

Table 1. Summary of strengths and weaknesses of ecological assessments of stressor impacts at different levels of biological organization.

Level of Organization	Examples	Strengths	Weaknesses
Individuals	Mortality Growth Reproduction Bioenergetics Behavior Biomarkers Morphology Disease	High mechanistic understanding in certain instances; relatively inexpensive analyses; often high stressor specificity; good understanding of background conditions; biological markers can give excellent indicators of exposure;	Requires a species by species approach; little known ecological relevance; weak relationship with ecological effects; individuals may be relatively unimportant to overall population demography; effects of multiple stressors unclear; often not representative of ecological services.
Populations	Density Age structure Reproductive rate Recruitment Genetic structure Spatial distribution Migration/immigration Invasive species	Fundamental units of ecological systems; large database on sensitivity to specific stressors; excellent statistical and deterministic models available for population assessments; T&E legislation; focus of ERA; populations are the foundation of ecological services such as silviculture, fisheries and social icons (e.g., salmon in the Northwest).	Requires species by species approach; quantitative sampling difficult for some species; population densities may be highly variable; spatial structure can be difficult to ascertain; population of interest can be difficult to define.
Communities	Species diversity Species richness Dominance Community composition Habitat structure and function	High ecological relevance; may control ecosystem processes; strong theoretical background in disturbance ecology; variety of statistical approaches available for terrestrial, freshwater and marine systems; USGS GAP program has cataloged a number of communities and habitats and mapped some areas in great detail.	Arbitrary spatial and temporal scale; taxonomic difficulties for some groups; difficult to demonstrate causal relationship between stressors and community responses; assumption of community equilibrium not always valid; historical data for many sites are not available.
Ecosystems	Nutrient cycling Energy flow Decomposition Primary production Secondary production Spatial structure	High ecological relevance; responses are closely related to ecosystem services, especially nutrient cycling, climate, and the overall spatial structure of habitats. Remote sensing data are available for much of North America and the coastal regions; serves as an appropriate scale for examining the interactions of natural and human systems (urban areas and wildlands).	High variability; relative insensitivity; functional redundancy; low specificity to stressors; limited understanding of background conditions and underlying mechanisms; little agreement over which ecosystem processes are most important; relatively expensive analyses and often requires extensive computing resources; confounding factors make the determination of causality problematic; data analysis tools are underdevelopment, and data are often at different scales of spatial and temporal resolution.