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Workers sow small tree seedlings into the ground as part of restoration efforts in a forest. Photo Credit: Adobe Stock.

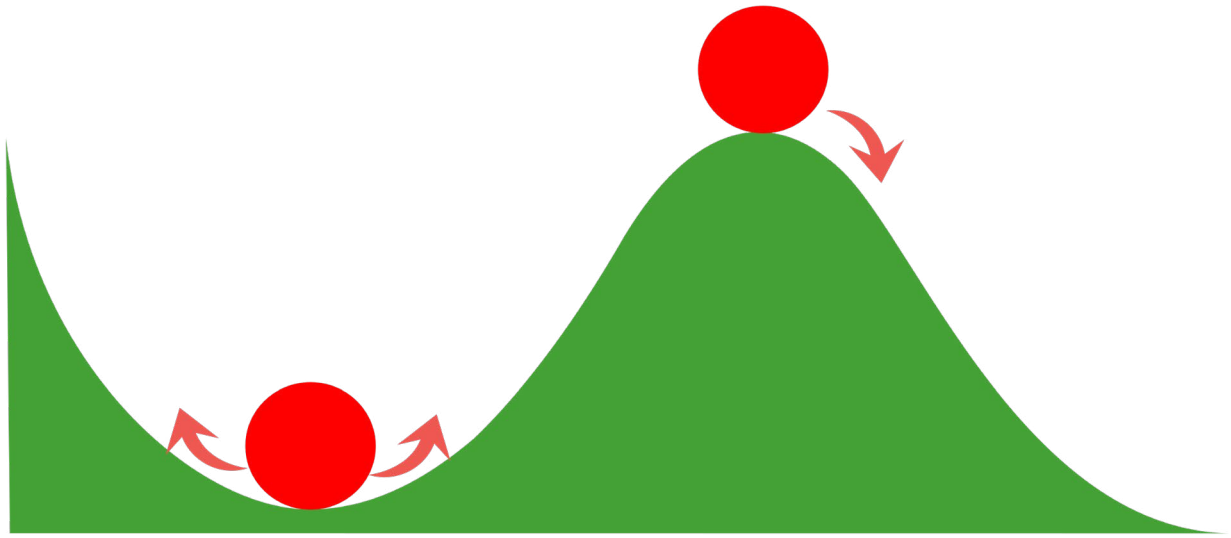
Explainer – Resilience Theory and Socio-Environmental Systems

By Margaret A. Palmer, SESYNC | July 11, 2022

Overview:

Resilience is the ability to withstand or recover from a disturbance and thus implies a starting state or dynamic equilibrium of a system that is altered by some disturbance (figure below). Such disturbances could be a physical, ecological, or social event, such as storms, the arrival of invasive species, economic downturns, social movements, etc. Theories of resilience assume there are system processes in place that confer resistance to or recovery from system alteration—although that does not necessarily mean the system returns to the same previous state. Such processes could include the ability of wetlands to absorb storm surges and slow wind energy, thereby protecting adjacent ecosystems (**ecological resistance**), or it could include the availability of funds to help people who have lost their homes or livelihoods (**socioeconomic resilience**).

The origins of resilience thinking arose from the physical sciences and Isaac Newton's laws of motion, in which the state of an object (at rest or in motion) doesn't change unless there is an external force, and displacements from a state produce forces that tend to oppose that displacement. In engineering, resilience is the ability of a material like rubber to absorb energy if struck and then release that energy as it springs back to its shape. But today, resilience has applications in almost all disciplinary domains—psychology, economics, organizational science, health care, chemistry, and more.



The ball in the valley is in a dynamic equilibrium. Like all systems, its state changes somewhat over time and space as illustrated by the two arrows. However, it would take a major perturbation (think, a force) to move it out of this state and up the hill. Once the ball is on top, the illustration is meant to show that the new state is highly vulnerable to change with the one arrow suggesting it may shift to an entirely new state (new dynamic equilibrium) if it moves into the next valley. The ball could, however, move back to the former equilibrium state if the perturbation is temporary and the system has resilient processes in place.

The Resilience Concept for Socio-Environmental Systems

Crawford Holling first applied resilience to ecological systems in 1973, and now ecologists use it almost routinely. Ecologists operationally define resilience as the magnitude of disturbance that a system can absorb before it flips to another state. They have linked resilience to theories of species diversity, adaptation and evolution, ecosystem restoration, conservation and management, ecosystem productivity, population dynamics, extinction risk, and much more (Chambers, Allen & Cushman, 2019; Donaldson et al. 2019; Zabin et al. 2022; Machado-Silva et al. 2021). In general, the assumption is that diversity in any form—genetic, species, physical heterogeneity—enhances ecological resilience.

Social resilience is the ability to cope with disturbances that result from social, political, environmental, and other forms of change. Researchers have applied social resilience to issues of physical and mental health in the context of disease, domestic abuse, and poverty, as well as to issues of community response to storms, economic shocks, and conflict (Barrett & Constas 2014; Archer et al. 2020; Alizadeh & Sharifi 2022). Social resilience varies by economic standing, race, and social status, largely due to differences in access to resources. Much like biological diversity and its link to ecological resilience, studies have shown that social resilience is higher when there are diverse social networks, varying sources of income or economic assets, and diverse skills and abilities possessed by citizens (Grêt-Regamey, Huber, & Huber 2019; Pfefferbaum, Van Horn, & Pfefferbaum 2017).

Research on what confers socio-environmental system resilience is growing constantly. Some of this research focuses on the role of social processes in conferring resilience, e.g., the sharing of natural resources among Indigenous subsistence fishing communities in the Arctic (Scaggs, Gerkey, & McLaughlin 2021). Other studies focus on environmental features that enhance resilience such as connectivity in the context of landscape ecology (Butler et al. 2022). Increasingly, studies are considering how ecological and social processes together have the potential to enhance or reduce socio-environmental resilience (Kattel 2020; Kliem & Sievers-Glotzbach 2022).

Many scholars view socio-environmental resilience as a "reorganization" process that occurs in response to a major social or environmental disturbance. As described in the SESYNC explainer "Socio-Environmental System Change and Reorganization," this theory asserts that S-E systems move through a series of identifiable states that are governed by processes operating at different temporal and spatial scales.

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This work was supported by the National Socio-Environmental Synthesis Center (SESYNC) under funding received from the National Science Foundation DBI-1639145.