Resilience Theory and Social-Ecological Systems

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Roots of Resilience

- Capacity to absorb shocks and still maintain function (sustaining) (Holling 1973);
- “Engineering resilience” (өөрөө сэргэх чадвар) focuses on maintaining function near single steady state;
- Capacity for renewal, re-organization (self-organization) and development (developing);
- Resilience-сэргэн хөгжих чадвар (multi-states, non-linear dynamics)

Adaptive Renewal Cycle: Panarchy

Exploitation (r); Conservation (K); Release (omega); Renewal (alpha)
Gunderson and Holling, 2002

Social-Ecological Systems

- Land - The Human-Environmental system in the Global Land Project-joint IGBP-IHDP program (2005);
- The Earth as social-ecological system;
- How globalization (rising connectedness, increased speed, spatial stretching and declining diversity) is affecting resilience of SESs? (Oran 2006).
Critical concern: Dryland systems
- Cover 41% of Earth’s land surface and more than 2 billion people inhabit them, 90% of whom are in developing countries.

Dryland systems experienced the highest population growth rate in the 1990s.

People living in drylands tend to have the lowest levels of human well-being, including the lowest per capita GDP.

Drylands have only 8% of the world’s renewable water supply.

Approximately 10–20% of the world’s drylands are degraded (medium certainty).

Principle 1. Dryland H-E systems are coupled, dynamic, and co-adapting, with no single target equilibrium point.

Principle 2. The critical dynamics of dryland systems are determined by “slow” variables, both biophysical and socioeconomic.

Principle 3. Slow variables possess thresholds that, if crossed, cause the system to move into a new state or condition.

Principle 4. The involvement of multiple stakeholders, with highly differing objectives and perspectives, illustrates the need to pay attention to the multilevel, nested, and networked nature of H-E systems.

Principle 5. The key to maintaining functional co-adaptation of coupled H-E systems is an up-to-date body of “hybrid” environmental knowledge that integrates local management and policy experience with science-based knowledge.

Drylands Development Paradigm

Reynolds et al. 2007
Socio-ecological resilience

- Adaptive capacity;
  - Adaptability – capacity of people to build resilience through collective action;
  - Transformations toward more sustainable development pathway.
- Transformability – capacity to build new social-ecological system;
  - Cross-scale dynamic interactions;
  - Recent advances include social learning & social memory, mental models & knowledge-system integration, visioning & scenario building, leadership, agents & actor groups, social networks, institutional & organizational inertia & change;
  - Adaptive governance for socio-ecological resilience.

Resilience Conference, 2008, Stockholm

Resilience and Transformation of Pastoral Community – Cultural Landscape Systems in Mongolia

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Traditional Informal Nested Holarchy: Social-Ecological Resilience

Traditional pastoral networks emerged in resource limited and highly variable environment, and evolved to increase its resilience.

Traditional Cultural Landscape: Biocomplexity

Transforming socialist forces
Transforming capitalist forces

How
- Resilience
- Adaptation
- Vulnerability
- Complexity
- Sustainability
- Poverty trap of the coupled pastoral system are changing due to
- Market forces
- Global warming
- Globalization?

Application to Mongolia

- Traditional pastoral community-cultural landscape systems as coupled social-ecological systems;
- Resilience examples:
  - Recovery of rangeland ecosystems after disturbances such as fire, rodents, grasshoppers, butterflies etc.
  - Recovery after zud
  - Diversity of five animals with different rate of recovery;
  - Mutual assistance (social resilience);
  - “Tragedy of commons” is applicable if there isn’t any cooperation &
  - Pasture usage efficiency dramatically increases with cooperation (Elinor Ostrom, Resilience conference 2008)

Sacred lands
Reserve
Pasture
Summer
Spring
Fall
Winter
Hay land
Otor – pasture located far from main camp

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Transforming
socialist
forces
Transforming
capitalist
forces

1960 - 1990
Since 1990

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Regime Shift since 1990: Dynamics of the Coupled Pastoral System

Socialist period | Transition to market economy and democracy

Regime Shift since 1990: Cashmere

Regime shift since 1990: Poverty Trap

Scenarios for pastoral social–ecological systems

Western models
- Ranches
- Rich herders (15%)
- Community based natural resource management
- Strengthening of traditional pastoral networks

Win-Win
- Farmer’s association
- Cultural landscape use
- Ecosystem state is good
- Subsistence

Tragedy of Commons
- Weak cooperation
- Landscape fragmentation
- Land degradation
- Poverty trap (60%)

Traditional System
- Strong cooperation
- Cultural landscape use
- Ecosystem state is good
- Subsistence

Sustainable transformation with ICT & renewable energy

Privatization 1991-1993

Attractor domain

1999-2002 zed

1999-2002 adap

Adaptive Renewal (since 2002)

Collapse (1999-2002)

Exploration (1990-1999)

Market forcing

Livestock number, millions

Livestock number, millions in sheep unit
Conclusions

- **Sustainable community development**: Strengthening of traditional and newly re-emerged pastoral community-cultural landscape systems, remotely located from cities and infrastructure, with modern technologies such as renewable energy, distance learning, wireless communication, distance diagnosis etc.
- **Transformation** of herders, who lost their traditional resilience mechanisms and are living in forest steppe and meadow steppe, especially near big cities and infrastructures, into sustainable farmers.