INSIGHT #6 KNOWLEDGE SYSTEMS AND LEARNING

Combining knowledge systems and promoting learning about social-ecological dynamics enhance the fit between ecosystems and institutions

Blueprint solutions seldom work for complex social-ecological systems. Combining knowledge systems and platforms for learning is essential in ecosystem stewardship.

A key insight from resilience research is that management and governance of social-ecological systems needs to be ecologically informed if it is to have the intended effects on e.g. ecosystem services. This means that management practices and institutions are designed to continuously respond to changes in the ecosystem, using the best available knowledge about complex social-ecological dynamics and updating this knowledge in a learning-by-doing process (Colding et al. 2003, Olsson et al. 2007).

The best available knowledge is not just found in scientific literature, but also among local stewards such as fishermen, farmers, birdwatchers, urban dwellers and others who interact with ecosystems on a day-to-day basis (Barthel et al. 2010, Colding et al. 2006, Colding and Folke 2009, Crona 2006, Schultz et al. 2007). Such knowledge is referred to as local ecological knowledge (LEK) (Olsson and Folke 2001). In many places, local groups have coevolved with their environments over many generations and embedded their traditional ecological knowledge and understanding in practices, beliefs, and culture (Berkes et al. 2000, Gadgil et al. 1993, Lansing and Fox 2011, Tengö and Belfrage 2004, Tengö et al. 2007, von Heland 2011). Resilience research emphasize collaboration of interdisciplinary and transdisciplinary knowledges, such as combining architecture and urban planning with ecology in the design of urban areas.

Different knowledge systems generate different insights about the dynamics of social-ecological systems (Ernstson and Sörlin 2009), and when they are combined, a richer, often surprising picture may emerge (Carpenter et al. 2009) that enables a more fine-tuned design of management (Crona 2006, Olsson and Folke 2001). In adaptive management, knowledge and management practices are continuously tested and refined through careful monitoring of effects on the ecosystem (Fazey and Schultz 2010, Hughes et al. 2007). Stewardship of social-ecological systems benefit from institutions that support a combination of knowledge systems, in ongoing learning processes (Folke et al. 2003, Crona and Bodin 2006, Olsson et al. 2007).

Adaptive co-management and adaptive governance are approaches for facilitating knowledge exchange and learning between actors who interact within different contexts, with different parts and aspects of the social-ecological system (see Insight #3).

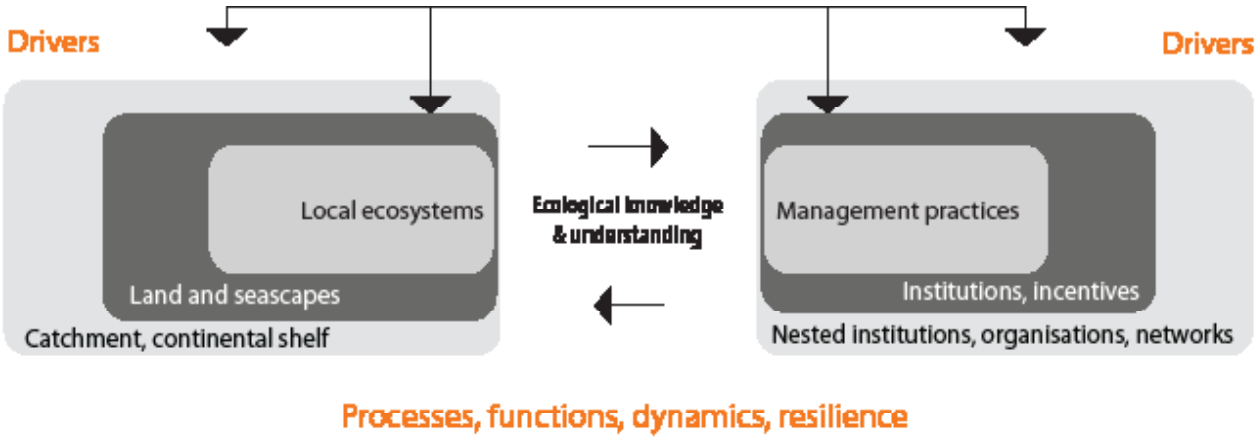

Fig. 1. Management and governance of social-ecological systems needs to be ecologically informed. Ecological knowledge and understanding helps reconnect management practice, networks and institutions to stewardship of ecosystem (Berkes and Folke 1998).

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Centre research on social-ecological knowledge & learning

Stockholm Resilience Centre's research on social-ecological knowledge and learning follows several strands.

One focuses on learning in ecosystem management settings, covering the dynamics of how local knowledge and practice affect generation of ecosystem services (e.g. Bodin et al.2006, Andersson et al. 2007, Elmqvist et al. 2010, von Heland 2011), the effects of network structure on knowledge and learning (e.g. Bodin and Prell 2011, Crona and Bodin 2011, Crona and Hubacek 2010), how learning develops in communities of practice (e.g. Barthel et al. 2010), how knowledge travels and interact across scales in adapting institutions (e.g. Biggs et al. 2007, Boyd and Folke 2012), boundary management (e.g. Crona and Parker 2009, 2011), and the effects of different types of learning platforms (e.g. Moellenkamp et al. 2010, Schultz and Lundholm 2010).

A second strand focuses specifically on group learning and social learning, e.g. for climate change adaptation, water governance and integration in policy processes (e.g. Hertin et al. 2009, Pahl-Wostl et al. 2007, 2011, Simonsson et al. 2011, Whitmarsh et al. 2009).

Another strand focuses on environmental learning for sustainability, dealing with perceptions, values and cognitive development (Biggs et al. 2007, Davies and Lundholm 2012, Lundholm 2007, Lundholm et al. in press, Rickinson and Lundholm 2008, Rickinson et al. 2009, Sternäng and Lundholm 2010, in press) and how to link to resilience thinking (Krasny et al. 2010, Lundholm and Plummer 2010). Scientists and practitioners closely interact in many of these studies, recognising that science is one among many stakeholders in ecosystem stewardship.

Allotment garden in Stockholm National Urban Park: Social-ecological memory is retained and transmitted through participation in learning processes, oral communication, collective gatherings, and imitation practices. It resides in structures of chalets and garden plots and other physical forms and artefacts as well as a number of rules-in-use (institutions). It is spread and embedded in various forms of media, social networks, collaborative organizations, markets, and legal structures (Barthel et al. 2010). Photo: J. Lokrantz/Azote

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KEY FINDINGS:

In practice, the combination of knowledge systems requires platforms for learning, where actors can exchange information and develop a shared understanding of the system (Hahn et al. 2006, Schultz and Lundholm 2010). Such platforms can clarify the context in which the system is embedded and empower participating actors (Bendt et al. in press). For instance, urban green commons can provide arenas for citizens to i) actively manage and experience the value of ecosystem services, ii) learn about ecosystem processes, iii) shift values and norms towards connecting to the biosphere, iv) build social capital, v) develop sense-of-place in cities, and vi) develop and retain social-ecological memory (Colding 2011).

Combining knowledge systems can create conflict and tension, and needs skilled facilitation and careful design of the learning platform (Hahn et al. 2006. Schultz et al. 2007, Crona and Parker 2009, 2011, Bergsten 2012). One important barrier to the combining of knowledge systems is that people within one knowledge system may not perceive or value the knowledge generated in other knowledge systems and such a barrier may contribute to social-ecological traps (see Insight #5).

Complex problem solving benefits from a diverse team of competent individuals. When combining knowledge systems and promoting learning, a balance needs to be struck between developing a common understanding and maintaining an underlining diversity of perspectives, i.e. the heterogeneity of knowledge (Bodin and Norberg 2005, Carpenter et al. 2009, Lindahl and Johannesson 2009).

Learning about sustainability. In education for sustainability it is not sufficient to learn about ecosystems. It is just as important to gain an integrated knowledge about society and the various roles of people as consumers, voters and citizens (Lundholm 2011). This is also true for environmental learning in place specific problem solving (Bendt et al. in review). Organizational learning for climate adaptation is often constrained by the ability to justify the required resources (Rudberg et al. in press). Concepts from the learning literature provide lessons for long-term policy development (Nilsson et al. in press).

Knowledge about complex social-ecological systems is always incomplete (Polasky et al. 2011). Ecosystem stewardship should consider the role of uncertainty and surprise by taking into account a wide range of perspectives, encouraging transparency with regard to conflicting viewpoints, stimulating a diversity of models, and managing for the emergence of new syntheses that reorganize fragmentary knowledge (Carpenter et al. 2009). Ecosystem stewardship may require the reconciliation of apparently contradictory perceptions of ecological change (Daw et al. 2011).

Local stewards hold fine-grain knowledge about ecosystems and social-ecological interactions. Local communities can act as stewards of ecosystem and desired ecosystem services (Schultz et al. 2007, Tengö et al. 2007). Farmers, foresters, fishermen, hunters, nature engaged groups can provide detailed knowledge with long-term monitoring of particular species, habitats, and ecological dynamics (Schultz et al. 2007). Local norms and rules evolve with experiences of social-ecological dynamics. For example, strict taboos with strong enforcements have developed where the flux of people across the landscape is high (Tengö and von Heland 2012). Allotment gardeners have a higher quality local ecological knowledge and stronger sense-of-place in their stewardship of ecosystem services compared to employees that manage city parks (Andersson et al. 2007). In addition, local stewards detect extreme events that outsiders who only visit occasionally (e.g. scientists) might miss (Crona 2006). Traditional ecological knowledge systems not only depend on but also sustain essential ecosystem services (Tengö et al. 2007, von Heland 2011).

Local ecological knowledge is embedded in social-ecological memory. Knowledge, experience and practice of managing a local ecosystem and its services are captured, stored, revived and transmitted through time in social-ecological memories (Barthel et al. 2010, Barthel et al. in press). Particularly important during periods of change and crisis, they provide foundation for modification of rules, and typically refers to decadal time scales, as opposed to months or a year (Berkes and Folke 2002). A social-ecological memory helps retain experiences that can be recombined with new knowledge and learning for social-ecological innovation (see Insight #4). But social-ecological memory may also constrain learning and innovation and contribute to traps and collapsing societies (von Heland 2011). Knowledge systems are intertwined with culture, identity and moral order (Gartin et al. 2010, Tengö and von Heland 2012, de la Torre Castro and Lindström 2010, von Heland 2011).

Combining knowledge systems in new ways. New information and communication technologies are revolutionizing the generation of and access to ecological data. Using webcrawlers and internet-based monitoring has potential in complementing conventional ecological monitoring and tap into these increased flows of information to detect "early-warning" signs that may signal abrupt ecological changes (Galaz et al. 2010).

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