



Operationalising systemic resilience

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ABSTRACT

This paper provides a critical analysis and synthesis of insights from the fields of Resilience Thinking, Critical Systems Thinking, Community Operational Research and Development Studies; and presents an operational framework for 'systemic resilience'. The framework is grounded in strength-based multi-stakeholder processes that explore the framing of 'resilience of what, to what, for whom, over what time frame'. Insights from Critical Systems Theory and Systemic Intervention demonstrate that rigorous framing of resilience necessarily involves participatory systemic boundary critique and both theoretical and methodological pluralism. This framework has implications for Community Operational Research activities aimed at building community resilience, and a suite of general principles is provided to this end. The Systemic Integrated Adaptation program in Nepal is provided to highlight applications in Community Operational Research, and also to highlight the flexible nature of the framework through the use of novel participatory techniques. Finally, the paper provides a discussion aimed to promote dialogue between the Resilience, Systems Thinking, Community Operational Research and Development communities.

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1. Introduction

This paper provides an operational framework for understanding and managing system resilience, based on a novel synthesis of insights from the fields of Resilience Thinking, Critical Systems Thinking, Community Operational Research (COR) and Development Studies. The paper begins with an overview and synthesis of extant meanings of resilience, and provides an inclusive conceptualisation that situates any particular definition. It then demonstrates how applications of key insights from Critical Systems Thinking can be used to operationalise the prevalent but contentious concept of resilience in an open, inclusive, critical and rigorous manner. In particular, the literature on systems thinking highlights that any attempt to characterise system resilience inevitably relies on normative and partial system boundary judgements, so rigour in this pursuit requires the participation of diverse stakeholders and experts in critical processes, and is always an intervention. Development theory and practice has a long history of wrestling with issues of participation, representation, power and empowerment. Both Critical Systems Thinking (especially its application in Community OR), and Development Studies acknowledge issues of what constitutes improvement, who gets to decide this, for whom and how. Thus, this paper draws on development theory and COR in creating an operational framework

for systemic resilience that is ethical and empowering for those involved.

This systemic resilience framework has been applied, tested and refined in 21 countries across 5 global regions - South Asia, South-East Asia, East Africa, West Africa and Europe - which include both developing and developed world contexts. The Systemic Integrated Adaptation Program in Nepal, which is concerned with climate resilience of small holder farming communities, is provided as an illustrative case study. Though the case provided in this paper focuses on community resilience, the framework is independent of scale, it has been applied from household, through community, to regional scales through CGIAR, UNEP-WCMC and EU based action research programs (Helfgott, Vervoort, & Bailey, 2014; Vervoort, Helfgott, & Lord, 2016; Vervoort, Helfgott, Lord, & Vervoort, 2016; Wicander et al., 2015). Building on the case study, the paper provides a set of principles for building community resilience. Finally, the paper presents a general discussion of the application of the systemic resilience framework.

Resilience, Systems Thinking and Development have their foundations in different disciplinary and socio-cultural domains and are largely distinct communities of practitioners. However, they all share, at their core, the motivation to protect or improve certain systemic conditions. They all wrestle with concerns regarding the implications of interconnectedness, reductionism, technocracy, representation, marginalisation and vulnerability. There are also very crucial differences amongst the communities; in particular, the contemporary systems thinking community and develop-

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ment practitioners both explicitly acknowledge that they are interventionists, which is not yet the case amongst the majority of resilience researchers and practitioners. COR and development studies explicitly critique normal science ontology and seek means to provide rigour and legitimacy without relying on positivist science, or unjustifiable claims of objectivity through either holism or reductionism. This paper demonstrates that there are significant insights to be gained from bringing these theories and practices, and ultimately the associated communities, together to learn from one another. As well as providing an operational framework for systemic resilience, this paper seeks to provide the basis for ongoing dialogue between these communities. Accordingly, some extra detail has been included when reviewing key insights from each of the fields than would have been provided if addressing only one readership, in order to facilitate dialogue between the communities.

2. Three types of system behaviour

Resilience has become a central theme of research, policy and programs, across disciplines and sectors, all over the world, from community to global scales (Bhamra, Dani, & Burnard, 2011; Martin-Breen & Anderies, 2011). However, the global spread of resilience has not resulted in global definitions. There are as many different understandings of both the concept and application of resilience as there are practitioners; each with practical reasons for adopting a particular interpretation in their context. Accordingly, resilience has been described as a boundary object, loosely structured in common use, open to interpretation, and only obtaining meaning in a particular context (Brand & Jax, 2007). Boundary objects are flexible, interpreted differently in different disciplines, sectors and social worlds, but have enough common threads to be recognizable (Star & Griesemer, 1989). Some authors have flagged the risks that, as such, resilience “may become a hollow concept for planning: an empty signifier that can be filled to justify almost any ends” (Porter & Davoudi, 2012). Yet, resilience has the *potential* to reframe our thinking and planning to better embrace change, uncertainty, unknowability and normativity, and it remains important to engage with in spite of these challenges.

Furthermore, there *are* common threads. Across all disciplines, sectors and social worlds, resilience relates to the response of a system to disturbance or change, whether that disturbance is sudden and shocking or more gradual. When a system is subjected to disturbance, these are the only possible outcomes: it withstands the disturbance, maintaining the specified features of interest, or not; if not, it either recovers the features of interest in an acceptable time frame or not; if it does not maintain the specified features of interest and does not recover them, but ends up in a different condition following disturbance, then the question is whether or not the change in the system is considered desirable, or even an improvement.

The term ‘resilience’ was first formally used in physics and engineering, where it was defined as the capacity of a material to absorb energy when it is deformed elastically, and, upon unloading, to have this energy recovered and to ‘spring back’ and regain its original shape (Campbell, 2008). Some work in ecology adopted this idea, and the term was used to define the capacity of an ecosystem to resist a perturbation and/or to return to equilibrium after having been subjected to shock. For example, ‘a resilient ecosystem can withstand shocks and rebuild itself when necessary’ (Resilience Alliance 2002), and resilience is ‘the capacity of an ecosystem to resist a perturbation or to return to equilibrium after having been subjected to shock’ (van der Leeuw & Aschan-Leygonie, 2005). Some social-ecological definitions echo the understanding of absorbing disturbance and maintaining specified properties in the face of change, defining resilience as ‘the capacity

of social-ecological systems to absorb recurrent disturbances ... so as to retain essential structures, processes and feedbacks’ (Adger, Hughes, Folke, Carpenter, & Rockström, 2005).

The ability to withstand or recover from disturbance corresponds to the notion of stability, particularly in mathematics. Conceptualization of resilience as stability around a particular equilibrium (Gunderson, 2000; Holling, 1996) leads to consideration of return times and return paths to the original state, hysteresis, whether or not the state of the system remains in the neighbourhood of the original equilibrium – often visualized as staying within the same ‘basin of attraction’ or moving to an ‘alternate stable state’ or ‘alternate regime’ (Walker, Holling, Carpenter, & Kinzig, 2004).

However, many scholars involved in resilience in relation to social-ecological systems increasingly avoid the use of terms meaning ‘staying the same’ or ‘recovering’, and prefer the concepts of renewal, regeneration and reorganization following disturbance, or adapting as a mechanism for coping with change: ‘The resilience approach is concerned with how to persist through continuous development in the face of change and how to innovate and transform into new more desirable configurations’ (Folke, 2006), or ‘Resilience is the capacity of a system to absorb and utilize, or even benefit from, perturbations and changes that attain it’ (Holling, 1973). It is not always desirable to return to the same equilibrium and disturbance can be an opportunity for positive change. Adding the notion of innovating, adapting and benefiting to the conceptualization means that systems do not need to return to the same equilibrium or maintain the same regime in order to be resilient. They can be considered resilient as long as the resulting change is judged to be at least as desirable as the original state or regime.

The notion of desirability adds a clearly normative dimension to resilience. In fact, a great deal of resilience literature is concerned with maintaining desirable states or regimes and avoiding or reversing undesirable states or regimes as ‘collective capacity to manage resilience, intentionally, determines whether they can successfully avoid crossing into an undesirable system regime, or succeed in crossing back into a desirable one’ (Walker et al., 2004).

Three types of behaviour, each described as resilience in the literature, can be summarized as follows:

- 1 Robustness/Resistance: absorbing the disturbance and maintaining specific features of interest; ability to resist change.
- 2 Stability/Recovery: recovering from the disturbance and returning to the original specific features of interest.
- 3 Adapting/Benefiting: adapting as a result of the disturbance and moving to a new situation that is at least as desirable as the original, potentially more so.

If a system is able to withstand disturbance, it will be called resilient; if a system is able to recover from disturbance, it will be called resilient; if a system is able to improve following disturbance, it will be called resilient. The only response to disturbance that is not considered resilient is when the system changes to a condition that is deemed less desirable than prior to the disturbance. In inter- or transdisciplinary settings, it is useful to adopt an inclusive understanding of resilience as the capacity of a system to cope with change by any of the means listed above – these are all strategies for coping with change and avoiding transition to an undesirable state.

3. ‘Re’framing resilience

Resilience is normative in that it relies on the definition of desirable versus undesirable system features. Judgement of what is desirable and what constitutes improvement or detriment is observer dependent. Changes that benefit one stakeholder may be detrimental to another. The questions of who gets to define what

is desirable and how this will be negotiated raise interesting challenges to operationalizing resilience in practice, and directly point to practical and ethical considerations that the development sector has been wrestling with for decades, where what constitutes development or improvement, for whom and by whom, has predominantly been decided by the haves rather than the have-nots (Mikkelsen, 2005; Tvedt, 1990).

Further, where system boundaries are drawn, what is included in the analysis, which features of the system are allowed to change and which must be preserved, and what sorts of change constitute improvement, completely determines what is interpreted as resilience, adaptability, vulnerability or collapse, and so forth. Consider, for example, the ancient Mayan Civilization. In his book *Collapse* Jared Diamond cites the Mayan Civilization as an archetypal example of collapse (Diamond, 2005). However, a response to Diamond entitled *Questioning Collapse*, argues that it was a sustainable decision on the part of the Mayans to migrate, based on the distribution of their resource base, and in this way their descendant populations survived and persist today, self-identifying as Mayans (McAnany and Yoffee 2009). Hence, they argue that the Mayans are an example of adaptation and resilience rather than collapse. The authors highlight and critique normative historical, political and cultural labels of what constitutes civilization and societal 'success' or 'failure'. Interpretations of resilience are highly dependent on the perspectives taken on any particular system and the values adopted: these things affect the definition of the boundaries of the system, the desirability of features, which features people want to preserve and which they think ought to be changed.

The type of disturbance is also important. Systems can be very resilient to one type of disturbance but vulnerable to another. For example, Mumbai slum dwellers have developed strategies for coping effectively with year-on-year flooding; however, they are completely vulnerable to the outbreak of a viral epidemic (Varghese, 2011). Further, increasing resilience or robustness to one type of disturbance can often lead to increased vulnerability and fragility to other types of disturbance. Doyle *et al.* highlight what is called the robust yet fragile nature of the internet: that every time a particular type of disturbance is designed for and overcome, the more heavily designed the system becomes to the known and identified disturbances, the more fragile it seems to become to unknown and unforeseen disturbances in the future (Doyle *et al.*, 2005). Action taken now to build robustness or stability may reduce adaptive capacity to future changes. This also highlights that resilience is a concept that is meaningless without specification of the timescale under consideration. Timescale determines the relevant disturbances; timescale also determines whether or not the features of interest have recovered in an acceptable fashion.

In summary, resilience is a property of a system that describes the nature of the response of the system to a particular disturbance, of a particular magnitude, from the perspective of a particular observer over a specified timescale. Thus, any method used to characterize resilience relies on a clear specification of the boundaries of the system under consideration, of the notion of improvement within those boundaries, and for whom, the type and magnitudes of disturbance to be considered and the timescale to be considered. In order to discuss resilience meaningfully, it is essential to talk about resilience of what, to what, from whose perspective and over what time frame. These key issues represent a framing cycle, since each element has the potential to iteratively reframe all of the others, as shown in Fig. 1 (Helfgott, 2014).

4. The problem of holism

Resilience thinking grew out of a desire to be holistic; to avoid the over-simplifications and narrow reductionist approaches that led to poor stewardship of human and natural systems and col-

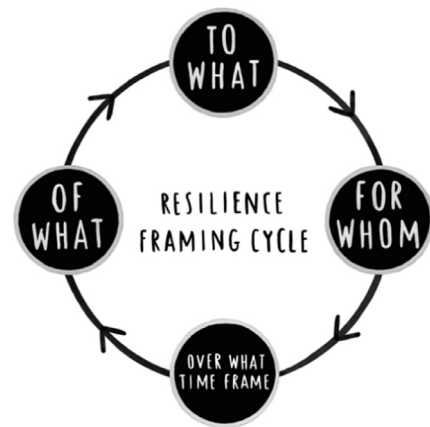


Fig. 1. Resilience framing cycle.

lapse in the past (Hughes *et al.*, 2007; Walker *et al.*, 2004). According to a widely held understanding of the resilience idea, resilience thinking means an effort to 'look at the whole' of an issue (Folke *et al.*, 2010; Walker & Salt, 2006). That is, to include the entire relevant problem environment in one's definition of a modelling, design or governance problem. This claim to holism is something that has been taken for granted in much of the resilience literature. It has been a very fashionable idea and it represents a self-justifying ideology: that resilience thinking is comprehensive rather than reductionist.

Another important part of taking a resilience approach is acknowledging the fundamental interdependence and interrelatedness of all things (Walker & Salt, 2006). Many authors have written about 'panarchy' (the cyclical collapse and renewal of a system within certain constraints), and cross-scale and cross-level effects (Gunderson & Holling, 2002); about the need for interdisciplinarity (Brand & Jax, 2007; Folke, 2006); the interaction of multiple stressors (O'Brien *et al.*, 2004); and the multi-consequentialist nature of any intervention aimed at building resilience (Agrawal, 2011). There is increasing awareness of the links that exist between physical, social, economic, political and ecological systems at all scales (Gunderson & Holling, 2002). These cross-scale, cross-sector, cross-discipline links make the setting of boundaries, when seeking to understand resilience or to intervene, 'difficult and often highly contentious' (Midgley, 2000). The way system boundaries are drawn, which disturbances are being considered, and what constitutes desirability and improvement over what time frame, determines what will be considered resilience or adaptation versus vulnerability or collapse, and determines the conclusions and recommendations for actions that are drawn.

Within the systems thinking literature, Werner Ulrich highlights that comprehensiveness and reductionism both rely on the same type of rationality, instrumental rationality, as both strive for unconditional justification (Ulrich, 1993). However, comprehensiveness is challenged because comprehensive thinking on social and ecological issues 'can find no natural boundaries' (Ulrich, 1993). Because of the interconnectedness of all things - a fundamental part of resilience thinking - comprehensiveness would imply expanding our system boundaries to include 'the World and God and everything' down to an infinite level of detail, or otherwise be left with a problem that is incompletely specified because something relevant has been left out of the analysis. This is what Ulrich refers to as 'the problem of holism' since 'the holistic imperative of "considering everything relevant" is philosophically as inescapable as it is impracticable' (Ulrich, 1993).

To a certain extent, this problem seems to have plagued resilience in practice, with some perceiving that the best resilience

thinkers are those with the biggest models. The systems thinking and operational research communities went through a similar process that led to the 'death of the super model' in the 1970s (Midgley & Richardson, 2007). The problem with saying you are going to be holistic is that, while it is a worthy goal, it is unachievable in practice due to the fundamental interdependence and interrelatedness of all things. 'The quest for comprehensiveness, although it represents an epistemologically necessary idea, is not realizable' (Ulrich, 1993). As human beings we do not have a 'God's eye view' of everything because there are limits to our understanding. Those limits are called boundaries, and system boundary judgements are inevitable. Given the underpinnings of resilience in an ontology of interconnectedness, like systems thinking, the real challenge posed by the resilience idea is not that, in order to be rational, we need to be comprehensive, but rather that we must learn to deal critically with the fact that we never are.

5. A participatory imperative

The systems thinking literature has a long tradition of wrestling with interconnectedness, the quest for comprehensiveness and the problem of holism. In the late 1960s, Charles West Churchman, one of the most influential thinkers within the systems movement, asked, 'How can we design improvement in large-scale systems without understanding the whole system, and if the answer is we cannot, how is it possible to understand the whole system?' (Churchman, 1968a). He answered that we cannot apprehend the 'whole system' in any objective sense, and that we make value-laden judgements about what to include and what not to include, that these choices have power since they determine the assessment of improvement, and there is therefore an ethical dimension to how they are made.

Those involved in understanding or modelling human and natural systems make judgements about what is important to include in the analysis and what can be delegated to the system's environment. These judgements are influenced by their education, social and cultural values, their purpose in conducting the analysis, the methods they use, the information/data available and a range of intangible factors. What belongs to the 'whole system' is entirely dependent on and relative to the inquirer's choice of conceptual boundary (Ulrich, 1983). As such, whenever we speak of a system, it should be obvious that we are not speaking of transcendent reality (Matthews, 2004).

Vickers's notion of an 'appreciative system' highlights that our human experience develops within us a propensity to notice particular aspects of our situation, to categorize them in particular ways and to measure them against particular standards, norms or values (Vickers, 1965). This experience-based system of understanding the external world around us is the 'appreciative system which creates for all of us, individually and socially our appreciated world' (Checkland, 1981). Fig. 2 is a depiction of different appreciative systems, with different boundary judgments. The system boundary judgements made inform the systems models subsequently developed and, therefore, our understanding of that portion of the "real" world (Churchman, 1968b). Moreover, as discussed, these boundary judgements also determine what will be defined as resilience or adaptation versus degradation or collapse.

Accepting that boundary judgements are inevitable, normative and affect our conclusions and recommendations for action about resilience implies that we should progress with humility, in a reflective and iterative manner that involves all those whose lives might be affected in whatever intervention we might propose. Participation of diverse affected stakeholders is a requirement for scientific rigour since resilience thinkers cannot rest on indefensible claims of objectivity or comprehensiveness. It is also a prac-

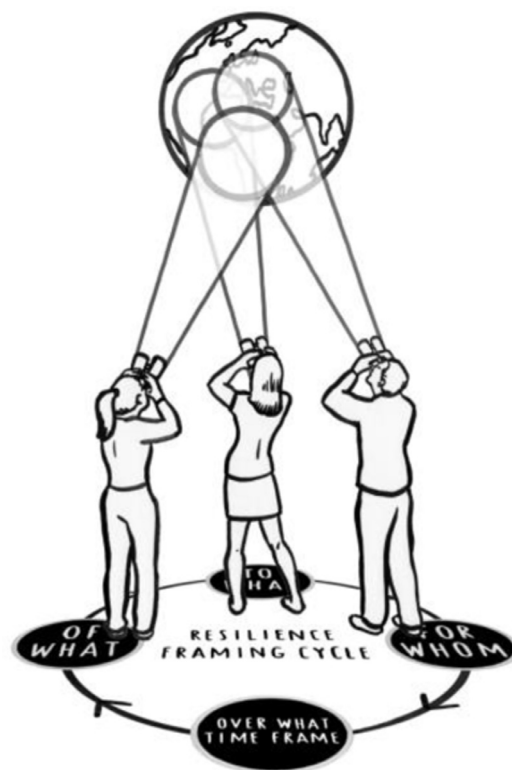


Fig. 2. Different frames.

tical requirement since 'it is only by being open to exploring the boundaries of issues from global environmental issues to local homelessness, and encouraging the participation of diverse stakeholders, while capturing and effectively communicating uncertainty, that a variety of possible angles can be covered, and unanticipated negative side effects of intervention can be minimized' (Midgley, 2000).

This necessitates the use of participatory methods for understanding, modelling or managing resilience. Furthermore, since we can only ever have a partial view of the relevant problem context, there will always be some unanticipated consequences of any intervention. Accordingly, our approaches must be reflectively assessed and improved through an iterative process of feedback loops of learning by doing. This understanding forms the basis of the reflective, iterative, participatory approach to operationalizing resilience advocated in this paper.

6. Boundary critique, pluralism and intervention

Critical Systems Heuristics (CSH) is a social theory and systemic methodology for handling the issues flagged above (Ulrich, 1983, 1987). It is founded upon the following ideas: (1) that system boundary judgments are inevitable and everyone makes them – scientists, planners and lay people alike; (2) that these boundary judgments are subjective or inter-subjective and shaped by our values; (3) that they determine the knowledge generated and the conclusions and recommendations for action drawn; and (4) that planners can only ever refer back to their boundary and associated value judgments to justify the merits of propositions. It is a methodology that supports professional practice through the critical employment of the systems idea and a framework for reflective practice (Ulrich, 1983).

To make this idea practical, Ulrich developed a set of 'critical systems heuristics' questions that both planners and ordinary peo-

ple could use. These questions are asked about both what the situation is and what it ought to be, focusing on four areas: Motivation – why are you interested in the system or would you want to be intervening in this system in the first place? Control – who should have decision-making power? What should different groups of people have some say over? Knowledge and expertise – what forms of knowledge are necessary and from what sources? Legitimacy – what are the values this is based on? Are you creating an oppressive system, or one that benefits some and harms others, and if so what can and should you do about it? These questions provide a systematic methodology for characterizing the system of interest and making the related normative content of system boundary judgements explicit. This is fundamental to ethical and rigorous scientific practice. The language of the original questions is not necessarily easily transferable to the organisations that are frequently the partners for implementation of the operational framework described in this paper. Accordingly, the questions have been adapted and rephrased here (as recommended by Midgley, 2000, who likewise discusses the need to adapt the questions) for the purpose of developing a transferable methodology for boundary critique specifically for resilience framing.

Operationalising resilience in practice involves negotiation of the following key framing questions:

- What are the boundaries of the system of interest (which social, cultural, technical, economic, political or ecological factors are included)? (Resilience of what?).
- Which disturbances should be included in the analysis? (Resilience to what?).
- Which features of the system need to be preserved, which features can change, and what constitutes desirable change (improvement) for whom? (Resilience for whom?).
- What is the timeframe for analysis and planning? (Over what time frame)?

The answers to each of these key framing questions iteratively inform the others, and depend on who is involved in answering them, on whose behalf, as shown in Fig. 1. In any real world situation different stakeholders and experts often have very different opinions on the answers to these key framing questions. Given these differences of opinion, the answers generated for the resilience framing questions depend upon the following questions, informed by Ulrich's CSH, which crucially unpack the “for whom” dimension of resilience:

- Who ultimately gets to decide the answers to the resilience framing questions, who has a say, and how will this be done?
- What is the purpose of the initiative? Who gets to decide this?
- Who is supposed to benefit? That is, whose interests should be served by any proposed efforts (which human actors, non-human species and so forth)? Who gets to decide this and how will it be decided?
- Who is and who ought to be considered a professional or an expert? What forms of knowledge (scientific/local/traditional) are sought in the process of understanding and/or managing resilience?
- Which world views (different visions of improvement, success or desirability) are present and how are differences to be reconciled in the process of framing resilience?
- What secures the emancipation of marginalized groups from the premises and promises of those involved in understanding and managing resilience?
- Who is to be the witness to the interests of those affected but not involved in planning, decision-making or implementation? Who should be treated as a legitimate stakeholder, and who argues (should argue) the case of those stakeholders who cannot speak for themselves, (including future generations and non-human nature)?

There are likely to be differences in opinion on the answers to this second set of questions too, and transparent negotiation is required for scientific rigor and ethical practice (Ulrich, 1983). Thus, operationalising resilience, even for descriptive purposes, becomes a value-laden intervention, though many resilience practitioners do not explicitly acknowledge that they intervene. Both sets of questions are needed to fully characterise resilience “for whom”. As in the case of Ulrich's original framing of Critical Systems Heuristics, these questions are designed to be applied reflectively by the team of researchers involved in characterizing and managing resilience and also polemically in dialogical processes involving both involved planners and affected citizens – in fact, involving as many diverse stakeholders as possible.

Systemic Intervention (SI) is a methodology that explicitly acknowledges the interventionist nature of endeavors such as this (Midgley, 2000). It builds on and incorporates Ulrich's boundary critique while going beyond the simple 12-question method. The realization that we can explore different boundary judgements and the values associated with these legitimates the notion of theoretical pluralism: drawing on multiple theories depending on our purposes. Different theories assume different boundaries of analysis, so if we can decide between a wide range of possible boundaries, which is certainly the case when framing resilience, we can also draw upon a wide range of theories (Midgley & Richardson, 2007).

Furthermore, different methodologies and methods make different theoretical assumptions. Therefore, if theoretical pluralism is possible, so is methodological pluralism (Midgley & Richardson, 2007). This is the theoretical rationale for methodological pluralism, but there are more important practical reasons for it: there is no method that can do everything, or that is equally accessible to the different types of stakeholders involved in any real-world application of resilience. It is therefore a good idea to draw upon multiple methods when seeking to characterize resilience. Accordingly, this operational framework for systemic resilience involves the use of a range of different methods from different disciplines and sectors.

It is for these same reasons that extensive work has been conducted applying CSH and SI within COR activities in multiple sectors, including (Boyd, Brown, & Midgley, 2004; Midgley, 1997; Midgley, Munlo, & Brown, 1998). In fact, SI was developed with COR as its first application area; thus, the case is made that resilience, systems thinking and COR are in alignment with implications for practice in all these fields.

The key features of SI are: systemic boundary critique; theoretical pluralism, methodological pluralism; and dialogical as well as instrumental reason. Applying the principles of SI to resilience requires that the operational framework adopts theoretical and methodological pluralism. This means an imperative to use multiple methods and tools from multiple theoretical backgrounds to frame resilience. The framework presented here also encourages resilience research to be conducted in interdisciplinary teams so that lenses from different disciplinary backgrounds (which generate different appreciative systems) can be applied to the same topic.

This operational framework embraces Gregory's notion of discordant pluralism (Gregory, 1996). An advocate of discordant pluralism acknowledges that often different theoretical perspectives are discordant, and cannot be resolved into a single overarching theory without distortion and loss of nuanced information that is contained in each perspective. Tensions between them are keys to deeper understanding, as they promote continued debate and communication between different perspectives. Therefore, rather than minimizing tensions, discordant pluralism aims to promote communication between ‘discordant’ theoretical perspectives with the aim of coming to a deeper understanding than is achievable by attempting to reconcile or compartmentalize them.

7. Strength-based development and Community Operational Research

Over the course of several decades, the development sector has undergone a paradigm shift from problem-based approaches, focusing on what is lacking in societies and the provision of external resources, expertise and solutions, to strength-based approaches, focusing on the strengths in societies and building on the capacities that exist, empowering people for their own development from the inside out (Dureau, 2007; Helfgott, 2008). The foundational principle of strength-based approaches is that, 'although there are both capacities and deficiencies in every community, a capacities-focused approach is more likely to empower people and mobilize citizens to create positive and meaningful and sustainable change from within' (Foster & Mathie, 2001). Furthermore, problem-based approaches often prove disempowering and in this way undermine resilience (Helfgott, 2008).

Whereas problem-based approaches focus on deficiencies, asking 'Why have you failed?', strength-based approaches focus on capabilities, asking 'What makes success?' (Dureau, 2007). The community looks to the past for where they prospered before and articulate a history of success in their own terms. The process of articulating past achievements and successes builds energy and greater freedom to imagine a desirable future that is less limited by present expectations and negative bias. They then look to the future and envision where they would like to be at the end of the planning horizon. Existing knowledge, skills, tools and resources are systematically uncovered and catalogued; then designs are developed based on the mobilization of resources and ownership of plans.

Using strength-based approaches in practice implies a paradigm shift from the problem-based perspective of any group as 'complex masses of needs and problems' to 'diverse and potent webs of gifts and assets' (Kretzmann & McKnight, 1993). Each society has a unique set of knowledge, skills, tools and resources that can be channeled for development. The role of external intervention adopted in this operational framework is to support local actors in being drivers of change in their own context, through an iterative process of articulating visions, goals and community capacity as they evolve. In this operational framework for systemic resilience, a strength-based approach is adopted to maximize the chances of empowering actors and minimizing negative impacts of the intervention. Two methodologies for strength-based development are drawn upon in sequencing the operational methodology: Asset-Based Community Development (ABCD) (Kretzmann & McKnight, 1993) and Appreciative Inquiry (AI) (Cooperrider & Srivastva, 1987). Both approaches involve leveraging existing capacities and assets of individuals, local associations and institutions in locally developed plans for achieving desirable visions.

Here resilience, strength-based development and Community Operational Research come into alignment. Like Vickers, Ulrich and Churchman before them (Churchman, 1968a; Ulrich, 1983; Vickers, 1965), White and Taket, who are Community Operational Researchers, also recognize that the success of an intervention can ultimately only be judged by the 'affected': "whether it succeeds in achieving some outcomes that can be seen as liberating or emancipatory is only ever locally decidable" (White & Taket, 1997), which also contributes to arguments regarding the framing of resilience and who gets to decide. White and Taket strikingly capture the essence of the strength-based approach to development by advocating practitioners "Withdraw allegiance from the old categories of the negative, which Western thought has so long held sacred as a form of power and an access to reality. Prefer what is positive and multiple: difference over uniformity; flows over unities; mobile arrangements over static systems" (White & Taket, 1997).

Following their guidelines, this operational framework adopts pluralism in each of the following:

- *The facilitation process*: Pluralism in the facilitation process is advanced by a strategic reduction in the expert's authority. White and Taket suggest that "a post-modern expert would be more of an interpreter, and would recognize any project of interpretation as something that can be carried out collaboratively" (White & Taket, 1994). They hope to subvert the traditional understanding of a practitioner as holding the privileged position of 'expert', stating "It is a mistake to accept the expert as having the final word as to the meaning of the client's problems".
- *The modes of representation employed*: Pluralism in the modes of representation employed is advanced by disputing the claims to objectivity suggested by certain types of representation. White and Taket suggest that practitioners always play a role in 'constructing' that which they later claim to have discovered. Accordingly, they suggest that systems practitioners need to develop modes of representation that can be produced in conjunction with participants and are, therefore, open to interrogation by them.
- *The use of specific methods/techniques*: Different methods and tools are more or less accessible to different stakeholder groups. Using multiple methods and tools increases the likelihood that each stakeholder group has the opportunity for their knowledge, values and agendas to be included in the process.
- *The nature of the client*: Pluralism in the nature of the client is advanced by acknowledging and respecting the views of a wide range of stakeholders in the intervention. The presence of different views of the problem / system(s) of interest may require the practitioner to work with more than one rationality simultaneously. Different stakeholders have different appreciative systems, informed by different boundary judgments, goals or values, none of which is, in principle, more legitimate than others. Shared criteria for legitimacy may be reflected upon in the participative research process, and they could be emergent rather than introduced by one particular stakeholder.

8. Integrated operational framework

Integrating insights from Resilience, Critical Systems Thinking, Community Operational Research and Development Studies suggests an operational framework for systemic resilience based on strength-based participatory multi-stakeholder processes to explore and negotiate the framing of 'resilience of what, to what, for whom, over what time frame'. This involves critical reflection on the complete set of resilience framing questions, including those informed by Ulrich's CSH, provided in Section 6. Applying the principles of Systemic Intervention requires that the operational framework adopts theoretical and methodological pluralism. The framework encourages resilience research to be conducted in interdisciplinary teams so that lenses from different disciplinary backgrounds (which tend to pick out different features and/or have different appreciative systems) can be applied to the same topic. It seeks pluralism in facilitation, in the modes of representation used, the tools applied, and the understanding of the client. Perhaps most importantly, it advocates humility.

Methodologically, the integrative operational framework has the following broad phases, each of which can itself involve the application of varied and multiple tools, and involve multiple forms of representation, adapted for each stage in a particular context:

- Systemic boundary critique to explore the "of what".
- Visioning activities to explore and negotiate what constitutes desirable change and "for whom".

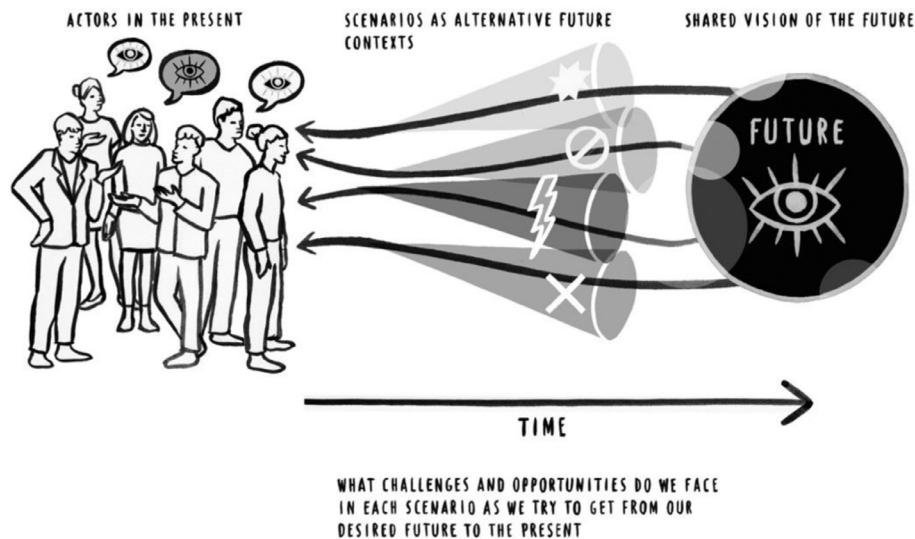


Fig. 3. Operationalizing resilience: systemic boundary critique, visioning, back-casting and exploratory scenarios.

- Mobilization through asset-mapping and back-casting of plans that build on what exists, and also specifies over “what time-frame”.
- Exploratory scenario development, as scenarios provide the “to what” by capturing salient future uncertainties we wish to be resilient to.
- Scenario guided revision of plans increases capacity to cope with future uncertainties.
- Implementation, where necessary with locally driven leverage of external support.
- Evaluation, learning and re-evaluation, and continuation of the process by the community in an iterative manner.

The ordering of these activities draws on Appreciative Inquiry (Cooperrider & Srivastva, 1987) and Asset-Based Community Development (Kretzmann & McKnight, 1993).

In the process shown in Fig. 3, participants aspire to steward the system towards desirable outcomes and away from undesirable ones, across a broad range of diverse plausible future scenarios. This matches the understanding of resilience as the capacity of a system to maintain or create desirable states and avoid undesirable states in the face of disturbance and change (Folke 2006; Walker et al., 2006). Thus, the process represents a resilience-planning approach, based on the acknowledgement that it is impossible to predict, still less control, all of the sources of change that affect the system.

The visioning stage of the process allows space for discussion of what constitutes desirable and undesirable outcomes for whom. Building shared visions for desirable futures also creates buy-in to the broader process, since it targets activities at what people want; it also has a bonding impact on the group. It is a very important part of the process yet, especially in scientific contexts, often little to no time is spent discovering and articulating the vision or goals for desirable outcomes or states; this is skipped over or taken for granted (Meadows, 1994). The visioning stage provides the basis for the back-casting phase (Ackoff, 1979a, 1979b, 1981; Ackoff, Magidson, & Addison, 2006).

The initial back-casting creates tangible plans for participants to steward the system towards desirable and away from undesirable futures, which build on what exists and generate meaningful engagement. Further work steps are necessary since all people hold implicit and explicit assumptions about the way the future will be

(often a continuation or worsening of current trends) that shape decision-making and planning (Wack, 1985). These assumptions can limit the options considered and blind decision-makers to the consideration of uncertainties, thereby reducing resilience. The exploratory scenario phase surfaces and challenges these assumptions by exploring different plausible futures and subsequently examining what would work and what would not work within each.

The term ‘exploratory’ is used to refer to scenarios that explore ‘what could plausibly happen’, rather than describe ‘what will probably happen’ or ‘what is desirable to happen’ (Börjeson, Höjer, Dreborg, Ekvall, & Finnveden, 2006). In Fig. 3, each exploratory scenario is represented as a different tube containing different challenges and opportunities. The scenario process is used to challenge assumptions about the future, and this process provides a safe space for marginalised voices to challenge dominant frames and express their needs and aspirations. The future is a safer space to challenge the status quo than the present because there is less buy-in to a very specific vision of the future (Wilkinson & Eidinow, 2008).

The combination of normative back-casting and exploratory scenarios tests the robustness of an increased set of actions in a diverse range of contexts, and builds capacity for planning and decision-making under uncertainty and change (Chaudhury, Vervoort, Kristjanson, Erickson, & Ainslie, 2013; Kok, van Vliet, Bärlund Ilona, Dubel, & Sendzimir, 2011; Robinson et al. 2011). Each of these activities provides many opportunities to incorporate different perspectives and concerns, and for trade-offs to be made explicit and negotiated. Following on from this, the plans are implemented, leveraging support where necessary. The implementation process is itself action learning, and the cycle is continued iteratively. The pluralist principles described in Section 6 are employed during implementation.

This operational framework has been applied in many different contexts from community through national to regional level resilience planning processes, and in each case appropriate tools were developed for implementation of each stage of the methodological process above. The case study presented below, from the Systemic Integrated Adaptation Program in Nepal, was chosen to highlight an application of relevance to Community Operational Research.



Fig. 4. Illustrative climate analogue map showing Beora and the three exchange locations.

9. Case study: The Systemic Integrated Adaptation Program in Nepal

9.1. Systemic Integrated Adaptation program design

The Systemic Integrated Adaptation Program (SIA) is provided as an illustrative case study of the operational framework in practice. The program was fundamentally concerned with the resilience of small holder farming communities to climate change, taking into account the integrated social, economic, political and environmental systems in which they are embedded. It aimed to overcome the threats posed by a changing climate to achieving food security, enhancing livelihoods and improving environmental sustainability. Its purpose was to co-identify and support appropriate actions at multiple levels, from community organising through to national policies across social, economic, institutional and environmental dimensions. SIA took place within the broader CGIAR Climate Change, Agriculture and Food Security (CCAFS) Program, for a duration of three years.

The program itself was designed to embody the principles of Systemic Intervention and strength-based development. SIA consciously engaged a multi-disciplinary team of researchers to apply multiple lenses to the focal topic; in this case the lenses were social, economic, environmental and political. Each lens was represented by a dedicated researcher supported by a subject matter expert, all of which was coordinated by a team of systems thinkers. Multiple methods drawn from each lens informed, and were recursively informed by, a series of strength-based Participatory Action Research activities from household to national levels. Soft systems analysis and participatory boundary critique techniques were used iteratively throughout the program to integrate understanding across activities and lenses. The outputs of these processes were subjected to open critique by stakeholders and subject matter experts through pluri-disciplinary dialogues.

9.2. Resilience of small-holder farming communities to climate change in Nepal

This section focuses on the community level action research process enacted by the SIA program with small-holder farming communities to address climate change on the Terai plains of Nepal. The Rupandehi district of the Terai was chosen as a focal area, due to its agricultural significance for Nepal combined with its vulnerability to climate change. Within Rupandehi, the village of Beora was chosen based on the enthusiasm of the local community to take part in the program and the presence of local partners in an ongoing relationship with the community who could carry

work forwards when the program ended. The location of Beora can be seen on the map in Fig. 4.

9.2.1. Methods

The SIA program in Nepal applied a novel suite of approaches within the operational framework to characterise and manage resilience, including a community-wide diagnostic and planning process used to iteratively explore the boundaries of issues relating to community resilience to climate change. This process has been extensively documented and a detailed manual is provided through CCAFS (Helfgott et al., 2014). This iteratively involves processes of ‘sweeping-in’, systemic boundary critique, and systemic analysis techniques to negotiate “of what” and “to what”; visioning activities to explore notions of desirability from different perspectives and negotiate locally desirable outcomes for the community as a whole; a suite of asset-mapping techniques; and back-casting of plans that build on what exists and involves negotiation of “over what timeframe”. Following this, a novel experiential approach to exploratory scenario development was used to engage with diverse “to what” situations, followed by the scenario-guided revision of plans to increase adaptive capacity. This process ended with the plan implementation phase, and the evaluation and learning phases, and there were ongoing reflective action processes throughout.

A specifically unique aspect of the Nepal process is the use of farmer exchanges to climate analogue locations as an experiential basis for exploratory scenario development. A climate analogue location is a place which currently experiences a plausible climate future for the reference village. CCAFS, in collaboration with the University of Leeds and the Walker Institute, developed the CCAFS Climate Analogue Tool (CAT). The CAT uses General Circulation Model (GCM) ensembles and current climate data sets in unison to connect sites with statistically similar climates, across space and/or time, and uses Geographic Information Systems (GIS) software to visually map climate analogues (Ramírez-Villegas et al., 2011). The SIA program used the CAT to inform a series of farmer exchanges to locations with diverse plausible climate futures, and each exchange was used as the basis for generating a different plausible scenario for the future of the initial reference village. The diversity of climate futures was included to take into account the uncertainties involved in climate modelling, and allow multiple plausible futures to be engaged with.

The exchanges were embedded within the program and were designed to build strategic capacity, and break down assumptions about the future which hinder adaptive capacity. Farmer exchanges are themselves an excellent knowledge sharing and capacity building opportunity; in this case farmers from different climate

conditions could share knowledge about what works and does not work in those conditions and gain access to an increased set of climate adaptation options. The approach taken was participatory, multi-stakeholder, strength-based, integrated and critically reflexive. A full report detailing all of the specific methods used, and the results of each, is available through CCAFS (Bailey, Chaudhury, Helfgott, Sova, & Thorn, 2012). The main phases and results are summarized below.

9.2.2. Process summary and outcomes

9.2.2.1. Village-wide diagnostic and planning process. The primary climate related challenges identified by the community were rising temperatures, which threaten crop yields and other livelihoods, as well as leading to fatigue and illness within the community. Variability of rainfall and inadequate water for crops also impact yields.

Community analysis of the factors which most challenged their capacity to be resilient included lack of irrigation infrastructure creating vulnerability to inadequate and erratic rainfall; lack of education limiting capacity to improve and adapt farming, add value to products, or diversify livelihoods for resilience; poor fertilizer availability and high farm input prices compound poverty and poor crop yields; low market prices for agricultural products make it impossible to break out of poverty traps with current farm-based livelihoods; deforestation and lack of trees affect water and temperature regulation and also sources of building materials and fuel, which in turn relate to poverty and crop yields; poor health, worsened by extreme temperatures, which make it difficult to work and to carry out desired adaptation actions; poor seed availability plus loss of indigenous seeds limits sustainable farming techniques, creates dependence on limited seed supplied commercially, and affect crop yield; pests and diseases effecting crops are reported to be increasing with temperature, affecting crop yield, food security and livelihoods.

The community revealed a large number of existing responses, as well as many they are open to, but had not yet tried to implement. Based on asset-mapping, many responses were deemed within reach following some community planning and action. These responses included adult knowledge sharing schemes, programs to better clean and maintain channels that divert water from the river, boreholes, pumps and irrigation channels, planting trees, producing home-made fertilizers, crop diversification, income diversification and saving schemes, plus seed banks for traditional and new seed varieties.

Notions of desirability, local values, visions and aspirations for the future were explored through three types of visioning activity. The community articulated visions for the future of Beora in the form of a detailed map of the future village, a collage showing features of their desired future and a set of narrative visions. The community prioritised three elements of their future visions for climate resilience for detailed planning: improved soil quality and pest management, increased agricultural production, and adequate water for irrigation. Based on this, strategic plans that built on locally available strengths and resources were developed through back-casting. Each of these is summarized below:

Back-cast 1: Improved soil quality and pest management

To achieve improved soil quality and pest management, the community drew on three currently available resources: 'land', 'farming knowledge' and 'hard-working people'. The intervention began with the development of a forum for knowledge sharing and pooling of resources on how to measure soil quality and to share pest management strategies. The community envisioned improving coordination to solicit external support and expertise. In particular, they identified the need for soil quality measurement and support in Integrated Pest Management.

Back-cast 2: Increased agricultural productivity

Three management practices were envisioned by the community to increase both the quality and the quantity (75% anticipated yield increase) of rice production within Beora, allowing the community to compete with Indian subsidy pricing, and react to rainfall variability, among other benefits. These were: seed varietal selection, water use, and fertilizer application. To plan for this broad list of interventions, the group shortlisted rice as the target crop, as it represents the primary contributor to Beora's economic livelihood. To better understand their varietal options, they planned to approach market staff, informed neighbours, government actors, Agrovets, private sector actors, and/or NGOs for more information.

Back-cast 3: Adequate water for irrigation

The group identified all potential sources of water: groundwater (natural springs and boreholes), rainwater and river water (the Rohini and Tinaru Rivers). Beora is already connected to the Tinaru River via a canal system, but receives limited water due to upstream users. The participants suggested there would need to be efforts to expand its carrying capacity and frequent community working days to clean the canal. Other sources are essential, and here the community was focused on groundwater. The Beora Borehole Group (BBG) was formed to manage a collective borehole irrigation system. An engineer from the Ministry of Land Reform and Management would be solicited to map current and planned borehole locations so as to maximise the efficiency of the whole system. Pumps would be needed to extract the water from the boreholes and the existing network of feeder canals would be used to distribute the extracted water. Afforestation efforts would be conducted in parallel to help regulate rainwater in the long term.

These three initial back-casted plans captured extant assumptions about what is feasible or not and why. They served as a baseline to allow the analyst to observe changes in thinking that occurred as a result of the subsequent farmer exchanges and related scenario planning activities. These changes were elucidated through comparison of the initial back-casts with those after the exploratory scenario exercises.

9.2.2.2. Farmer exchanges. CCAFS provided climate analogue maps for the reference village to the year 2030, as villagers considered this the longest relevant time horizon for their engagement. A scoping mission was used to identify a set of three exchange locations that represented the largest possible diversity of climate futures: Madheye Nagar, Chutara and Durua, shown as EX1, EX2 and EX 3 respectively on Fig. 4.

Prior to the exchanges, a training program was conducted to equip participants with the climate knowledge and critical thinking skills to make the most of the exchanges, and to ensure participants understood that exchange locations represented plausible climate futures rather than predictions or prophecies. Participants used flip cameras to share footage of their home life with host farmers and to share their experiences with their own community upon their return.

Exchange 1: Madheye Nagar, Dang District

The first exchange was conducted at Madheye Nagar. The exchange site is located in the centre of the Deukhuri Valley with the Rapti River to the south, a community forest to the west and the Syaru River to the east. The community has lived in this place for many generations, evolving a complex system of agro-cultural traditions. These included terracing, precision irrigation, intercropping, vegetable farming and silviculture. They have established community savings groups, organised community events and festivals, and conducted training, including the installation of biogas plants. Other adaptation initiatives included diverse vegetable farming as an alternative or complement to rice and wheat cultivation in response to increasingly dry conditions; off-season vegetable selling at high market value in the neighbouring town of Lamahi; the three-phase kalam method of rice cultivation, which

enhances production and reduces inputs; conservation agriculture methods; small-scale private fish farming with herbivorous varieties such as grass carp; harvesting of medicinal plants; electric irrigation pumps, and tube wells used for drinking water; and small-scale reforestation.

Exchange 2: Chutara, Chitwan District

The second exchange took place in Chutara, Madi Valley, Chitwan district. Madi Valley is a unique location in that it is a buffer zone surrounded by two nature conservation areas – the Chitwan National Park and Valmiki Tiger Reserve, as well as a number of community forests. The valley is also used as a transit point to the Indian border. Adaptation options seen in Chutara included vermicomposting, biopesticides, the development of women's groups, loans and savings schemes, local seed varieties, improved animal husbandry, vegetable farming, conservation agriculture, soil conservation and silviculture. There are nine women's groups in the community conducting education on family planning and maternal health, caring for marginalized members and non-group members through volunteer work and donations. They are also engaged in income-generating activities to raise school fees, and have a loans and savings scheme. They spoke passionately about how membership of the group has increased their standing within the household and the community, and has improved their confidence, autonomy and perception of themselves as agents of change.

Exchange 3: Durua, Kanjiwar Dang District

The third exchange took place in Durua, which is a settlement located along the Babai River in the Dang district. This community demonstrates high levels of social organization with many active committees and elected leadership positions, including an agricultural co-op, an electricity consumers group, a women's development group, several savings groups, a veterans group and a community-forest-user group. There are several examples of members of the community organizing themselves to address scarcities, lobbying relevant government authorities and designing interventions that uniquely fit their needs. Adaptation examples included diversification into vegetable farming; use of the three-phase kalami method of rice cultivation; conservation agriculture methods; electric irrigation pumps; canal construction and maintenance; user rotation schemes for irrigation; tube wells for drinking water; developing contingency funds for repair and maintenance of infrastructure, including electrical equipment; electricity access advocacy; participatory processes for producing community plans; development of an agricultural cooperative (female-led); promotion of local seed varieties; mushroom production; individual and communal fish farming; a few examples of biogas; operation of a communal rice mill; large-scale reforestation; planting of medicinal trees; tree sapling production; and productive uses of marginal lands.

9.2.2.3. Post-exchange scenario exercise. Following each exchange, participants reflected on aspects of the exchange location that were similar or different. The items that were different were divided into two further categories: aspects that are incommensurable and aspects that are different now, but could plausibly happen in the future. The scenario extracted from the exchange was experiential. It consisted of all of the aspects of the exchange experienced by participants subtracting incommensurable differences. For example, the first exchange site was within 1 km of a river, which allowed alternative irrigation strategies and a broader variety of cropping options; the second exchange site experienced human wildlife conflict due to borders with protected areas; and the third exchange site had very different topography.

The photographs taken by participants were used to create a photo board of images that best represented the scenario they were creating to aid visualization when working through the



Fig. 5. Exchange photo-board collage.

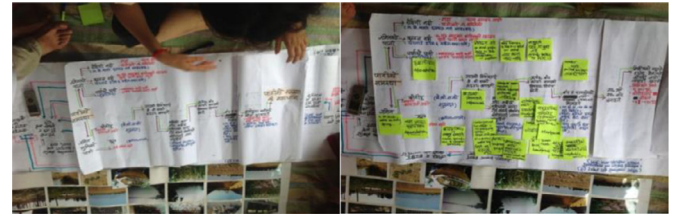


Fig. 6. Revising back-casts in the context of each scenario.

subsequent back-cast revisions. An example photo-board collage is shown in Fig. 5.

From the list of similarities and plausible differences, discursive reflection and stories, and the photo-board collages, a description of a plausible future for the initial village was created from each exchange. Each of the initial back-casted plans was revised in the context of all of the scenarios. Activities that were no longer feasible or became redundant were flagged, new options learned during the exchange were included, and new opportunities capitalized on. This process was repeated after each exchange. Fig. 6 shows the original back-cast on the left-hand side and the process of revising it on the right-hand side.

Back-casts 1 and 2 were amended to incorporate community forestry, particularly woodlot development. The woodlot would increase the availability of building materials to construct zero-grazing pens for goats and cattle, where manure for organic fertilizer can be collected. Organic material collected from the woodlot would also serve as a source of fodder for livestock. In addition, farmer-based organization development was reinforced in all plans as a result of the strong group culture found in Chutara as a means to promote land consolidation and group vegetable/grass farming.

Back-cast 3 was amended to consider the increased rainfall availability during summer months. Although it was envisioned that groundwater extraction would still be necessary, the adaptation involved reduced emphasis on the construction of boreholes, and more emphasis placed on surface water irrigation, including canal development and maintenance in the future climate scenario. This included the planting of bamboo along canals to prevent erosion and maintain canal integrity.

Comparison between the original and revised back-casts provided a measure of the changes in thinking, which became possible following the exchange-scenario exercises. In all cases, participants were open to many more actions and action pathways to achieve desired outcomes. This process demonstrates that the exchange-scenario exercise was effective at producing changes in thinking, in breaking down preconceived ideas about the future and opening the minds of participants to new possibilities about their futures.

9.2.2.4. Village-wide dissemination and planning. A workshop was conducted for village-wide dissemination and planning. Discussion was facilitated around the observation that each scenario provides

different opportunities to capitalize on and different barriers to overcome. A plan to continue revisiting and revising was also laid out. After this discussion, participant Janaki Chaudhury remarked, ‘While we do not know exactly how the future will be, there are many things we can do which will build our capacity to cope with change’ (Bailey et al., 2012). External agencies and NGOs with the potential to support the plans were present for the entire workshop. Responsibility was assigned to appropriate individuals and groups for ensuring the continuation of the planning and implementation process.

9.2.2.5. Hand over to local implementing groups and partners. A key dimension of the methodology is succession planning and linking with institutions capable of supporting the plans and actions of the community. It was important to link the activities of the program with ongoing action to avoid disillusionment and disempowerment in the community. The allocation of seed funding was included in the program to ensure this by facilitating immediate actions identified in the strategic plan to continue project momentum. The village was given 1000 USD as ‘seed money’ after the planning and prioritization process was completed. The community did not know about this money until that time. It was determined that the seed money be channeled through Friends Service Council Nepal – a local NGO the community has an on-going relationship with. The actions prioritized were Integrated Pest Management, communal village cleaning and canal maintenance, development of the communal borehole system, improved sanitation, and a community vegetable-growing scheme.

9.2.2.6. Iterative follow-up. The team returned after one year and two years to assess progress with the support of local partners. The success of the program handover was assessed after one year using Most Significant Change focus groups with villagers and members of partner organizations, semi-structured interviews and transect walks in Beora (Davies & Dart, 2005). The program was evaluated overall by the community as ‘very beneficial’, and according to community leader Kalam Bahadur, “People have gone out and seen different things, different works, and based on that they can imagine different things and they want to change things, because of the concepts are changing ... The program made people imagine what might happen because of our own activities so that motivated people for lots of changes”.

One key benefit is improved capacity for community organizing. Various groups are now functioning, including the group vegetable cooperative called Garima Farmers’ Cooperative. Garima Farmers’ cooperative organised the gaining of skills in Integrated Pest Management (IPM) through a ten-week program financed by the seed funding. Funds were also used to procure tools, including pumps for a community-group vegetable farm on communal land.

A number of women indicated an increased confidence and status within the community and both men and women had a stronger sense of responsibility for their contribution to the development of Beora. Women attributed this to seeing other women’s groups in the exchange locations and being encouraged to actively participate in the program. They reported empowerment through the opportunity for training and education. Anita Chaudhury, a community member who did not directly participate in the exchanges but nevertheless experienced their impact, reported that “Women are more conscious of their rights and what they should achieve from society and family. I heard from people who went on the exchange that in those places women are very forward, they talk and they have formed groups and they have developed much within themselves and I got the impression that we should also try to be like them ... this program has brought a shift in peoples’ concept, especially the female group of this community to do

something. I myself now have the confidence that I can study further, I can continue my study which was left behind”.

The ongoing support of partner organisations in Beora requires project-based funding. Unfortunately, the seed funding was not used to gain further project-based funding but to partially fund a number of initiatives as mentioned above. This meant that, over time, without funding or support, a number of larger initiatives which required further funding other than the seed funding, including a sanitation program and the collective borehole program, have stalled. More support was needed to develop fundraising and partnership capacity in the community, which was initially unfamiliar with approaches to lobbying for project funding and partnerships.

9.3. Implications for building community resilience

Based on the case study provided here, together with insights from multiple communities in 20 other countries in which this framework was applied, the following axioms for building community resilience are proposed:

- *Local ownership and leadership matter:* The success or failure of various resilience or adaptation interventions over time relied upon local people having the will, resources and skills to carry them forward.
- *Alignment with local values, visions and aspirations for the future is essential:* Allowing stakeholders to identify what matters to them; their own values, visions and aspirations for the future; and to co-develop appropriate solutions to their own problems helps to generate local ownership and leadership and the will to implement and maintain the intervention. Communities are receptive to external input where they have identified the need to seek support on their own terms.
- *Building resilience takes time:* As with any development or change management process, change takes time and ongoing support is required. It can take time for changes to diffuse through a community through observation and trial. Being able to see an option work in practice is particularly important to people who cannot afford to take too many risks.
- *Succession planning and ongoing support is essential:* Research projects tend to have limited time frames, and in all implementations of this operational framework, communities reported that any initiatives that had failed or stagnated had done so because of lack of consistent ongoing support.
- *Building on existing strengths in the community:* Rather than relying on leveraging external knowledge and resources, empowering the community to build on its strengths in pursuit of its own self-identified solutions is far more sustainable, particularly in the situation where continuous and ongoing external support is not consistently available and people ultimately have to rely on themselves.
- *Community organizing is a major source of adaptive capacity for poor rural communities:* Getting together to leverage skills and resources, both internally and externally, occurs in almost all community resilience plans.
- *Learning by doing:* Due to the inevitably partial and normative nature of system boundary judgements there will always be unanticipated side-effects of any intervention and this necessitates a continued process of learning by doing.
- *Working with agricultural communities to facilitate resilience involves shared and reversed learning:* the community teaches us about its needs, about what will work, what would not, and why (also see (Ackoff, 1970)). Accordingly, it is important to:
- *Acknowledge different forms of knowledge, including local and traditional knowledge and different ways of obtaining knowledge in any resilience intervention.*

- Each community is unique and options that work in one place may not work in another, even very close by: thus, it is important to co-develop resilient pathways together with communities, based on local strengths and drawing on suites of flexible options that can be tailored by communities themselves to their particular needs.

10. Conclusion

Bringing together key insights from Resilience, Critical Systems Thinking, Community Operational Research and Development Studies not only provides the basis for the operational framework and methodology presented in this paper for understanding, measuring and building resilience in practice, but also necessitates critical, iterative and reflective approaches to operationalizing resilience. Given the underpinnings of resilience in an ontology of interconnectedness, the inevitability and subjectivity of system boundary judgements, and the dependence of any notion of resilience on them, the real challenge posed by the resilience idea is not that, in order to be rational, we need to be comprehensive; but rather, that we must learn to deal critically, explicitly and ethically, with the fact that we never are.

An examination of the Resilience and Critical Systems Thinking literatures demonstrates that resilience practitioners cannot rest on indefensible claims of objectivity when discussing system resilience of any kind. Any conceptualisation of resilience depends upon definition of resilience of what, to what, for whom and over what time frame. In practice, this comes down to the challenge of explicitly negotiating the boundaries of the system of interest (which social, cultural, technical, economic, political or ecological factors will be included in the analysis) and within these boundaries, which features of the system need to be preserved, which features can change, and what constitutes desirable change (improvement); which disturbances are relevant to include in the analysis; what is the timeframe for analysis and planning; and whose views are accounted for in deciding on these things. This is an iterative process, as the answers to each of the key framing questions subsequently re-inform each other as shown in Fig. 1.

The “whom” part of resilience framing is particularly crucial and needs to be properly unpacked. Who gets to decide the answers to the resilience framing questions, who has a say, and how this will be done, will largely determine the way resilience is ultimately conceived. This unpacking is achieved using a series of questions informed by Ulrich’s CSH. These questions address the purpose of the initiative, whose interests should be served by any proposed efforts (which human actors, non-human species and so forth), who is considered a professional or expert, what forms of knowledge and expertise will be sought in the process of understanding and/or managing resilience, who gets to decide these things and how. Thus, operationalising resilience, even for descriptive purposes, becomes a value-laden intervention, though many resilience practitioners, especially those involved in descriptive and analytical work, do not currently acknowledge that they intervene.

A systematic operational framework for transparent and rigorous framing of resilience has been presented. The operational framework is process-based, employs theoretical and methodological pluralism, pluralism in facilitation, in the modes of representation used, in the tools applied, and in the understanding of the client. Multi-stakeholder processes are used for all phases of the framework to unpack the “for whom” in practice. Systemic boundary critique is used to address “resilience of what”; exploratory scenarios are used to address resilience “to what”, capturing the salient future uncertainties we wish to be resilient to; visioning activities explore and express notions of desirability to different stakeholders.

The process is strength-based so that its application contributes not only to characterising and measuring resilience, but also to building resilience in practice. Mobilization is achieved through asset-mapping and back-casting of plans that build on what exists. Back-casting involves clear specification of time-frame. Scenario guided revision of plans increases capacity to both apprehend and cope with future uncertainty. Finally, the process is iterative and ideally involves implementation, evaluation and continued learning by doing.

Finally, this paper is a first step towards dialogue between the Systems Thinking and Community Operational Research, Resilience and Development Studies communities. There is great scope for further and rich collaboration between these largely distinct groups of researchers, to continue to explore conceptual and methodological overlaps, synergies and gaps. In the context of these explorations we will be able to unfold how these communities can co-inform one another and work together.

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