Resilience Analysis Workshop Summary

June 26-27, 2013

Quw'utsun' Cultural and Conference Centre

Duncan, BC

POLIS Project on Ecological Governance
watersustainabilityproject

Centre for Global Studies

Brock University
Environmental Sustainability Research Centre

Introduction

Watersheds are complex systems. Human, economic and ecological dimensions are dynamic and interact. For example, agricultural commodity prices can influence the types of crops grown, animal stocking rates, and general land management practices undertaken by farmers, which in turn can impact the quality of the environment both locally and downstream. This subsequently impacts the ability of individuals downstream to enjoy the natural environment and to live a healthy life. With a growing awareness of how our watersheds functions, some of these interactions are now well known. But often the interactions among these dimensions are unpredictable. The large number of actors, with varied interests, further adds to the complexity of watersheds. These interests are frequently conflicting and therefore, determining what is desirable from these multiple perspectives is not a simple task – but resilience thinking can help.

Resilience[1] thinking is an emerging approach that it is intended to help understand social-ecological systems and to navigate contested desires in the context of uncertainty and complexity. Resilience practice enables individuals to engage with complexity and uncertainty by determining the key variables to focus on in order to maintain what is valued within and about the system, and by enhancing the system's ability to deal with both the expected and unexpected disturbances.

Resilience thinking

Resilience is a concept that describes the ability of a system, such as a watershed and all the components within it, to persist, learn, change, and/or transform in response to disturbances. Disturbances can come from outside the system or from within and they may be anticipated, or they may be a surprise. Understanding how to improve the ability of the system – including its ecological, economic, political and social aspects – to adapt to any disturbance is increasingly acknowledged as important.

Resilience practice

Resilience analysis is recognized as an innovative tool for bringing people together and facilitating discussion between individuals to discuss social and ecological issues. It is being used in a range of contexts for a variety of concerns. In Australia, for example, resilience analysis has been applied in many watersheds and regions with success. In preparation for the development of a new Community Strategic Plan, the Wakool Shire Council in New South Wales, Australia is using resilience analysis as a way to encourage a collective understanding within the community of the processes and factors shaping landscapes, livelihoods and community life in the region and how change to these factors might potentially shape the region into the future. In the Central West and Namoi Catchments, resilience is being incorporated broadly into natural resource management through Catchment Action Plans which are based on extensive community and expert involvement over several years. Here in Canada, resilience analysis has recently been introduced on a smaller scale in the Hammond River Watershed in New Brunswick and the Cowichan Watershed in British Columbia.

A resilience analysis workshop provides an opportunity for those involved in caring for the watershed to come together and discuss shared values and concerns about existing or potential disturbances to their system, identify indicators and ways to measure the system's capacity to be resilient to those disturbances, and ultimately, enhance their capacity to respond to challenges. Resilience analysis can build on and complement existing plans. It offers a different perspective that considers complexity, uncertainty, and change.

[1] The term resilience is used in this document to refer to social-ecological resilience and is defined as "(1) the amount of disturbance a system can absorb and still remain within the same state or domain of attraction, (2) the degree to which the system is capable of self-organization (versus lack of organization, or organization forced by external factors), and (3) the degree to which the system can build and increase the capacity for learning and adaptation" (Folke, 2006, pp. 259-260).

This document discusses resilience thinking and provides a summary of a resilience analysis workshop in the Cowichan Watershed in British Columbia. The goal of the one and a half day workshop that took place June 26-27, 2013 at the Quw'utsun' Cultural and Conference Centre was to introduce the resilience perspective to watershed management and governance. Workshop participants included:

Tom Anderson (Cowichan Valley Regional District)
Darrin George (Cowichan Tribes and Cowichan Watershed Board)
Wayne Haddow (BC Ministry of Agriculture)
Rodger Hunter (Cowichan Watershed Board)
Robert Hutchins (Town of Ladysmith, Cowichan Valley Regional District and Cowichan Watershed Board)
Lori Iannidinardo (Cowichan Valley Regional District and Cowichan Watershed Board))
Jane Kilthei (One Cowichan)
Tim Kulchyski (Cowichan Tribes and Cowichan Watershed Board)
Lorna Medd (Cowichan Watershed Board)
Ian Morrison (Cowichan Valley Regional District and Cowichan Watershed Board)
Helen Reid (Cowichan Tribes)
Kai Rietzel (Cowichan Land Trust)
Calvin Swastus (Cowichan Tribes)
Gerald Thom (Cowichan Lake and River Stewardship Society)

Workshop facilitators and resource people included:
Julia Baird (Facilitator)
Oliver Brandes (Resource person)
Ryan Plummer (Facilitator)
Michele-Lee Moore (Resource person and facilitator)

Over the course of the workshop, participants worked through several exercises focused on values and disturbances at the watershed scale and at the scales above and below, drivers of change, specified and general resilience, and adaptive capacity. In following the general structure of the workshop, the remainder of this document is divided into four sections. The first section describes the system including an explanation of social-ecological systems, the importance of considering different scales and a discussion of values and disturbances. The second section introduces specified and general resilience and provides examples of how these concepts were explored in the workshop. The third section touches on adapting and transforming and offers a brief conclusion. The fourth and final section provides additional resources on resilience thinking and practice.

Describing the system

Social-ecological systems

Critical to resilience thinking is the idea that social and ecological systems are highly interconnected. What happens in one part of the system impacts the other, even when cause-effect relationships are not entirely clear. Watersheds are a great example of linked social-ecological systems as they emphasize the seemingly simple, yet very important perspective of humans-in-nature. Everyone lives, works and plays in a watershed. Change in the social system through human actions and interactions will have an influence in one way or another on the ecological aspects of that watershed. For example, a change in population size leading to increased residential and commercial development may result in alterations to the natural course and flow of streams, reductions in natural habitat and habitat connectivity, increased surface runoff entering bodies of water and many other potential ecological changes. Similarly, a change in the ecological system can have a profound impact on the social system. For example, a decline in fish stocks may trigger change in policies related to commercial and/or recreational fisheries, which in turn can impact the longevity of family businesses and even alter the identity of a community. Changes like the ones described here can create feedback effects; that is, change in the social system can act as a catalyst for change in the biophysical system, which subsequently results in further changes to the social system. As a result, it is useful to take an integrative (social-ecological) perspective when discussing resilience.

Scales

Individuals are usually interested in one part (scale) of a system; this is referred to as the focal scale. From a resilience perspective it is extremely important to also consider the scales above and below the focal scale. For example, if the focal scale is a watershed, the scales below may include sub-watersheds and specific reaches of a river. On the other hand, the scales above may include the larger river basin or region. What happens at one scale can have a profound impact on the scales above and below. For instance, government policy favouring traditional approaches to farming can prevent uptake of beneficial management practices at the scale of the individual farm. Conversely, an individual farmer using beneficial management practices may influence surrounding farmers to use similar practices on their land eventually resulting in changes to regional policy.

Accordingly, it is critical to acknowledge that a social-ecological system cannot be understood by focusing on only one scale without appreciating the dynamic influences from the scales above and below. Ignoring cross-scale effects is a common reason for failures in natural resource management systems.

Figures 1 and 2 depict the scales of interest for the workshop. Figure 1 portrays the focal scale for the workshop, the Cowichan Watershed. At the scale below are specific sites within the watershed including different communities, lakes, and wildlife reserves. Figure 2 shows the scales above the focal scale. Vancouver Island and part of the Lower Mainland Region of British Columbia is shown with the Cowichan Watershed outlined in grey. While not visible in these figures, it is also important to consider the national and international scales.

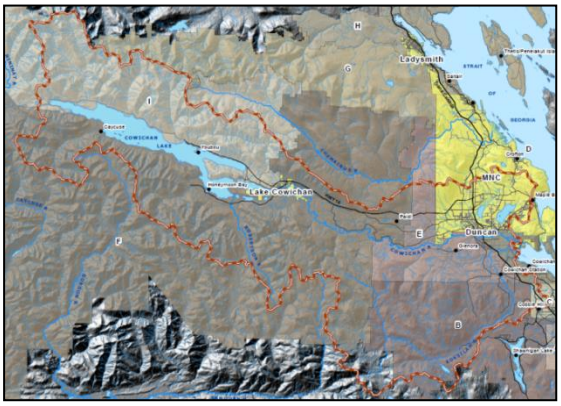

Figure 1. Cowichan Watershed boundary

Figure 2. Vancouver Island with the Cowichan Watershed boundary outlined in grey.

Values and disturbances

After identifying the focal scale and the scales above and below, the next step in describing the system is to address the two part question, resilience of what, to what? The 'resilience of what' refers to what is important or valued in and about the system, what it is about the system that people want to make resilient. Values can be social, cultural, economic or ecological and can be present at any scale. Describing the system in terms of values allows those caring for the watershed to assess what is worth spending time and effort on. On the other hand, 'resilience to what' relates to disturbances to the system. As with values, disturbances can be social, cultural, economic or ecological and can occur at any scale either frequently or infrequently. Furthermore, disturbances can come from outside the system or from within and they may be known and anticipated, or they may be a surprise. For example an anticipated disturbance might be low river levels and stressed salmon after a dry winter and spring, and a surprise disturbance might be a new virus that impacts salmon health. Discussing disturbances enables individuals to gain an understanding of what the system has to deal with.

The first activity of the workshop asked participants, what do you value about the Cowichan Watershed? Participants were asked to consider the focal scale and the scales above and below and write down what they value or would like to maintain. Participants were then asked to map their values and discuss them with the group. Values at the focal scale and scales below are shown in Figure 3 and values at the scale above are shown in Figure 4.

Figure 3. Values (green and orange) and disturbances (pink) at the focal scale and specific sites.

Following the values activity, the focus shifted to what threatens the Cowichan Watershed. Similar to the first activity, participants were asked to consider the challenges and disturbances in the watershed and at the scales above and below and write them down. The disturbances mapped and discussed by participants are shown in Figures 3 and 4.

All values and disturbances identified by participants were recorded and frequencies were tallied. Following the workshop, the values and disturbances underwent categorization by scale. These categories and several examples are presented in Boxes 1 and 2. The number after each category reflects the number of values or disturbances within that category.

Figure 4. Values (green and orange) and disturbances (pink) at scales above the focal scale.

Box 1. Categories of values

<u>Site specific</u>
Exceptional/unique built and natural features (30)
- Wake, Somenos, Quamichan, and Cowichan Lakes
- Bald Mountain
- Kinsol Trestle
- Farmers' market

Cultural and medicinal uses and historical value (26)
- Healthy medicinal plants
- Historical reference

Healthy habitats and wildlife populations (24)
- Heron rookery
- Intact critical habitat
- Edible shellfish and other wild foods

Economic value (12)
- Forestry
- Salmon harvesting

Recreational and educational opportunities (10)
- Fly fishing, fishing derby, kayaking, river trails, camping
- Cowichan Estuary Nature Centre

Good stewards and acts of stewardship (3)
- Prosperous ecologically sensitive farmers
- Successfully relocated industry (away from estuary)

<u>Cowichan Watershed</u>
Protected areas (6)
- Protection of lake and river riparian areas
- Vast old growth stands – Douglas Fir

Healthy wildlife populations (2)
- Birds and animals in the forest in healthy numbers
- Abundant native wildflowers

Cultural use (1)
Harmony around resource issues (1)

<u>Scales above</u>
Ecosystem health (14)
- Clean water for all life – human, plant, animal
- Abundance of returning fish to spawning grounds
- Healthy forest ecosystem

Local involvement and collaboration (8)
- Hard work of Vancouver Island watershed organizations
- Local collaboration

Cultural and historical values (6)
- Cultural values maintained for Cowichan Tribes
- Goats wool – historical

Recreational opportunities (5)
- World class recreation
- Internationally envied fishing

Good stewards and acts of stewardship (3)
- Discharging clean storm water and sewage effluent

Prosperous lands (1)
- Agriculture

Funding opportunities (1)
- Long term funding

Box 2. Categories of disturbances/threats

<u>Site specific</u>

Water pollution and related impacts (23)
- Agricultural pollution/runoff
- Human waste pollution
- Boil water advisories

Issues related to water level extremes (15)
- Flooding issues in Honeymoon Bay
- Low flows below weir
- Decrease in inflow into Cowichan by 36% since 1980s

Poor land management (13)
- Access issues to Cowichan Lake
- Dykes and roads blocking fish movement and migrations

Erosion and sedimentation (12)
- Broadway run
- Gravel deposition Lower River

Economic interests over environmental protection (11)
- Dredging for log movement disturbing biotic communities and flows
- Lack of private land forestry regulations

Tourism and recreational impacts (9)
- RV riparian "camping" Hawes Bay
- High speed boats in Cowichan Lake

Habitat degradation and impacts (3)
- Knotweed lake and river

Funding concerns (2)
- Lack of funds for naturalists – Quamichan Stewards

Governance concerns (1)
- Commercial core divided between four governments

<u>Cowichan Watershed</u>

Logging (8)
- Boom in logged areas
- Clear cut logging

Lack of funding (2)
- Lack of funding for CLRSS

Lack of meaningful operational management (2)

Lack of meaningful consultation and discussion (1)

<u>Scales above</u>

Insufficient governance mechanisms (9)
- Lack of ability to enforce riparian areas regulation
- Lack of private forest land regulations

Lack of understanding and/or information regarding environmental issues (8)
- Thinking carbon credits will save us when massive reductions are needed
- Lack of common knowledge and shared values
- Lack of community understanding of issues and connections

Human/industry actions at broader scale (6)
- Globalization impacts (trade, bulk H20)
- Raw log exports

Environmental hazards (3)
- Weather extremes
- Climate change threats to water cycle

Funding availability (3)
- Lack of funding – CWB

Private land ownership impacts (2)
- Clash of private property rights and river system values

Specified and general resilience

When discussing resilience, it is necessary to consider two complementary aspects – specified and general resilience. Specified resilience refers to the ability of a specific part of a system to respond to a particular, known disturbance in order to maintain the valued characteristics of the system. For example, the resilience of fish populations in the face of increased fishing pressure. On the other hand, general resilience applies to the system as a whole and refers to the capacity of a system to absorb disturbances of all kinds including unknown and unforeseen ones. General resilience is a concept to help think about the qualities of a system that is forgiving of management/policy mistakes, can absorb large shocks, and allow all parts of the system to keep functioning as they have in the past or to adapt. For instance, openness is a general quality of a social-ecological system that may enable or enhance the development of general resilience. Openness concerns the ease with which people, ideas and species can move into and out of a system. Individuals from outside the system bring new ideas and have different experiences dealing with a variety of shocks and disturbances which may prove to be a valuable resource when the system is faced with a particular type of disturbance for the first time. Similarly, following a large infrequent disturbance like a forest fire, seed dispersal is critical for regeneration.

Preparing a system for a specific disturbance enhances the system's capacity to deal with that particular threat but at the same time, may be reducing the system's general capacity to absorb other kinds of disturbances. Yet, "best" management practices often tend to focus on specified resilience only. The trade-off between specified and general resilience necessitates the consideration of both when thinking about the resilience of a system.

Although resilience is often thought of as a positive system property, undesirable situations can also be very resilient. Therefore, engaging with resilience involves either building the resilience of a desirable situation to avoid crossing thresholds or degrading the resilience of an undesirable situation in an effort to reverse a threshold crossing and return to a more desirable situation.

Specified resilience

As stated above, specified resilience is the ability to respond to specific, known disturbances. Responding to disturbances requires the ability to anticipate changes and the capacity to adapt. A simple example of this is using the weather forecast to dress appropriately.

A small set of three to five key variables at each scale determine the important changes in a system. There are limits to how much those important variables of a system can be changed before it can no longer continue to function in the same way; these limits are known as thresholds. When a threshold is crossed, the system functions in a different way. In lake systems for example, a well-known threshold exists related to phosphorus levels. Once the phosphorus threshold is crossed the lake system can flip from a clear water lake system, capable of supporting a variety of aquatic species, to a eutrophic lake system in which algal growth dominates and the same types of fish populations can no longer be sustained.

Figure 5. Workshop participants discussing alternate states the estuary could be in.

The consequences of crossing a threshold can be quite severe. Thresholds are not always easy to identify and crossing them is not always reversible. It is for this reason that the resilience perspective focuses a great deal on trying to understand critical thresholds, determine where they are and what influences their location, and how to enhance the capacity to deal with thresholds This helps us to either avoid crossing a threshold or work towards crossing a threshold for a more desirable system (e.g., moving from a eutrophic lake to one that supports aquatic life).

Using a specific concern raised in the disturbances activity, specified resilience in the Cowichan Watershed was explored. First, participants discussed the estuary broadly and the alternate states the system could be in (Figure 5). Three alternate states were identified – desirable, current and undesirable – and described in terms of biophysical characteristics, cultural values, governance, economic structure, expectations of actors, and practices. Figure 6 illustrates these alternate states and provides some examples of how each state was characterised.

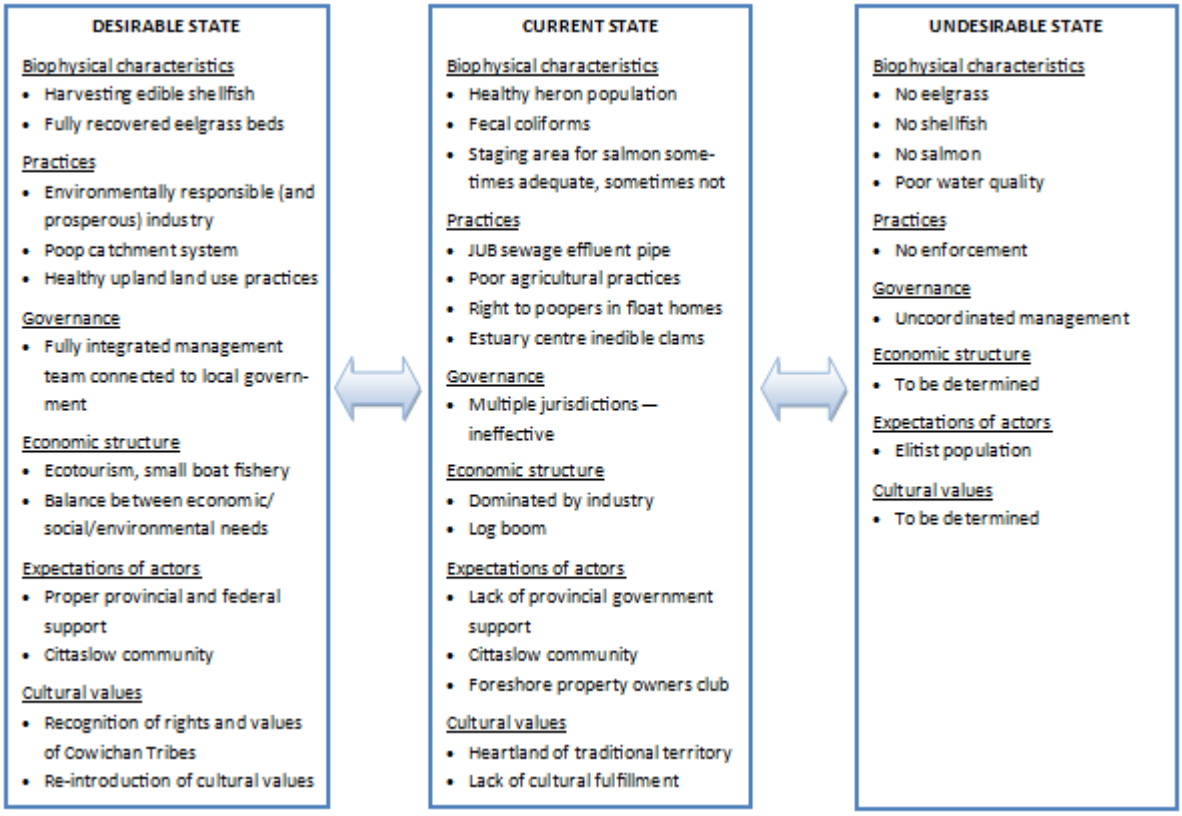

Figure 6. Descriptions of the alternate states the estuary could be in.

Following the conversation about the estuary, the group chose to focus in on the specific issue of clams in the estuary. Similar to the discussion about the estuary, participants identified and described the alternate states the system could be in, what has the potential to cause a shift from one state to another and what thresholds exist. As illustrated in Figure 7, participants identified and described two alternate states – the desired state and the current state. Participants suggested that the desired state is characterized by edible clams while the current state is characterized by inedible clams, fecal coliforms and viruses and other pathogens. Furthermore, participants acknowledged that a water quality threshold had already been crossed which lead to the shift from the desired state to the current state. Participants proposed that the threshold crossing occurred as a result of four main issues. The four issues presented by participants were industrial pollution, agricultural pollution, human waste and the longer term issue of sedimentation. Participants expressed a desire to reverse the threshold crossing and help move the system back towards a more ecologically and socially desirable state. Accordingly, participants began discussing potential ways to make this happen. Immediate solutions offered by the group included removal of the effluent pipe, establishing regulations and/or incentives for boats and float homes in the estuary to manage waste, and finding positive and community-building complements and alternatives to the Environmental Farm Plan in order to motivate agricultural landowners to act and address the issue of a lack of manure storage. Additionally, it was noted that over the long term, healthy eelgrass beds and riparian zones must be restored (replanted) in order for this shift to take place. The model created from this discussion is a simplified version of what is known as a state-and-transition model.

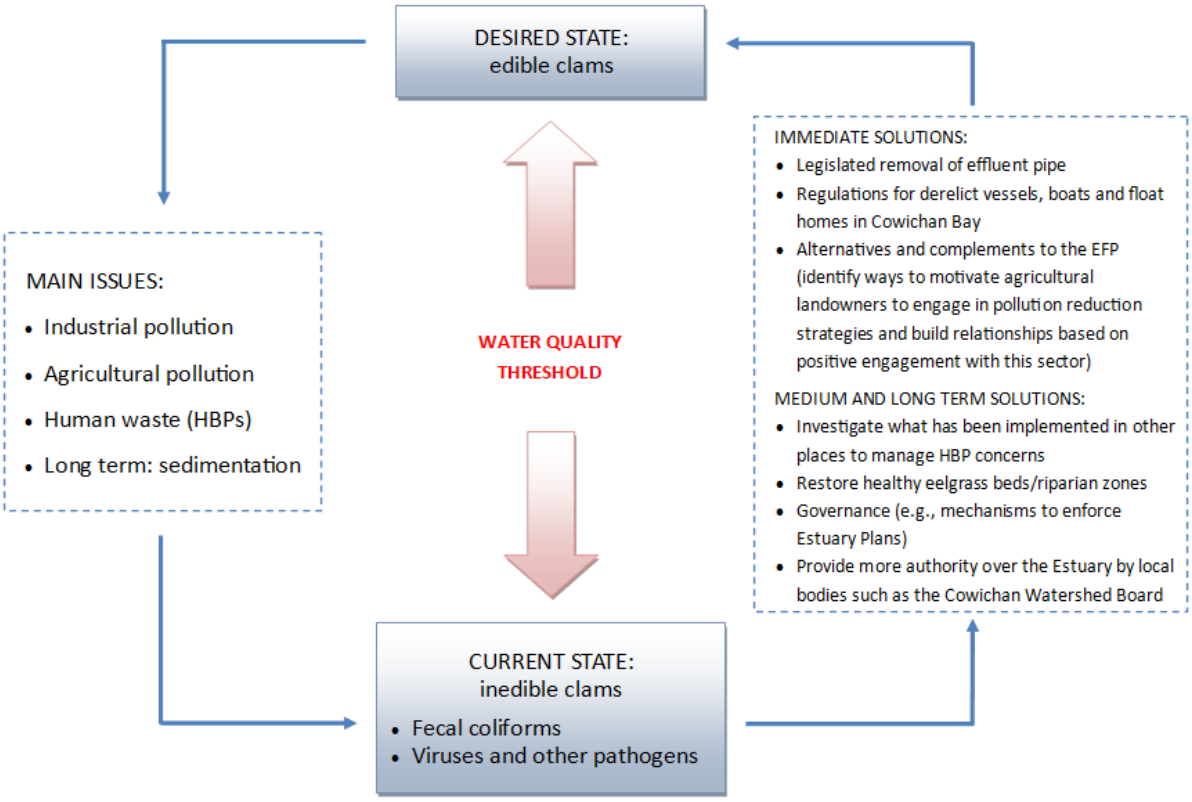

Figure 7. Simplified state-and-transition model for the estuary with a specific focus on clams.

General resilience

General resilience refers to the **general qualities** needed in a system in order to respond to changes; known and unknown. Three important functions of general resilience are being able to respond quickly and effectively in the right places in the right way, having reserves and access to needed resources, and keeping options open.

One way to begin considering general resilience is from an adaptive capacity perspective. Adaptive capacity is the ability of a social-ecological system to adjust or resist disturbances; moderate potential damage; and, take advantage of opportunities. Some factors that enhance the adaptive capacity of a farm for example, include the ability to diversify activities (e.g., diversify crop selection, vary buyers from local markets to large national distributors, supplement income streams through ecotourism), having a good level of knowledge about land management practices, having reserve funds and increasing the size and diversity of one's network in order to draw on the knowledge, experience and resources from a range of people and perspectives. These qualities would allow a farm to continue to operate under a range of potential adverse circumstances including crop price fluctuations, climate extremes, farmer injury, low commodity prices, unexpected major expenses, and others.

In order to introduce the concept of adaptive capacity and begin thinking about adaptive capacity factors, participants were asked to identify an unexpected disturbance that the system experienced in the past and that was dealt with effectively. The 2009 flood was chosen as an appropriate example for the exercise. Participants were then asked to recall what helped them or enhanced their ability to deal with the unexpected disturbance. Figure 8 provides a brief description of the disturbance surrounded by those factors identified by participants. Factors include having a regional network, awareness at a provincial level, well-trained staff and a culture of volunteerism and community spirit within the watershed.

Building on the initial adaptive capacity exercise, participants were then asked to think about their system from a broad perspective and consider all disturbances. In pairs, participants came up with two adaptive capacity factors they thought might be important for the resilience of the watershed when considering unknown disturbances, or when considering the range of disturbances already influencing the watershed. Each pair shared their two factors with the group and explained the importance of the factors and how they might be useful when considering the disturbances identified in the mapping exercise from day one of the workshop. All of the adaptive capacity factors presented were combined to form a master list of factors.

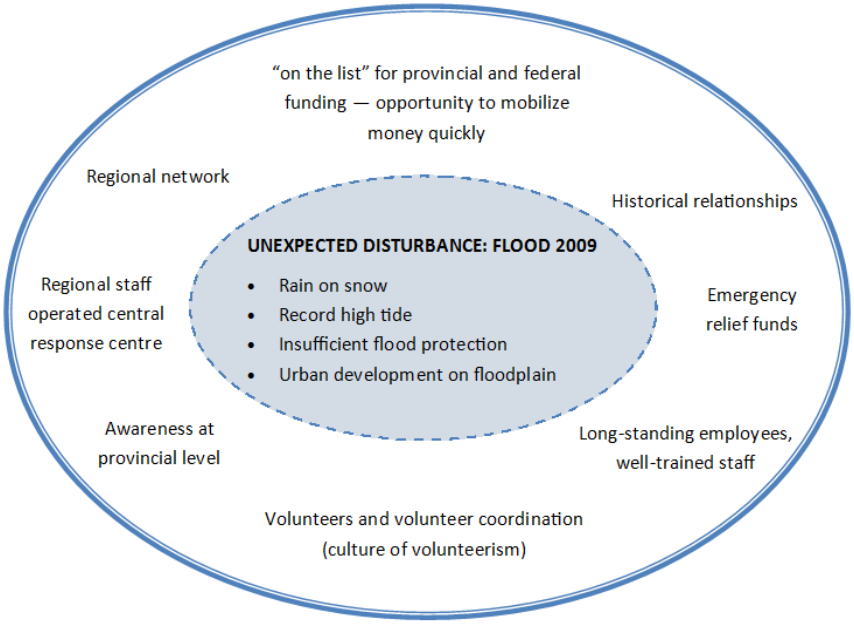

Figure 8. Factors that allowed the Cowichan Watershed to deal with the 2009 flood.

In the second part of the exercise, participants received four stickers each to allocate to adaptive capacity factors on the master list based on importance. No limit was placed on the number of stickers that could be allocated to a factor – the greater the number of allocated stickers, the greater the perceived importance of the factor. At the conclusion of the exercise, communication was rated as the most important adaptive capacity factor with eleven stickers, engaging unusual suspects came second with eight stickers and relationship building and preparedness were tied for the third spot with six stickers each. The complete list of factors and the allocation of stickers are shown in Figure 9.

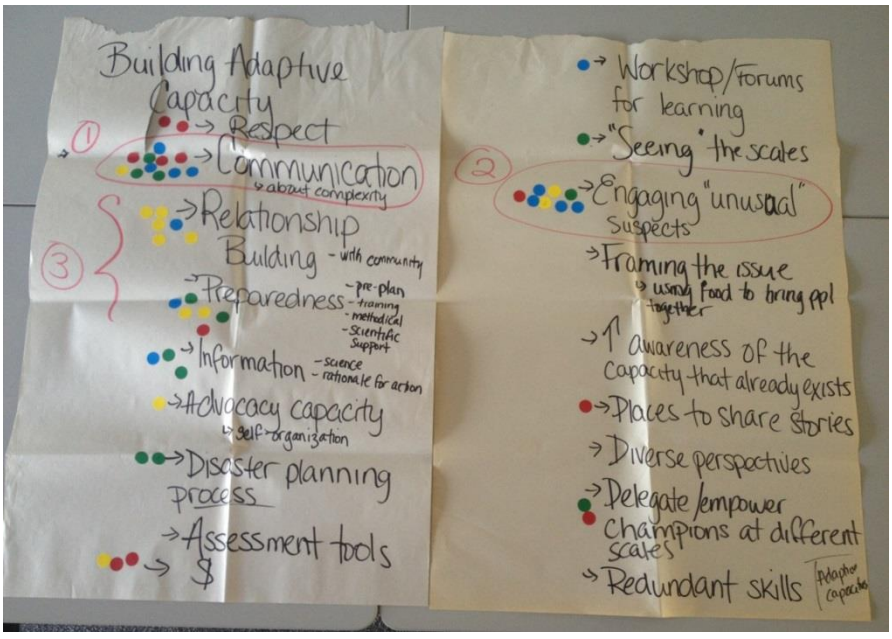

Figure 9. Outcome of the adaptive capacity sticker exercise

Following the adaptive capacity sticker exercise, participants chose to focus in on the factor rated second in terms of importance and discussed strategies to enhance this factor. Strategies to 'engage unusual suspects' included strategic efforts to hold 'one on one' meetings beginning with opinion leaders, engaging social networks with the Cowichan Watershed, and pre-planning a communication strategy.

Conclusion

Adapting and transforming

As previously stated, both desirable and undesirable situations can be resilient and as such, engaging with resilience involves either building the resilience of a desirable situation to avoid crossing thresholds or degrading the resilience of an undesirable situation in order to reverse a threshold crossing and return to a more desirable situation. However, not all thresholds are reversible and at some point it may be necessary or desirable to create a fundamentally new system. The capacity to do this is referred to as transformability. Transformations can be planned as in the case of southeast Zimbabwe where cattle ranchers have created a new way of making a living by converting their farms into game-hunting and safari parks when ranching was becoming increasingly less viable. Transformations can also be unplanned like the transformation of the Aral Sea from a large lake, with a prosperous fishing industry, to one where the fishing industry is almost non-existent. Transformations that are planned have initial costs but these costs are typically minor in comparison to those associated with unplanned transformations that are forced on a system. The resilience analysis workshop in the Cowichan Watershed did not reveal a need for a major transformation in the context of the examples explored. However, the crossing of a water quality threshold noted in the specified resilience exercise indicated that efforts may be required to intentionally breach a threshold to move toward a more desirable state – of edible shell fish in the estuary. More broadly and beyond the scope of this resilience analysis workshop summary was the discussion around the potential transformation needed in governance and concern around local authority regarding the variety of issues and challenges – both predictable and otherwise – facing the watershed in the coming years.

Acknowledgements

Thank you to the Cowichan Tribes for welcoming participants to the Quw'utsun' Cultural and Conference Centre and for providing catering for the workshop and to Rodger Hunter for his invaluable assistance throughout the preparation process. We would also like to sincerely thank all of the participants for their enthusiastic involvement; their insightful contributions are what made the workshop such a success. The workshop took place as part of a broader project titled “Building Capacity for Success: Towards Watershed Governance in British Columbia and Beyond” – results from this workshop will be reported out at a national watershed governance Forum in January 2014. The workshop was led by researchers from the POLIS Project on Ecological Governance and Water, Innovation & Global Governance Lab both located in the Centre for Global Studies at the University of Victoria; and, Environmental Sustainability Research Centre, Brock University. Financial support for the project from the Canadian Water Network is gratefully acknowledged.

Contact information

If you have any questions about the workshop or require further information, please do not hesitate to contact us using the contact information provided below.

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Additional resources

For additional information on resilience thinking and resilience practice, please refer to the links provided below. A brief description accompanies each link.

http://www.youtube.com/watch?v=tXLMeL5nVQk
In this short video, Australian ecologist Brian Walker uses the field of trauma surgery to provide an explanation of resilience theory.

http://www.stockholmresilience.org/21/seminar-and-events/whiteboard-seminars/2-15-2011-what-is-a-regime-shift.html
This video is one of several whiteboard seminars made available online by the Stockholm Resilience Centre. Oonsie Biggs, a researcher at the centre, discusses social-ecological regime shifts using the example of a clear water lake shifting to a eutrophic lake.

http://www.stockholmresilience.org/21/seminar-and-events/whiteboard-seminars/4-1-2011-what-is-resilience.html
In this whiteboard seminar, Carl Folke explains the concept of resilience and how it can be applied with emphasis on three core elements of resilience – persistence, adaptability and transformability.

http://www.resalliance.org/index.php/resilience_assessment
This workbook titled "Assessing resilience in social-ecological systems: Workbook for practitioners" is available for download free of charge at the link above. The workbook provides descriptions and examples of key resilience concepts and uses strategic questions and activities to guide practitioners through a process for assessing resilience in social-ecological systems. A workbook for scientists is also available online.

Walker, B., & Salt, D. (2006). Resilience thinking: Sustaining ecosystems and people in a changing world. Washington: Island Press.
An excellent introduction to resilience thinking is presented by Walker and Salt in this book. The authors touch on the major concepts for understanding resilience and provide case study chapters to clearly illustrate these concepts. Reading this book will provide individuals with an interest in resilience thinking with a good foundation of knowledge.

Walker, B., & Salt, D. (2012). Resilience practice: Building capacity to absorb disturbance and maintain function. Washington: Island Press.
As a follow-up to their book "Resilience thinking: Sustaining ecosystems and people in a changing world", Walker and Salt's most recent book applies resilience thinking to real-world examples with the aim of exploring ways to promote and maintain resilience. Similar to their first book, the authors include case study chapters to reinforce the concepts they describe.

http://www.namoi.cma.nsw.gov.au/36846.html
Example of how resilience is being incorporated into natural resource management planning in the Namoi Catchment, Australia as a result of collective efforts between communities, the Catchment Management Authority and experts.

http://cw.cma.nsw.gov.au/AboutUs/2011capconsultation.html
Example of how resilience is being incorporated into natural resource management planning in the Central West Catchment, Australia as a result of collective efforts between communities, the Catchment Management Authority and experts.