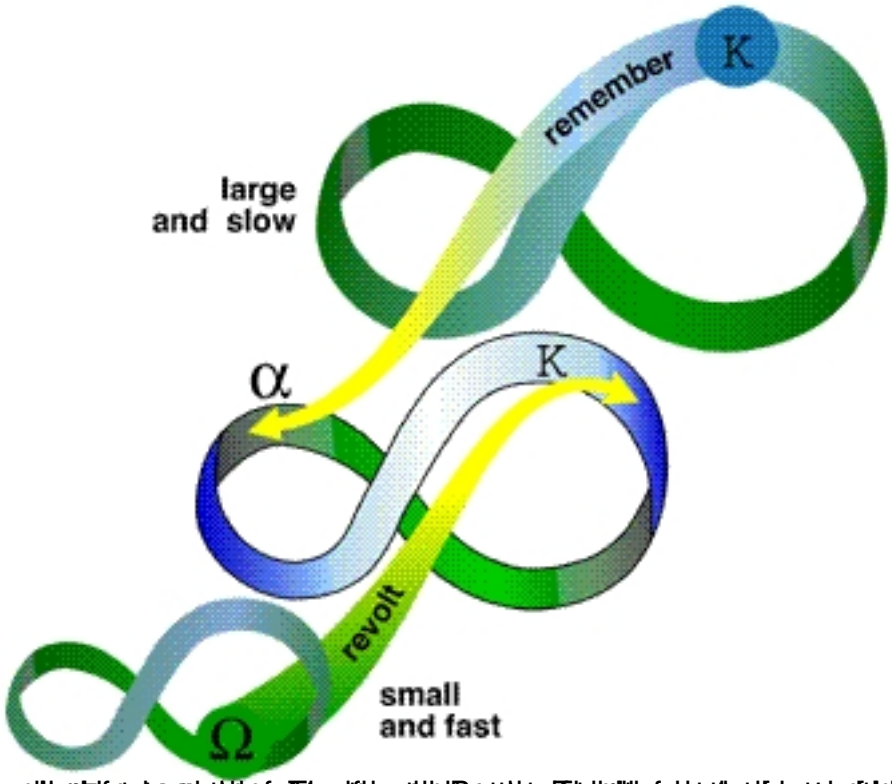
Empirical evidence of natural, disturbed and managed ecosystems identifies four key characteristics:

- Change is neither continuout and gradual, nor continuously chaotic. It is epicodic, regulated by interactions between fast and slow variables
- Different scale levels concentrate resources and potential in different ways, and non-linear processes reorganize resources across levels
- Ecosystems do not have a single equilibrium; multiple equilibria are common. Ecosystems have processes that maintain stability in terms of productivity and biogeochemical cycles; as well as processes that are destabilizing, which provide diversity, resilience and opportunity

- Management systems must take into account these dynamic features of ecosystems and be flexible, adaptive and experiment at scale levels compatible with the levels of critical ecosystem functions.

Stages of the Adaptive Cycle: Basic Ecosystem Dynamics


α
K
r
Ω
conservation
reorganization
exploitation
release
potential
connectedness


remember
K
large
and slow
α
K
revolt
small
and fast
Ω