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# Forget returning to lost ecological paradises or how ecosystems respond to various pressures and follow unexpected ways (Saga of Willapa bay, NW, USA).

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## Abstract

The purpose of this research is to illustrate the panarchic structure & dynamics of ecosystems to understand its evolution over time towards a novel "eco social system" by highlighting its biocomplexity, which involves the on-going multiplicity of interrelated relationships and levels. The framework includes the three dimensions of complexity (spatial, temporal and organizational) in order to increase the exploratory analysis power of the case study. The method wants to be as simple as possible and reproducible to other cases.

Our case study concerns Willapa Bay (NW, USA) and its watershed that was not really populated until early 1800s. We built a huge multidisciplinary database to document the "natural" and human stories on this territory for a progressive exploitation of its terrestrial and aquatic biodiversity. Examining three groups of living resources (forests, salmon and oysters) as integrators of the evolution of the ecosystem, we sought the interactions among non-human (climate, weather, major events such as earthquakes, tsunamis, wildfires) and human (exploitations, institutions, various level regulations, economic crises, wars, markets and technological innovations).

This reconstruction describes this multiscale dynamics through adaptive cycles associating the elements of "natural", economic, social and political systems without forgetting management agencies and users.

These dynamics are always shaped by uncertainties that arise not only from ecological and natural variability, but also mostly from economic disruptions, political changes, and changes in societal perceptions (Hanna, 1998). In many cases, the revelation of changes in the past leads to awareness and the need to change the status quo between stakeholders.

Therefore, it seems essential to knowing the environmental and social theatre where the episodes and events have taken place and are still taking place to admit the endless change of novel ecosystems that never will go back to their initial status.

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