Diagnosing Disaster Resilience of Communities as Multi-scale Complex Social-Ecological Systems

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Summary

• Disaster resilience of communities under global changes cannot be understood without knowledge on the broader social-ecological system (SES) in which they are embedded.
• Building on key theories and concepts on SES, resilience, development, and disaster risk, we developed a multi-tier framework for diagnosing community disaster resilience.
• We highlight the cross-scale influences and feedbacks on communities that exist from lower (e.g., household) to higher (e.g., regional, national) scales and applied the framework to diagnose and assess disaster resilience in various cases of disaster events in China and Nepal.

Theories and Concepts

• Our definition of Disaster Resilience: The ability of a system, community or society to pursue its social, ecological and economic development objectives while managing its disaster risk over time in a mutually reinforcing way.

Key frameworks, theories and concepts: Ostrom’s SES Framework; Holling’s adaptive cycle and panarchy; DEID’s Sustainable Livelihood Framework; IPCC’s Climate Risk Framework

A Multi-tier and Cross-scale Framework

Social, Economic, and Political Settings (S)

Resource Systems (RS)
- e.g. Natural capital, Physical capital, Financial capital

Governance System (G)
- e.g. Social network, Political capital, formal & informal rules

Risk 

Resilience 

Socio-Ecological

Focal Action Situation

Interactions (I) → Outcomes (O)

e.g.

Exposure

Vulnerability

Adaptation

& Management

Governance System (G)

Resource Units (RU)
- e.g. Dikes & Levees, Housing, Trees, Economic assets

 Actors (A)
- e.g. Households, Communities, NGOs, Local to national govt.

Related Ecosystems (ECO)

A multi-scale perspective of communities as social-ecological systems, showing the relationships between the spatial extent, response times, and persistence times of different system elements. Individual elements are nested within each other.

Application and Discussion

1. Wolong Nature Reserve and the 2008 Sichuan Earthquake

Comparison of Key Variables

Wolong
Sanjiang

Social, Economic, and Political Settings (S)

SA: Conservation policies
SB: Reconstruction implementation
CA: Number of actors
CB: Leadership/entrepreneurship
CF: Trust and legitimacy
DG: Knowledge of SES/mental models

Government organizations

Special district

Three more

Government organizations

None

None

Network structure

Hierarchy & interconnecting

Hierarchy

Hierarchy & interconnecting

Government rights

Heritage & traditional

Sustainable values

Land use planning

Monitoring and sanctioning

Moderately strong

Weak

Resource Systems (RS)

RS1: Location
RS2: Human constructed facilities
RS3: Financial system
RS4: Predictability

Resource Units (RU)

RU1: Growth or replacement rate
RU2: Durability
RU3: Economic value
RU4: Income inequality
RU5: Income level
RU6: Income diversity

Karnali river flood, Nepal