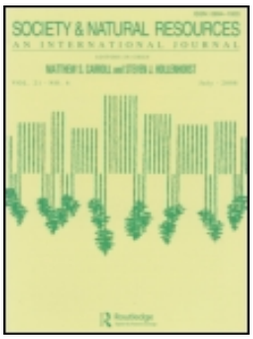

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Articles

Research Approaches for Understanding, Enhancing, and Monitoring Community Resilience

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The growing interest in the understanding of community resilience suggests a need for improving research approaches. This article reviews methods used to date, and suggests opportunities for expanding the range and efficacy of approaches used to understand, improve, and monitor the coupled social and ecological aspects of community resilience. We explore three potential foci: research approaches that enhance understanding of community resilience; those that help to improve community resilience through the research process; and the further development of methods to guide monitoring. Most studies have relied on mixed and multistaged methods, including in-depth interviews and case studies. We comment on the wide range of approaches used, and suggest others that could be valuable. There is particular scope for greater use of cumulative studies, historical or retrospective studies, participatory methods, and systems approaches, and a need for more methods that explore the coupling of social and ecological dimensions.

Keywords community-based research, community development, humans and natural ecosystems, research methods, social–ecological systems, social learning

There is a growing interest in the concept of community resilience and in improving the understanding of the social components of social–ecological systems. A refinement of methods is needed to improve understanding and to learn how to build community resilience through processes of trial and evaluation (Wilson 2012) and in particular collaboration (Goldstein 2012). Continuing the effort to draw attention to community resilience (Berkes and Ross 2013; Davidson 2013; Ross and Berkes 2013), here we critically review methods used and assess opportunities to introduce additional approaches for understanding, enhancing, and monitoring community resilience.

Community resilience has received relatively little attention. The literature on social–ecological systems and resilience tends to deal with larger scales (e.g., regions),

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and the literature from the psychology of personal development and mental health emphasizes individual resilience (Brown and Westaway 2011; Berkes and Ross 2013). While there are many references to community resilience in the disaster management literature, there is limited definition of what is intended by the term (Manyena 2006), or elaboration of community resilience as a concept (exceptions include Paton and Johnston 2001; 2006; Norris et al. 2008). Disaster management literature draws largely from the psychology body of theory, but some authors use a social–ecological systems perspective (e.g., Goldstein 2008).

Magis (2010, 402) defines community resilience as "the existence, development, and engagement of community resources by community members to thrive in an environment characterized by change, uncertainty, unpredictability, and surprise." She observes that members of resilient communities intentionally develop their personal and collective capacities in order to respond to and influence change, and build their communities and community futures. Norris et al. (2008, 127) define resilience as "a process linking a set of adaptive capacities to a positive trajectory of functioning and adaptation in constituent populations after a disturbance," consistent with other definitions from psychology and mental health literature, which emphasize the notion of overcoming adversity of any type (Buikstra et al. 2010).

The social–ecological resilience literature emphasizes the coupling, interdependence, and coevolution of social and natural systems (Folke 2006), adaptive learning processes and feedback (Sendzimir et al. 2011), the importance of change cycles and thresholds, relationships across space and time scales, and levels of organization in terms of complex adaptive systems (Scheffer 2009; Chapin et al. 2009). Thus, this literature understands the community level as being interdependent with and influenced by other levels, emphasizing interactions at multiple levels, termed panarchy (Gunderson and Holling 2002). In the case of resource-dependent communities, it anticipates clear linkages between the resilience of a community and the ecosystem on which it is dependent. For the purposes of this article, we focus on communities of place (Berkes and Ross 2013), recognizing the importance of social connections and of shared norms and interests within those places (Agrawal and Gibson 1999).

An integrated approach to community resilience—one that bridges the separate fields that have developed the concept of resilience—should consider the characteristics of resilient communities (Berkes and Ross 2013; Norris et al. 2008; Magis 2010; Buikstra et al. 2010; Ross et al. 2010). Further, an integrated approach should consider how these characteristics are combined into resilience-building processes through the community's adaptive capacity (an ability to "cope with, manage or adjust to some changing condition, stress, hazard, risk or opportunity"; Smit and Wandel 2006, 282) and agency (capacity of an individual or group to organize, and act independently of direction and authority). Consistent with the psychology of development treatment of resilience as a field for emphasizing and developing strengths rather than redressing weaknesses, the integrated approach emphasizes practice: how adaptive capacity, self-organization, and agency can be fostered through processes such as community development, community-based planning, and social learning (Goldstein 2008; Davidson 2010).

Given these advantages of an integrated approach, community resilience research can benefit from guidance toward approaches to analyze the nature of community resilience, assist in practical ways to enhance resilience, and monitor and evaluate the success of interventions. This article considers research methods available for exploring community resilience and—where this can be coupled with

research—enhancing or monitoring it. It considers a set of studies from literature, and canvasses supplementary methods that could contribute to the study of community resilience but that have not yet been found in the literature directly on community resilience. We thus identify the needs and opportunities for research methods that (1) enhance understanding of community resilience or the contributing concept of adaptive capacity, (2) help to improve community resilience through the research process, and (3) guide monitoring toward continual learning and improvement in interventions.

Our target audience is community resilience researchers from various disciplines. We refer to ''researchers'' and ''research teams'' interchangeably, recognizing that the kind of research we refer to is often undertaken by teams, but individual research is certainly also feasible (Amundsen 2012). Purely developmental work that does not involve research (e.g., community development practices; evaluation of intervention programs) is outside the scope of this article. We are not focusing on intervention methods but acknowledge that some research approaches can serve resilience-building, as in participatory approaches to research (Goldstein 2012).

Approaches for Understanding Community Resilience

We are interested in community responses to crises and change, and concentrate on studies that explicitly address both social and ecological aspects of the social–ecological system, though many of the examples we use lean toward the social dimensions. We note a wide range of research approaches: Use of mixed methods, including interviews, is common as an approach in itself, within single or comparative case studies (e.g., the Kulig et al. series of studies [Kulig et al. 2008; Kulig et al. 2010]; Ross et al. 2010; Wilson 2012). Sendzimir et al. (2011) and Sallu et al. (2010) have made historical, comprehensive studies of social–ecological systems using mixed methods. Various studies have used natural science methods (along with social science), such as forestry inventories and remote sensing (Sendzimir et al. 2011). Table 1 illustrates methods used in studies specifically directed toward exploring and building community resilience. The table draws on both published and some less formally published literature, since full project reports are often more comprehensive than journal articles in documenting details.

The preference for mixed methods is immediately apparent from Table 1, and for good reasons. Since abstract concepts such as ''resilience'' defy direct observation (Carpenter et al. 2005), the combined insights of several methods are more likely to produce a robust understanding. There is a leaning toward commencing with secondary data drawn from related fields (e.g., Cuthill et al. 2008; Magis 2010), and toward use of case studies and interviews. A number of the studies are multistaged. There is some use of participatory methods, but in Table 1 examples there is no apparent use of participant observation, a useful method for gaining deep insights into social and cultural processes in context (Lu 2010; Berkes and Jolly 2001).

Goldstein (2008) used retrospective (approaches that consider the past) reflection after participating in a self-organized fire recovery network; Magis (2010) incorporated the use of focus groups. These are worth exploring as another way of having participants retrospectively examine the sources of their communities' resilience. Focus groups may cover similar content to individual in-depth interviews, but have the advantage of participants generating new collective understandings from one another's contributions. While we have not found oral history used explicitly in

Table 1. Approaches used to explore community resilience

Project and purpose with reference	Approach
Stanthorpe case study, Southern Queensland, Australia Learning the characteristics of community, group and individual resilience and how these can be fostered to strengthen capacity to cope with adversity. Hegney et al. (2008a; 2008b), Buikstra et al. (2010)	Single case study Participatory action research with the community and partner organizations, focused through meetings of a joint "project team" and community meetings. The PAR incorporated cycles of: • 12 Exploratory interviews. • 75 Semistructured convergent interviews (Dick 1990) using purposeful sampling of different sectors within the community. • Validation of community and individual attributes of resilience, using youth photovoice, and community workshops. • Preparation and validation of a resilience toolkit.
Cumulative case studies, Alberta, Canada Learning the characteristics of community resilience among rural communities facing a variety of hazards and economic downturn. Interest in relationship between health status and community resilience. Kulig et al. (2010), Kulig et al. (2008), Kulig (2000), Brown and Kulig (1996)	A sequence of comparative community case studies over 13 years, with six Canadian and one U.S. case (one Canadian community studied three times). Total of 254 interviews and 74 participants in focus groups. Also included use of health databases.
North Queensland Wet Tropics, Australia Studies to identify characteristics of community and social resilience, and develop indicators, to inform organizations about how to manage for and monitor social aspects of resilience within the social–ecological systems they manage.	Seven case studies by two cooperating teams conducting participatory approaches with local and regional organizations, respectively. These teams corroborated and converged their findings. Gooch and Rigano (2010) worked in partnership with a local government on an urban case study, focused on community resilience to declines in water quality. This used 22 semistructured interviews and a survey.

Gooch and Rigano (2010), Ross et al. (2010), Maclean et al. (2013)	Ross et al. (2010) worked with five regional organizations (government, nongovernment, and Indigenous) to identify attributes and indicators of social resilience to inform environmental and social management. They: • Conducted regular meetings with the partners to plan, conduct, and review the research. • Conducted six case studies (71 semistructured interviews) of past situations where local areas and their communities and organizations had overcome significant adversities. • Developed potential measures for monitoring and evaluation (see Table 2).
Forest-dependent communities, United States A search for indicators of resilience in forest-dependent U.S. communities, sought by the Round Table on Sustainable Forests, a forum of government and nongovernment organizations and individuals. Magis (2010)	Examination of 13 research and implementation projects (United States, Australia, Africa, Ecuador) focused on aspects of resilience. 10 Focus groups with 60 participants (conducted within a Round Table on Sustainable Forests set of events). Development and testing of a scale and metrics using content from the 13 projects.
Land and Ecosystem Degradation and Desertification: Response Assemblages (LEDDRA) project *Spain, Italy, Greece, Morocco, China* European Union project investigating linkages between community resilience and land degradation. Wilson (2012)	15 Community case studies in five countries. Multimethod qualitative and quantitative approach. Local teams with local knowledge working on-ground for each case study (and tailoring methods), coordinating team working across all projects for overall design and comparison. Focus on process indicators, based on a list of questions concerning economic, social, and environmental capital. Focused on continuity, sources of innovation, threats, and opportunities. Comparative analysis based on quantitative and qualitative information including the "storyline" of the community, resilience scores on each indicator, and means for each community, workshops, and coordinating team visits to case studies.

(*Continued*)

Table 1. Continued

Project and purpose with reference	Approach
Sahel, northern Africa Multilevel analysis of social–ecological system of forest decline and recovery in the Maradi and Zinder regions of Niger. Sendzimir et al. (2011)	Single case study of a large region. Systems thinking and analysis to examine patterns of causal relations among people, land use, agriculture, and forests at multiple levels in a long-term historical perspective: • Causal loop conceptual modelling with evidence from historical literature, long-term team experience in the region, aerial photos, and remote sensing. • Time series of patterns of deforestation and reforestation influenced by ecological, economic, and sociopolitical factors; emphasis on governance and livelihoods. • Strong understanding of social dynamics, in terms of individual and collective decision making and human behavior, e.g., NGO interventions, practice changes, and learning.

Table 1 cases, Marschke and Berkes (2006) and Ross et al. (2010) asked participants to recall a particular crisis and explain what helped their community or group to overcome it. A number of studies acknowledge the value of Indigenous people's oral histories, without explicitly showing their use (e.g., Trosper 2009).

Three examples attempted to explore resilience at multiple levels. The Stanthorpe case study (Hegney et al. 2008a, 2008b; Buikstra et al. 2010) explored community and individual resilience. Ross et al. (2010) produced indicators to assist regional management bodies to assess the likely status of social resilience in their regions and to monitor the efficacy of any resilience-building activities. Sendzimir et al. (2011) investigated a diversity of factors at work at village, regional, national and international levels in the greening (forest recovery) in the African Sahel.

We note the value of learning from what Wilson (2012) terms "cumulative studies": successive studies designed to build understanding in steps. Kulig and coauthors conducted a series of studies scoping the idea of community resilience (Brown and Kulig 1996), then exploring the nature and processes of community resilience in sets of communities experiencing a variety of stresses over time, including effects of mining, economic decline, and natural disasters (Kulig et al. 2010). Ross et al. (2010) continued the learning commenced by Hegney et al. (2008b; Buikstra et al. 2010) and Kulig et al., while Kulig's and Hegney's teams compared and converged their understandings (Kulig et al. 2010).

We suggest two research directions for understanding community resilience: continual refinement of the approaches and combinations of approaches already used successfully, and use of promising new ones. We support the continued use and refinement of the methods documented in Table 1 case studies, focusing on qualitative interviews and mixed methods. Expanded use of three areas and approaches seem particularly promising. First, participatory research processes are important particularly where communities could benefit from the process of sharing in research and so participate in a learning process, raising their awareness about resilience and having an opportunity to build adaptive capacity. Second, systems analysis approaches, used extensively in the social–ecological resilience literature, hold promise for community studies as well. Third, the study of the cognitive dimension of community resilience deserves more attention. We expand on each.

Participant observation (Jorgensen 1989) generally involves immersion in a situation, in order to learn through direct experience as a participant, observing daily happenings, hearing and initiating conversations, and reflecting on one's own experience. It is a holistic and adaptive methodology that opens up new lines of inquiry as it proceeds (Olsson and Folke 2001; Marschke and Berkes 2006). For example, Seixas and Berkes (2003) investigated a small lagoon in southern Brazil and found that participant observation provided insights on how the behavior of fishers and the actions of management agencies were linked, with an outcome of distinct temporal cycles of management and mismanagement. While anthropologists often seek long-term participant observation, short-term immersions are also possible, for instance, part-time participation in a group that meets periodically. While there are potential ethical issues in studying post-disaster communities, useful participant-observer roles may be adopted to contribute to recovery efforts (Goldstein 2008).

Systems approaches provide a good fit for the study of change processes (Berkes et al. 2003) and can be used to explore drivers and cycles of change. Tyler and Moench (2012) provide a framework that focuses on (1) system characteristics, (2) agent capabilities, and (3) institutions that link systems with agents. Béné

et al. (2011) carried out an action research project for poverty reduction intervention, and tested a participatory approach for adaptive management of community-based fisheries in the Niger River basin. Researchers struggled to reconcile human agency and systems perspectives. Potential approaches to the problem of dealing with agency in resilience research (Davidson 2010) may be found in the two references just cited and in Christensen and Krogman (2012), which elaborated a novel approach that builds on historical turning points in a community to understand how community members themselves develop thresholds that may be used to inform management. The resulting approach provides a less deterministic definition of thresholds informed by sociological theory (Christensen and Krogman 2012).

Cognitive dimensions have tended to be overlooked in the analysis of social–ecological systems (Brown and Westaway 2011). However, another body of theory, environment–behavior studies (environmental psychology), emphasizes the linkages between thinking about physical environments, behavior within them, and the ways people modify environments to obtain a better fit with their aspirations (e.g., clearing land for agriculture or to obtain ocean views). The social–ecological systems literature has just begun considering cognitive dimensions, with a special issue devoted to people's mental models of environments and systems (Lynam et al. 2012), including a variety of methods for eliciting individual and collective mental models of how social–ecological systems work (e.g., Stone-Jovicich et al. 2011; Etienne et al. 2012).

We observe that so far there is no standard, generally accepted single method for studies of community resilience. Most community resilience studies have relied on mixed methods, including case studies and in-depth interviews. Where they differ is not so much on the set of study methods used, but on the purposes of the enquiry and hence the types of questions asked. Retrospective approaches have been used in studies emanating from both the social–ecological systems and psychology bodies of literature. Some argue that it is impossible to measure resilience directly, as it is future oriented (Carpenter et al. 2005). If so, retrospective methods become particularly important to explore how communities have responded to and recovered from past shocks and stresses. Measurement of resilience is a large topic and outside of our scope. Suffice to say that some take the view that resilience can be observed, or to some extent predicted through examination of the closely related characteristic, adaptive capacity.

Research Approaches that Build Adaptive Capacity and Community Resilience

Some research methods go beyond understanding the nature of community resilience, to involve communities in ways that are likely to promote their resilience through the learning and other opportunities that occur through a participatory research process itself. Many studies are finding that the ability of communities to engage actively in reflexive learning processes is key for building resilience (Robinson and Berkes 2011; Amundsen 2012; Christensen and Krogman 2012). As an illustration, participatory methods were incorporated by Hegney et al. (2008b) in a partnership project with a community showing resilience during a drought and after a fire, using participatory action research (PAR) as the overarching framework. Convergent interviews (Dick 1990) and other methods were conducted as part of

PAR. The study was designed to promote simultaneous community and research learning, and to provide a toolkit (Hegney et al. 2008a) to assist community developers, community leaders, and service providers to incorporate resilience-building activities within their usual working roles.

The relationship between research team and community beneficiaries is central to any participatory research approach. We use the term *participatory research* to mean full community participation in all phases of research. Figure 1 illustrates such an approach, whereby academic researchers and community members (through their representatives) hold a planning process to agree on the purposes and processes of the research for mutual benefit, reflect on findings, and prepare the documentation together (often in several iterations), both parties learning from the process. There are many ways of customizing this basic approach, such as the ways in which research and interpretation roles are shared.

There is considerable scope for expanding the use of participatory methods, including PAR, and adaptations of participatory rural appraisal techniques (Greenwood and Levin 2007). Participatory action research to assist a community to explore what makes it resilient (or not) holds particular promise for social learning, a factor recognized as assisting resilience (Wilson 2012). Participatory rural appraisal is more suited to exploring resource use in a way that assists communities to understand themselves, but could easily be extended to comprehend the components and behavior of social–ecological systems, leading to discussions of community-based planning and community development (see later discussion) to improve

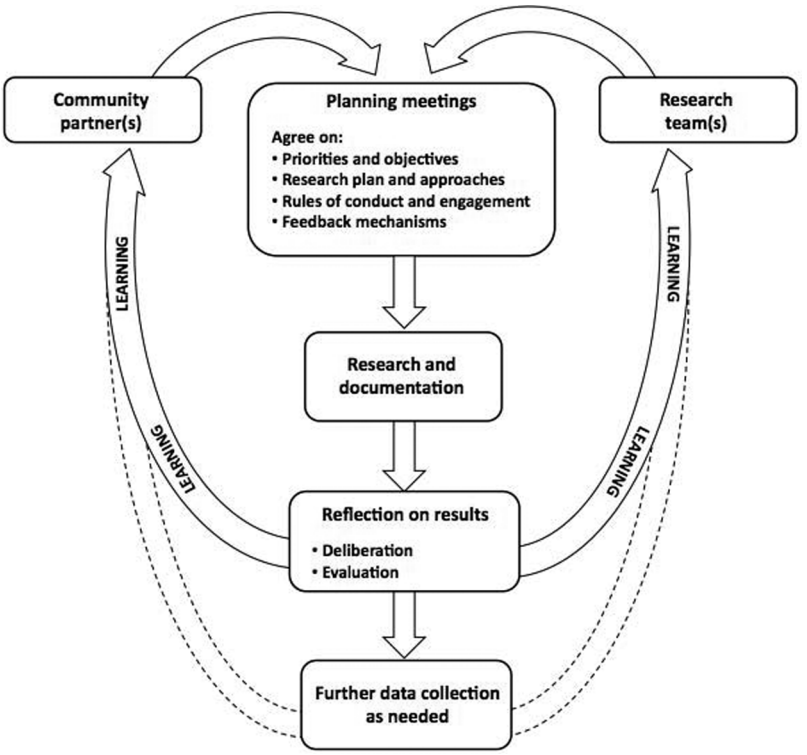

Figure 1. Generic model for participatory research to explore and build community resilience.

prospects by strengthening key elements. In all of these processes, careful attention is needed for engagement of participants, to offer opportunity to those interested while avoiding inclusion biases.

Some participatory methodologies that show promise are community-based planning approaches informed by resilience (Goldstein 2012); community development approaches (Zautra et al. 2008; Burnell 2013); social learning approaches (Armitage and Plummer 2010); and communities of practice (Wenger 1998). Adapting these methods to explore coupled social–ecological systems is a matter of framing interdependencies between people and their ecosystems, and then taking action to strengthen them. Thus, in a community planning approach, one could facilitate a community to develop understanding of its key social–ecological interdependencies, develop consensus on any needs to improve resilience, and plan ways in which to strengthen parts of the system to improve resilience. This may include building in redundancy, a feature noted in many resilient systems (Low et al. 2003).

There is considerable overlap between community-based planning and community development approaches, since community-based planning can be a good vehicle for community development, and much community development involves iterative planning within what we would now recognise as adaptive management cycles. A community development approach is necessarily participatory. A resilience-focused community development approach might make an initial assessment of both a community and its ecological interdependencies. Community members might conduct an assessment of their social–ecological system resilience for which tools are available (Resilience Alliance 2013).

A community development approach would seek to build on the social strengths of the community and its coupling with the local ecosystem, usually through a facilitated adaptive process taking one initiative at a time to develop group dynamics, confidence, knowledge and skills, and tangible improvements, through a buildup of small successes and failures that provide learning experiences (Olsson et al. 2004). Since community development is inherently systemic (seeking to improve many parts of a system through actions on one part at a time), resilience building might choose to focus on a particular strength known to support resilience, such as strong people–place relationships (Ross et al. 2010; Amundsen 2012), through a series of strategies chosen by the community and implemented at a pace comfortable for the community. Paton and Johnston (2001; 2006) advocate the use of community development approaches in disaster preparation and offer practical suggestions. One would expect a focus to foster increased knowledge, and social learning would, in effect, foster collaboration reshaping collective knowledge and informing "communicative resilience" (Goldstein 2012).

Taking inspiration from the social–ecological systems literature, key foci for a community development approach might include building collaborative social networks across, rather than purely within, communities and sectors—that is, building additional horizontal and vertical linkages (Berkes 2007; Seixas and Berkes 2010). To do so would prepare a community for future changes in environmental variability and uncertainty, not just for increasing resilience under present conditions (Robinson and Berkes 2011). Building multiple adaptive capacities might focus on windows of opportunity to take advantage of emerging social, economic or political conditions that might arise (Chapin et al. 2009).

A number of important issues are associated with adopting research methods that include aims and processes to build adaptive capacity and community resilience. Is there, and does there need to be, a delineation between scientist and development-practitioner

roles? Many natural, and to a lesser extent social, scientists are taught not to intervene, only to observe. Development practitioners aim to intervene constructively, and to learn from that process. Indeed, the paradigm of Critical Theory (Canella and Lincoln 2011) provides an ethical rationale and systematic approaches for interventions. The key is to collaborate with community partners, working with them rather than doing research on them; this is especially important when dealing with peoples emerging from colonization (Smith 1999).

Finally, methods for understanding and building community resilience can also pay attention to the ecological subsystem of social–ecological systems. The remarkable "greening" of part of the Sahel of Africa shows that the environment is not merely a "given" but can be changed and made more resilient over time, in turn contributing to community and regional resilience. Reversals toward reforestation in two regions of Niger were preceded by institutional changes in governance, then in livelihoods, and eventually in the biophysical environment, with the biophysical change driving further change in the other two domains (Sendzimir et al. 2011).

Approaches for Monitoring Leading to Learning

Monitoring, as an explicit search for information to assist learning, should be considered essential in the study of community resilience, as at any other level. The basic adaptive management cycle, learning by doing, relies on monitoring and evaluating outcomes to move forward (Gunderson and Holling 2002). Learning has been shown to be an important property of social–ecological systems for building resilience (Berkes et al. 2003; Armitage and Plummer 2010), and there is strong evidence to the effect that a community's own monitoring of a resource is one of the key variables for sustainable resource use (Nagendra 2007).

Our focus here is on research methods for designing and establishing good monitoring regimes, rather than collecting monitoring data once a regime is established. Some of the important areas are:

- Designing monitoring methodologies that match resilience or adaptive capacity-building objectives, with suitable frameworks, measures, or indicators (e.g., Vella et al. 2012).
- Ensuring these monitoring methodologies are well linked to planning and adaptive management cycles, to support social learning.
- Designing methods for monitoring shocks and stress on the social–ecological system, and adaptive responses by the community.
- Improving methods for monitoring the outcome of interventions.

Vella et al. (2012) outline a framework for monitoring community resilience. The Torrens Research Institute (2012) toolkit for assessing community disaster preparedness can easily be used for resilience monitoring. Ross et al. (2010) demonstrate the use of government statistics in monitoring community resilience. Longitudinal studies of communities provide relevant data, as do studies of individual-level resilience (e.g., Werner 1993). It may be possible to assess community resilience retrospectively by noting where community social–ecological systems have shown resilience through past events. Where resilience is yet to be tested through a major challenge, adaptive capacity (Armitage and Plummer 2010) may be the more relevant concept to use. Table 2 provides a selection of examples of approaches that can be used or adapted for monitoring community resilience.

Table 2. Possible ways to conduct community resilience monitoring

Aspects of resilience to monitor	Example and reference	Elaboration for community resilience monitoring
Persistence	Sachs Harbour, Northwest Territories, Canada, has experienced impacts from climate change but has persisted as a community to live in their particular environment (Berkes and Jolly 2001).	"Staying in the game" is the simplest indicator of resilience. Communities facing shocks and stresses can be followed up to find out whether they are persisting as a community living in their particular environment, as opposed to disbanding or relocating. Method—simple observation.
Problem solving	The community at Lake Racken, south-central Sweden, has faced a series of problems regarding its crayfish resource but has managed to solve one problem after another over many years (Olsson and Folke 2001).	Problem-solving networks and their ability to tackle increasingly more difficult problems is a qualitative indicator of the resilience of that community. The authors documented the series of problems faced (e.g., lake acidification) and the knowledge needed and used to address the problem. Method—participant observation, interviews.
Leadership	An examination of factors of success in a set of international cases combining conservation and development showed that leadership is a strong predictor of success, especially regarding bridging community and higher levels (Seixas and Davy 2008).	Explore the functions of community leaders and their linkages in identifying needs, dealing with problems, initiating self-organization, coordinating social interactions, and garnering external resources. Method—semistructured interviews.
Social networks (social capital)	In 38 coastal fishing associations in Chile, levels of bonding and bridging social capital differed, and the most successful associations were strong in linking social capital (Marin et al. 2012).	Social capital and social networks can be measured quantitatively, using interview data in social network analysis. This methodology can be repeated to obtain a time series regarding factors that are important for community resilience. Method—social network analysis.

(*Continued*)

Table 2. Continued

Aspects of resilience to monitor	Example and reference	Elaboration for community resilience monitoring
Engaged governance	Aboriginal and agency parties engaged in co-management in northern Australia developed qualitative, participatory monitoring procedures to identify indicators and measures of success (Stacey et al. 2013)	Participatory processes enable parties to identify their criteria for success, and how to measure performance. Where relevant measures are difficult to find, qualitative "measures" such as color coding are possible (Stacey et al. 2013). Methods—participatory action research to develop indicators, color coding.
Sets of attributes of social resilience	Regional organizations in northern Queensland, Australia, requested indicators and measures for monitoring social resilience. Researchers identified a set of attributes of resilient communities (qualitative indicators), and developed a set of monitoring criteria and measures (Ross et al. 2010; Maclean et al. 2013).	Time-series government statistics such as census data can be used as proxies for resilience attributes, with the caution that these may be weak approximations of the concepts intended. Method—use of government statistical data as proxies.

Table 2 shows that monitoring need not be a complex or expensive exercise; sometimes simple indicators suffice. Examples include a range of well-known research methods that can be used, such as participatory methods. In monitoring for community resilience, we need to look through a social–ecological systems lens, at the combined (or coupled) shifts of communities and ecosystems. In doing so, we would wish to look out particularly for nonlinear responses and potentially risky thresholds (Scheffer 2009). Those conducting monitoring would want to use the information in an adaptive management sense, to guide new cycles of adaptive capacity building.

Conclusions

This article seeks to assist the development of the research and practice field of community resilience by suggesting research approaches for improving the understanding of community resilience, learning how to improve community adaptive capacity, and learning how to monitor resilience so as to support learning and resilience building. Our conclusions will also apply to some concepts closely related to resilience, especially adaptive capacity. Indeed, given the significant overlap between adaptive capacity (a potential) and resilience (when that capacity becomes used in a

process of overcoming adversity), it may well be that studies that set out to explore community resilience have actually identified adaptive capacity—or both.

The limited empirical work to date on community resilience shows the value of using mixed methods and of conducting cumulative studies (sequences of studies in the same location), and the importance of building understanding by comparing results across studies. The present work concentrates on social aspects, and a particular challenge is to develop methods better capable of understanding the intertwined social and ecological aspects of community resilience.

We commend the use of participatory methods, so that a community can increase its own understanding through the research, reflection, and learning process and apply that learning. We identify opportunities to bring in new methods, for instance, participant observation over reasonably long periods, to analyze the dynamics of adaptation to a crisis, and resilience building that may emerge from it. This may reveal patterns that participants may not be able to verbalize sufficiently well. Longitudinal or follow-up studies, using one of a number of suitable methods, would be useful to investigate long-term disaster recovery, and waxing and waning in resilience. Participatory rural appraisal could use environmental cues to draw out aspects of the social–ecological system.

We further identify a need for continual learning and improvement, in both understanding community resilience and designing or advising with regard to effective interventions. Thus, there is potential to work across the three areas that we have identified in this article, so that research into methods for monitoring and evaluation assists the development of the other two fields, understanding resilience and research interventions to help build adaptive capacity and resilience.

Ethical issues are pertinent and important. Beyond the usual ethical considerations for social research (risks and benefits to participants, voluntary participation, and confidentiality of individual contributions), we need to consider intrusiveness in disaster or other stressful circumstances, with the ethics of researchers taking interventionist roles in research—or not taking roles that may assist the study community.

While this article concentrates on community resilience in its coupled human and environmental dimensions, we require a related endeavor to identify methods and analytical frameworks for connecting across the panarchy. Given that the community level is not isolated from influences from the higher levels, or the impacts of the well-being of households and individuals, we also need improved methods to identify how patterns in community resilience interact with those occurring at other levels.

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References

Agrawal, A., and C. C. Gibson. 1999. Enchantment and disenchantment: The role of community in natural resource conservation. *World Dev.* 27:629–649.

Amundsen, H. 2012. Illusions of resilience? An analysis of community responses to change in northern Norway. *Ecol. Society* 17(4):46. http://www.ecologyandsociety.org/vol17/iss4/art46/ (accessed 14 March 2013).

Armitage, D., and R. Plummer, eds. 2010. *Adaptive capacity and environmental governance*. Berlin, Germany: Springer-Verlag.

Béné, C., L. Evans, D. Mills, S. Ovie, A. Raji, A. Tafida, A. Kodio, F. Sinaba, P. Morand, J. Lemoalle, and N. Andrew. 2011. Testing resilience thinking in a poverty context: Experience from the Niger River Basin. *Global Environ. Change* 21:1173–1184.

Berkes, F. 2007. Community-based conservation in a globalized world. *Proc. Natl. Acad. Sci. USA* 104:15188–15193.

Berkes, F., J. Colding, and C. Folke, eds. 2003. *Navigating social-ecological systems: Building resilience for complexity and change*. Cambridge, UK: Cambridge University Press.

Berkes, F., and D. Jolly. 2001. Adapting to climate change: Social–ecological resilience in a Canadian western Arctic community. *Conserv. Ecol.* 5(2):18.

Berkes, F., and H. Ross. 2013. Community resilience: Toward an integrated approach. *Society Nat. Resources* 26:5–20.

Brown, D., and J. C. Kulig. 1996. The concept of resilience: Theoretical lessons from community research. *Health Can. Society* 4:29–50.

Brown, K., and E. Westaway. 2011. Agency, capacity, and resilience to environmental change: Lessons from human development, well-being, and disasters. *Annu. Rev. Environ. Resources* 36:321–342.

Buikstra, E., H. Ross, C. A. King, P. G. Baker, D. Hegney, K. McLachlan, and C. Rogers-Clark. 2010. The components of resilience: Perceptions of an Australian rural community. *J. Commun. Psychol.* 38:975–991.

Burnell, J. 2013. Small change: Understanding cultural action as a resource for unlocking assets and building resilience in communities. *Commun. Dev. J.* 48:134–150.

Canella, G. S., and Y. S. Lincoln. 2011. Ethics, research and critical social science. In *The Sage handbook of qualitative research*, 4th ed., ed. Y. S. Lincoln and N. K. Denzin, 81–90. Thousand Oaks, CA: Sage.

Carpenter, S. R., F. Westley, and M. G. Turner. 2005. Surrogates for resilience of social–ecological systems. *Ecosystems* 8:941–944.

Chapin, F. S. III, G. P. Kofinas, and C. Folke, eds. 2009. *Principles of ecosystem stewardship: Resilience-based resource management in a changing world*. New York: Springer-Verlag.

Christensen, L., and N. Krogman. 2012. Social thresholds and their translation into social–ecological management practices. *Ecol. Society* 17(1):5. http://www.ecologyandsociety.org/vol17/iss1/art5 (accessed 14 March 2013).

Cuthill, M., H. Ross, K. Maclean, K. Owens, B. Witt, and C. King. 2008. Reporting social outcomes of development: An analysis of diverse approaches. *Int. J. Interdiscip. Social Sci.* 3:145–158.

Davidson, D. J. 2010. The applicability of the concept of resilience to social systems: Some sources of optimism and nagging doubts. *Society Nat. Resources* 23:1135–1149.

Davidson, D. J. 2013. We still have a long way to go, and a short time to get there: A response to Fikret Berkes and Helen Ross. *Society Nat. Resources* 26:21–24.

Dick, B. 1990. *Convergent interviewing*. Brisbane, Australia: Interchange.

Etienne, M., D. R. Du Toit, and S. Pollard. 2011. ARDI: A co-construction method for participatory modeling in natural resources management. *Ecol. Society* 16(1):44. http://www.ecologyandsociety.org/vol16/iss1/art44 (accessed March 11, 2013).

Folke, C. 2006. Resilience: The emergence of a perspective for social–ecological systems analyses. *Global Environ. Change* 16:253–267.

Goldstein, B. E. 2008. Skunkworks in the embers of the Cedar fire: Enhancing resilience in the aftermath of disaster. *Hum. Ecol.* 36:15–28.

Goldstein, B. E., ed. 2012. *Collaborative resilience*. Cambridge, MA: MIT Press.

Gooch, M., and D. Rigano. 2010. Enhancing community-scale social resilience: What is the connection between healthy communities and healthy waterways? *Austr. Geogr.* 41:507–520.

Greenwood, D. J., and M. Levin. 2007. Participatory rural appraisal, rapid rural appraisal, and participatory learning and analysis. In *Introduction to action research*, 2nd ed., ed. D. J. Greenwood and M. Levin, 195–208. Thousand Oaks, CA: Sage.

Gunderson, L. H., and C. S. Holling, eds. 2002. *Panarchy. Understanding transformations in human and natural systems*. Washington, DC: Island Press.

Hegney, D., H. Ross, P. Baker, C. Rogers-Clark, C. King, and E. Buikstra. 2008a. *Building resilience in rural communities toolkit*. Toowoomba, Australia: University of Queensland and University of Southern Queensland. http://www.usq.edu.au/crrah/publications/2008/resiliencetoolkit (accessed 15 March 2013).

Hegney, D., H. Ross, P. Baker, C. Rogers-Clark, C. King, E. Buikstra, A. Watson-Luke, K. Mclachlan, and L. Stallard. 2008b. *Identification of personal and community resilience that enhance psychological wellness: A Stanthorpe study*. Toowoomba, Australia: University of Queensland and University of Southern Queensland.

Jorgensen, D. L., ed. 1989. *Participant observation*. Thousand Oaks, CA: Sage.

Kulig, J. C. 2000. Community resiliency: The potential for community health nursing theory development. *Public Health Nurs.* 17:374–385.

Kulig, J. C., D. Edge, and B. Joyce. 2008. Understanding community resiliency in rural communities through multimethod research. *J. Rural Commun. Dev.* 3:76–94.

Kulig, J. C., D. Hegney, and D. S. Edge. 2010. Community resiliency and rural nursing: Canadian and Australian perspectives. In *Rural nursing: Concepts, theory and practice*, 3rd ed., ed. C. A. Winters and H. J. Lee, 385–400. New York: Springer.

Low, B., E. Ostrom, C. Simon, and J. Wilson. 2003. Redundancy and diversity: Do they influence optimal management? In *Navigating social-ecological systems*, ed. F. Berkes, J. Colding, and C. Folke, 83–114. Cambridge, UK: Cambridge University Press.

Lu, F. 2010. Patterns of indigenous resilience in the Amazon: A case study of Huaorani hunting in Ecuador. *J. Ecol. Anthropol.* 14:5–21.

Lynam, T., R. Mathevet, M. Etienne, S. Stone-Jovicich, A. Leitch, N. Jones, H. Ross, D. Du Toit, S. Pollard, H. Biggs, and P. Perez. 2012. Waypoints on a journey of discovery: Mental models in human-environment interactions. *Ecol. Society* 17(3):23. http://www.ecologyandsociety.org/vol17/iss3/art23 (accessed 11 March 2013).

Maclean, K., M. Cuthill, and H. Ross. 2013. Six attributes of social resilience. *J. Environ. Plan. Manage.* doi:10.1080/09640568.2013.763774

Magis, K. 2010. Community resilience: An indicator of social sustainability. *Society Nat. Resources* 23:401–416.

Manyena, S. B. 2006. The concept of resilience revisited. *Disasters* 30:433–450.

Marschke, M., and F. Berkes. 2006. Exploring strategies that build livelihood resilience: A case from Cambodia. *Ecology and Society* 11(1):42. http://www.ecologyandsociety.org/vol11/iss1/art42/ (accessed 11 March 2013).

Nagendra, H. 2007. Drivers of reforestation in human-dominated forests. *Proc. Natl. Acad. Sci. USA* 104:15218–15223.

Norris, F. H., S. P. Stevens, B. Pfefferbaum, K. F. Wyche, and R. L. Pfefferbaum. 2008. Community resilience as a metaphor, theory, set of capabilities, and strategy for disaster readiness. *Am. J. Commun. Psychol.* 41:127–150.

Olsson, P., and C. Folke. 2001. Local ecological knowledge and institutional dynamics for ecosystem management: A study of Lake Racken watershed, Sweden. *Ecosystems* 4:85–104.

Olsson, P., C. Folke, and T. Hahn. 2004. Social-ecological transformation for ecosystem management: The development of adaptive co-management of a wetland landscape in southern Sweden. *Ecol. Society* 9(4):2. http://www.ecologyandsociety.org/vol9/iss4/art2 (accessed 2 March 2013).

Paton, D., and D. Johnston. 2001. Disasters and communities: Vulnerability, resilience and preparedness. *Disaster Prevent. Manage.* 10:270–277.

Paton, D., and D. M. Johnston. 2006. *Disaster resilience: an integrated approach*. Springfield, IL: Charles C. Thomas.

Resilience Alliance. 2013. Resilience assessment. http://www.resalliance.org/index.php/resilience_assessment (accessed 30 May 2013).

Robinson, L. W., and F. Berkes. 2011. Multi-level participation for building adaptive capacity: Formal agency–community interactions in northern Kenya. *Global Environ. Change* 21:1185–1194.

Ross, H., and F. Berkes. 2013. Community resilience: A rejoinder to Debra J. Davidson. *Society Nat. Resources* 26:25–29.

Ross, H., M. Cuthill, K. Maclean, D. Jansen, and B. Witt. 2010. *Understanding, enhancing and managing for social resilience at the regional scale: Opportunities in North Queensland*. Cairns, Australia: Reef and Rainforest Research Centre Ltd. http://www.rrrc.org.au/publications/social_resilience_northqueensland.html (accessed 2 January 2012).

Sallu, S. M., C. Twyman, and L. C. Stringer. 2010. Resilient or vulnerable livelihoods? Assessing livelihood dynamics and trajectories in rural Botswana. *Ecol. Society* 15(4):3. http://www.ecologyandsociety.org/vol15/iss4/art3 (accessed 2 March 2013).

Scheffer, M. 2009. *Critical transitions in nature and society*. Princeton, NJ: Princeton University Press.

Seixas, C., and F. Berkes. 2003. Dynamics of social-ecological changes in a lagoon fishery in southern Brazil. In *Navigating social-ecological systems*, ed. F. Berkes, J. Colding, and C. Folke, 271–298. Cambridge, UK: Cambridge University Press.

Seixas, C. S., and F. Berkes. 2010. Community-based enterprises: The significance of partnerships and institutional linkages. *Int. J. Commons* 4(1):183–212.

Seixas, C. S., and B. Davy. 2008. Self-organization in integrated conservation and development initiatives. *Int. J. Commons* 2:99–125.

Sendzimir, J., C. P. Reij, and P. Magnuszewski. 2011. Rebuilding resilience in the Sahel: Regreening in the Maradi and Zinder regions of Niger. *Ecol. Society* 16(3):1. http://www.ecologyandsociety.org/vol16/iss3/art1 (accessed 2 March 2013).

Smit, B., and J. Wandel. 2006. Adaptation, adaptive capacity and vulnerability. *Global Environ. Change* 16:282–292.

Smith, L. T. 1999. *Decolonising methodologies: Research and Indigenous peoples*. London: Zed Books.

Stacey, N., A. Izurieta, and S. T. Garnett. 2013. Collaborative measurement of performance of jointly managed protected areas in northern Australia. *Ecol. Society* 18:19. http://www.ecologyandsociety.org/vol18/iss1/art19 (accessed 11 March 2013).

Stone-Jovicich, S. S., T. Lynam, A. Leitch, and N. A. Jones. 2011. Using consensus analysis to assess mental models about water use and management in the Crocodile River catchment, South Africa. *Ecol. Society* 16(1):45. http://www.ecologyandsociety.org/vol16/iss1/art45 (accessed 11 March 2013).

Torrens Resilience Institute. 2012. *Developing a model and tool to measure community disaster resilience: Community disaster resilience scorecard toolkit*. Adelaide, Australia: Torrens Resilience Institute. http://www.torrensresilience.org/images/pdfs/toolkit/tritoolkit.pdf (accessed 18 May 2013)

Trosper, R. 2009. *Resilience, reciprocity and ecological economics*. New York: Routledge.
Tyler, S., and M. Moench. 2012. A framework for urban resilience. *Climate Dev.* 4:311–326.
Vella, K., A. Dale, A. Cottrell, and M. Gooch. 2012. Assessing community resilience to climate change. *Proceedings of the 12th International Coral Reef Symposium*, Cairns, Australia, July 9–13. http://www.reefbase.org/resource_center/publication/icrs.aspx (accessed 18 May 2013).
Werner, E. E. 1993. Risk, resilience and recovery: Perspectives from the Kauai longitudinal study. *Devel. Psychopathol.* 5:503–515.
Wenger, E. 1998. *Communities of practice: Learning, meaning and identity*. Cambridge, UK: Cambridge University Press.
Wilson, G. 2012. *Community resilience and environmental transitions*. Oxford, UK: Earthscan.
Zautra, A., J. Hall, and K. Murray. 2008. Community development and community resilience: An integrative approach. *Commun. Dev.* 39(3):130–147.