Aiming for resilience and adaptation in managing environment

An emerging environmental and emergency leadership in the twenty-first century

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Abstract

Purpose – Environmental and emergency leaders are important individuals who play a vital role in managing ecological resources. Based on the resilience thinking of Walker and Salt, this study highlights aims to how resilience for adaptive management can be built by incorporating vision formation of environmental and emergency management leaders.

Design/methodology/approach – The study addresses two research questions: What constitutes environmental and emergency leadership systems? How are the concepts of vulnerability, resilience, and adaptation relevant to the environmental and emergency management processes? The study employs two case studies and discusses how resilience leadership can be incorporated into environmental management and emergency management systems in organizations.

Findings – This study includes a review that consists of activities in resilience-building, and the process of vision formation. It explains how resilience thinking influences vision. Investigations of the application of the resilience approach by examining two environmental and emergency leadership organizations in Arizona demonstrate how situations can improve with resilience thinking and leadership in emergency and environmental management systems.

Originality/value – This study contributes to the knowledge body of resilience and leadership by calling importance and incorporation of resilience thinking into the management systems of environment and emergency management.

Keywords United States of America, Disaster resilience, Leadership, Emergency measures, Disaster prevention, Sustainable development

Paper type Research paper

Introduction

Environmental issues, including air, water and soil pollution, deforestation, climate change, shrinking arable land and a shortage of drinking water supply are deeply rooted in over-exploitation and an unsustainable use of natural resources. The well-being of the human species itself is threatened by environmental damage (Walker and Salt, 2006). As a result, global leaders issued a plea in 1987 for sustainable development to meet the needs and wants of the current generation without disturbing

International Journal of Disaster Resilience in the Built Environment
Vol. 3 No. 1, 2012
pp. 42-51

1759-5908
DOI 10.1108/17595901211201123

The author would like to thank Mr Albert Brown, Lecturer, Department of Technology Management, College of Technology and Innovation, ASU for his valuable comments on the first draft of this paper; also two anonymous referees who provided valuable comments.

the capacity of the natural world to support future generations (World Commission on Environment and Development, 1987).

To achieve long-term sustainability goals, environmental leaders must assume a pivotal role in managing ecological resources and easing environmental damages. The environmental commitment of various organizations also depends on their leaders (Bansal and Roth, 2000; Boiral *et al.*, 2009). With the focus on environmental leadership, the US Environmental Protection Agency and individual states have developed environmental leadership programs over the past decade with two purposes: to recognize environmental performance and to encourage better performance (Borck *et al.*, 2008). Environmental leadership is defined as "the ability to influence individuals and mobilize organizations to realize a vision of long-term ecological sustainability" (Boiral *et al.*, 2009, p. 479).

The aim of this study is to demonstrate how environmental and emergency leaders need to incorporate resilience, vulnerability and adaptation into their leadership if they wish to realize long-term sustainability goals. The research questions are:

RQ1. What constitutes environmental and emergency leadership systems?

RQ2. How are concepts of vulnerability, resilience, and adaptation relevant to the environmental and emergency management process?

Environmental and emergency management systems

Refsnes (1994) suggests that environmental management systems constitute elements of:

- policies and objectives;
- hazard and issue identification;
- performance monitoring and control;
- improvement programs;
- reporting;
- internal awareness and attitude building;
- community relations activities;
- training and education;
- review and audit programs;
- engineering controls;
- product and service controls; and
- emergency preparedness (the Appendix, Figure A1).

Emergency management includes:

- mitigation;
- preparedness;
- response; and
- recovery (Trammel, 2010).

Emergency management is one of the functions in the environmental management system. The two are closely related and academic communities consider them

an integrated discipline. In this study, it is argued that successful implementation of management processes depend on the leaders and managers who plan, organize, implement, lead, and monitor the entire environmental and emergency management process. However, a leader and a manager are two different people (Hild, 2010; Hild and Brown, 2010); not all managers are leaders while all leaders should be good managers.

Leader success depends on leadership traits. Vision is not only the most influential trait (Hild, 2010; Hild and Brown, 2010), it is a critical component of outstanding leadership (Humphreys, 2004). Vision is defined as "a set of beliefs about how people should act, and interact, to make manifest some idealized future state" (Strange and Mumford, 2005, p. 122). Boiral *et al.* (2009) suggest that the primary task of environmental leaders is to realize a vision of long-term ecological sustainability. To realize a vision, a leader must possess one that provides a ground on which a plan for long-term sustainability goals can be formulated. Strange and Mumford (2005) claim that vision is ultimately a cognitive construction or mental/conceptual model which shows causal linkages between goals and possible outcomes.

Vulnerability, adaptation, and resilience concept

The concepts of vulnerability, adaptation, and resilience are widely applied by practitioners engaged in fields related to social-ecological systems (Vogel *et al.*, 2007) and studied by academics (Folke, 2006). Resilience is defined as "the ability of a system to absorb disturbance and still retain its basic function and structure" (Walker and Salt, 2006, p. 1). "Vulnerability is the degree to which a system is likely to experience harm due to exposure to a hazard, either a perturbation (disturbance or shock) or a stress" (Turner *et al.*, 2003, p. 8074). "Adaptation is a process of deliberate change in anticipation of or in relation to external stimuli and stress" (Nelson *et al.*, 2007, p. 395).

Walker and Salt (2006) argue that three conditions can lead to un-sustainability: poverty, ignorance and misunderstanding, and willful excessive consumption. Their resilience concept deals with resource systems that no longer work. First, optimization management models are built on unrealistic assumptions such as changes being incremental and linear and not considering changes at higher and lower scales. Second, optimization models do not fit with societal values. As a result, current management models do not reflect the complex systems continually adapting to change. Assumptions of resilience include that:

- all systems are linked to a part of human and nature systems;
- the systems are complex and adaptive; and
- resilience is the key to sustainability of the systems.

Second, thresholds and adaptive cycles underpin the approach. Thresholds mean that social-ecological system have more than one stable state which can be shifted to different regimes or unstable states by extreme and unexpected changes. The authors argue that policies such as balancing supply and demand, imposing new laws and regulations, and developing technology will not solve environmental problems, but resilience thinking will.

To build resilience, four critical factors must be considered in the coupled systems of society and ecology:

(1) living with change;
(2) risk diversification;
(3) knowledge integration; and
(4) self-organization (Berkes, 2007).

First, adaptation to live with change is fundamental in building resilience. Change can be steady or abrupt, disorganizing and turbulent (Folke *et al.*, 2005). Second, diversification reduces risks. It may consist of biodiversity (various bio-species) in ecological systems, diverse partnerships, diverse constituents and actors, and diverse key stakeholders in policy arenas (Berkes, 2007; Kates *et al.*, 2001). Third, combining local and traditional knowledge allows for integration and an increase in learning capacity (Berkes, 2007; Folke *et al.*, 2005). Fourth, a system of resilience includes its capacity for self-organization because nature's cycles involve renewal and reorganization (Berkes, 2007; Folke *et al.*, 2005). The next section of the paper reviews research method employed in the study and describing how data are collected and analyses.

Research method

This study employs participant observation and unstructured interview methods. The researcher was a participant in a series of lectures delivered during a graduate course of study – titled Environmental and Emergency Management Leadership – offered in the Fall of 2010 at Arizona State University. The researcher asked unstructured questions to presenters during their presentations, deliveries, and discussions, related primarily to the topic of this study. The discussions and debates that took place among the presenters, guest lectures, students, and teachers during the lectures and in question and answer (Q&A) sections were observed and recorded carefully. Information including organizational background, policies, and plans of presenters were obtained from lecture handouts, reading materials, and web sites. Among the organizations associated with the presenters, two environmental and emergency management organizations – the Arizona Division of Emergency Management (ADEM) and the Sierra Club (SC) – were selected as subjects for investigating the application of the resilience approach to environmental and emergency leadership. The following two sections describe two case studies that investigate the extent and relevancy of resilience leadership and environmental and emergency management in a governmental and non-profit organization. The names of the presenters are withheld in the case studies.

Case study 1

The mission of the ADEM, a public agency that administers emergency management in Arizona (ADEM, 2010), states that "the Division shall prepare and coordinate emergency services and the efforts of government agencies to reduce the impact of disasters on persons and property." A lecture on development of ADEM emergency planning was delivered by the director of the agency, regarded as an emergency management leader. He explained his management plan during his lecture on the four stages of emergency management: mitigation, preparedness, response, and recovery. It is clear that the department plays an important role in planning effective disaster management state-wide. His four pillars framework – mitigation, preparedness, response, and recovery – was supported by families, communities, volunteers,

businesses, cities and towns, counties, tribes, states, and national and international programs. He listed emergency management planning as well connected to the National Response Framework and the National Disaster Recovery Framework, with legal agreements and close collaborations with other states at the national level. The National Incident Management System intends to standardize incident command, command and management, preparedness, resource management, communications, and information management; however, these are not compiled fully by states, counties, cities, and towns within the state.

His lecture covered other topics for emergency management best practices including comprehensive emergency management, environmental issues, and emergency programs. The National Environmental Policy Act, Endangered Species Act, and National Historic Preservation Act (NHPA) raise environmental issues when carrying out his emergency management activities. For example, NHPA prohibits his relocating to a place that belongs to a national historic site. Rapid response teams and metropolitan medical response systems ensure reaching out at disaster-affected areas in a timely manner.

In a response stage, he explains an emergency response plan and how a mitigation task force was organized. There have been 13 disasters that the Presidential Emergency Declaration classifies as emergencies. His response efforts include National Guard forces, other state agencies including Arizona Department of Emergency and Military Affairs, Arizona Department of Public Safety, Arizona State Division of Forestry, and American Red Cross. A communication strategy includes a state-wide, multiple-redundancy plan. The plan has telephone systems (e.g. landlines, cellular phones, satellites, etc.), radio systems (e.g. UHF, VHR, HF, 800 Mhz), warning systems, data systems (world wide web), and strategic communication caches. This multiple-redundancy plan ensures uninterrupted communications among command centers, rescue teams, and envoys.

Case study 2

An environmental activist group, John Muir founded The SC in 1982. The Arizona Chapter Director of the SC, Grand Canyon Chapter, conducted a guest lecture on SC's (2010) environmental leadership in an ETM 598 course. She states that SC's objectives are to:

(1) explore, enjoy and protect the wild places of the earth;

(2) practice and promote responsible use of the earth's ecosystems and resources;

(3) educate and enlist humanity to protect and restore the quality of natural and human environments; and

(4) use all lawful means to carry out these objectives.

She claims that the SC is regarded as one of the grassroots environmental organizations in the state. Its organizational goal is to advocate and address various environmental issues, including renewable energy, air quality, mass transportation, pedestrian-friendly development, ground water quality, removal of invasive plant species, and wildlife protection at the Arizona Legislature.

Her chapter, The Grand Canyon (Arizona) Chapter, was formed in 1966. The primary goal then was to stop dams in the Grand Canyon. The current projects include:

- restoring and protecting the Grand Canyon Ecoregion project, a water-sentinels program that focuses on protecting the Verde and San Pedro Rivers, and engaging people in watershed restoration and protection; and
- a borderlands project.

The chapter has long been engaged in protecting Arizona's public lands – national forests; local, state, and national parks; wildlife refuges; Bureau of Land Management lands; and others. According to her lecture, priorities are set in six main areas:

(1) border – to protect sensitive borderlands and wildlife;
(2) energy – to promote production and use of renewable energy;
(3) Grand Canyon – to restore eco-regions;
(4) public lands – to protect parks, wildlife, and monuments;
(5) water – to protect water resources and riparian areas; and
(6) wildlife – to protect endangered species.

The chapter seeks to establish legislation that promotes air, water, and renewable energy.

Results and discussions

This study analyses data based on the proposed framework of emerging environmental and emergency leadership (Figure A1). Specifically, the study examines leader vision by considering two groups of influential factors. First, a leader's vision is influenced by:

(1) adequate understanding of vulnerability, resilience, and adaptation concepts; and
(2) four critical factors: living with change, risk diversification, knowledge integration, and self-organization (Berkes, 2007).

Second, the study examines the activites carried out by leaders juxtaposed to the activites in the reslience framework (Figure A1).

From the data collected in case study 1, there are at least three areas where he could improve the resilience approach to emergency management leadership. Baker (2009) argues that an effective mitigation plan begins with an adequate understanding of vulnerabilities and hazards. The director should conduct an in-depth analysis on vulnerability to various natural and man-made disasters, including vulnerabilities to various sources of hazards, creating vulnerability maps, ranking most to least vulnerable locations, vulnerability indices, exploring socio-economic characteristics of disaster-prone areas, and vulnerability mapping of geographical places.

The importance of understanding resilience is awareness of an abrupt change and its impact on social-ecology systems (Walker and Salt, 2006). The director points out that communication is essential during an emergency. He considers the "state-wide, multiple-redundancy" plan the most reliable communication infrastructure during emergency events. Applying resilience thinking, the director should consider the possibility of an abrupt change in the communication system that could affect the distribution and dispatch system of relief supplies to disaster-impacted areas negatively. All of his communication systems operate with infrastructures

including receivers, satellites, and communication towers. In severe disasters, those infrastructures might be affected negatively and communications could be interrupted. When questioned during the lecture, he insisted that the multiple-redundancy communication strategy works well in any event. If the director held a comprehensive vision of disaster preparedness, he would seek alternative communication means in preparation for unexpected change.

Berkes (2007) notes that knowledge integration is one of the four critcial factors affecting a leader's vision for resilience. The director notes that there were tribal, city, and town plans for mitigation. His planning method does not embrace the participation approach for tribes. There are 22 tribes in Arizona and there are various requirements from the tribal groups for mitigation and response activities. Historically, President Obama declared 14 disasters; six were tribal. Some tribal groups do not comply with state emergency plans. In developing mitigation plans using the resilience approach, he should integrate local and tribal knowledge to complement effective strategy formulation.

Although the ADEM's emergency management plan is extensive, it may not be successful for resilience-building. Many emergency management plans fail because leaders concentrate on developing plans rather than on building capacity for community resilience (Choi, 2008).

From data collected in case study 2, the Director of SC Arizona Chapter could improve her organization's resilience-building by diversifying risk; she should specify the degree of vulnerability for each project. In her discussion of wildlife protection projects, she did not mention the degree of vulnerability of Arizona's native fish, toads, and tortoises. She simply stated that these wildlife need protection because they are about to become extinct; she did not state clearly what factors contribute to the wildlife's vulnerability. Understanding the underlying factors contributing to vulnerability provide opportunities to take initiatives for diversifying risk, one of the four critical factors for vision formation (Berkes, 2007). The Verde, San Pedro, and Colorado rivers are on the protected list including geographical regions that have urgent need to protect, but specific geographic places of vulnerability are not mentioned, nor are how each river system affects an entire social-ecological system. There are no studies on geographic vulnerability analyses for places that are included in her protected list. She could identify vulnerable places using geographical information system analysis.

Since social-ecological systems are dynamic and complex, understanding ecosystem and biodiversity resilience is essential for adaptive management in the resilience approach. Emphasis should be placed on the adaptive management process (Folke *et al.*, 2005). The director should encourage participation of various stakeholders in building knowledge and learning. Although SC demonstrates environmental leadership with its novel mission for restoration and protection of natural resources in social-ecological systems, much work remains to improve resilience thinking and build adaptive management.

Conclusions

This study demonstrates that leaders are key individuals who initiate, manage, and commit to environmental and emergency management systems. Successful implementation and positive outcomes of the managing process depend largely on leaders; a leader's effectiveness relies on vision. Leaders create a vision that provides a framework on which environmental and emergency management processes are established. To achieve

long-term sustainability, the best approach is resilience, including adaptive capacity building for managing resources in complex and dynamic social-ecological systems. Vision formation is influenced by understanding the vulnerability, resilience, and adaptation concepts, and adopting a resilience-building approach. Many organizations face failure because they assume vision is equal to effective strategic management; a visionary who lacks strategy is dangerous (Humphreys, 2004). I do not argue that resilience thinking is a comprehensive package for long-term sustainability; it addresses only one of the three drivers of un-sustainability, and much work remains to address the other two drivers, poverty and human consumption. I argue that to realize global, long-term sustainability of social-ecological systems, leaders must embrace the emerging environmental and emergency management leadership of resilience and adaptation.

References

ADEM (2010), Guest Lecture by Director, Arizoan Department of Emergency Management: Emergency Management Best Practices in Environmental and Emergency Management Leadership Course, Arizona State University, Tempe, AZ, 13 September.

Baker, S.M. (2009), "Vulnerability and resilience in natural disasters: a marketing and public policy perspective", *Journal of Public Policy & Marketing*, Vol. 28, pp. 114-23.

Bansal, P. and Roth, K. (2000), "Why companies go green: a model of ecological responsiveness", *Academy of Management Journal*, Vol. 43, pp. 717-36.

Berkes, F. (2007), "Understanding uncertainty and reducing vulnerability: lessons from resilience thinking", *Natural Hazards*, Vol. 41, pp. 283-95.

Boiral, O., Cayer, M. and Baron, C. (2009), "The action logics of environmental leadership: a developmental perspective", *Journal of Business Ethics*, Vol. 85, p. 479.

Borck, J.C., Coglianese, C. and Nash, J. (2008), "Environmental leadership programs: toward an empirical assessment of their performance", *Ecology Law Quarterly*, Vol. 35, pp. 771-834.

Choi, S.O. (2008), "Emergency management: implications from a strategic management perspective", *Journal of Homeland Security and Emergency Management*, Vol. 5.

Folke, C. (2006), "Resilience: the emergence of a perspective for social-ecological systems analyses", *Global Environmental Change – Human and Policy Dimensions*, Vol. 16, pp. 253-67.

Folke, C., Hahn, T., Olsson, P. and Norberg, J. (2005), "Adaptive governance of social-ecological systems", *Annual Review of Environment and Resources*, Vol. 30, pp. 441-73.

Hild, N. (2010), Lecture on Leadership and Leaders in Environmental and Emergency Management Leadership Course, Arizona State University, Tempe, AZ, 20 August.

Hild, N. and Brown, A. (2010), *Course Syllabus: ETM 598 Environmental and Emergency Management Leadership*, Arizona State University, Tempe, AZ.

Humphreys, J. (2004), "The vision thing", *MIT Sloan Management Review*, Vol. 45, p. 96.

Kates, R.W., Clark, W.C., Corell, R., Hall, J.M., Jaeger, C.C., Lowe, I., McCarthy, J.J., Schellnhuber, H.J., Bolin, B., Dickson, N.M., Faucheux, S., Gallopin, G.C., Grübler, A., Huntley, B., Jäger, J., Jodha, N.S., Kasperson, R.E., Mabogunje, A., Matson, P., Mooney, H., Moore, B. III, O'Riordan, T. and Svedin, U. (2001), "Environment and development – sustainability science", *Science*, Vol. 292, pp. 641-2.

Nelson, D.R., Adger, W.N. and Brown, K. (2007), "Adaptation to environmental change: contributions of a resilience framework", *Annual Review of Environment and Resources*, Vol. 32, pp. 395-419.

Refsnes, K. (1994), "From compliance to environmental leadership", *Marine Pollution Bulletin*, Vol. 29, pp. 279-83.

SC (2010), Guest Lecture by Director, Sierra Club Arizona Chapter: Sierra Club and Environmental Leadership in Environmental and Emergency Management Leadership Course, Arizona State University, Tempe, AZ, 31 August.

Strange, J.M. and Mumford, M.D. (2005), "The origins of vision: effects of reflection, models, and analysis", *Leadership Quarterly*, Vol. 16, pp. 121-48.

Turner, B.L., Kasperson, R.E., Matson, P.A., McCarthy, J.J., Corell, R.W., Christensen, L., Eckley, N., Kasperson, J.X., Luers, A., Martello, M.L., Polsky, C., Pulsipher, A. and Schiller, A. (2003), "A framework for vulnerability analysis in sustainability science", *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 100, pp. 8074-9.

Vogel, C., Moser, S.C., Kasperson, R.E. and Dabelko, G.D. (2007), "Linking vulnerability, adaptation, and resilience science to practice: pathways, players, and partnerships", *Global Environmental Change – Human and Policy Dimensions*, Vol. 17, pp. 349-64.

Walker, B.H. and Salt, D. (2006), *Resilience Thinking: Sustaining Ecosystems and People in a Changing World*, Island Press, Washington, DC.

World Commission on Environment and Development (1987), *Our Common Future*, Oxford University Press, Oxford.

Further reading

Gunderson, L.H. (2000), "Ecological resilience – in theory and application", *Annual Review of Ecology and Systematics*, Vol. 31, pp. 425-39.

Somers, S. and Svara, J.H. (2009), "Assessing and managing environmental risk: connecting local government management with emergency management", *Public Administration Review*, Vol. 69, pp. 181-93.

Wilson, K., Pressey, R.L., Newton, A., Burgman, M., Possingham, H. and Weston, C. (2005), "Measuring and incorporating vulnerability into conservation planning", *Environmental Management*, Vol. 35, pp. 527-43.

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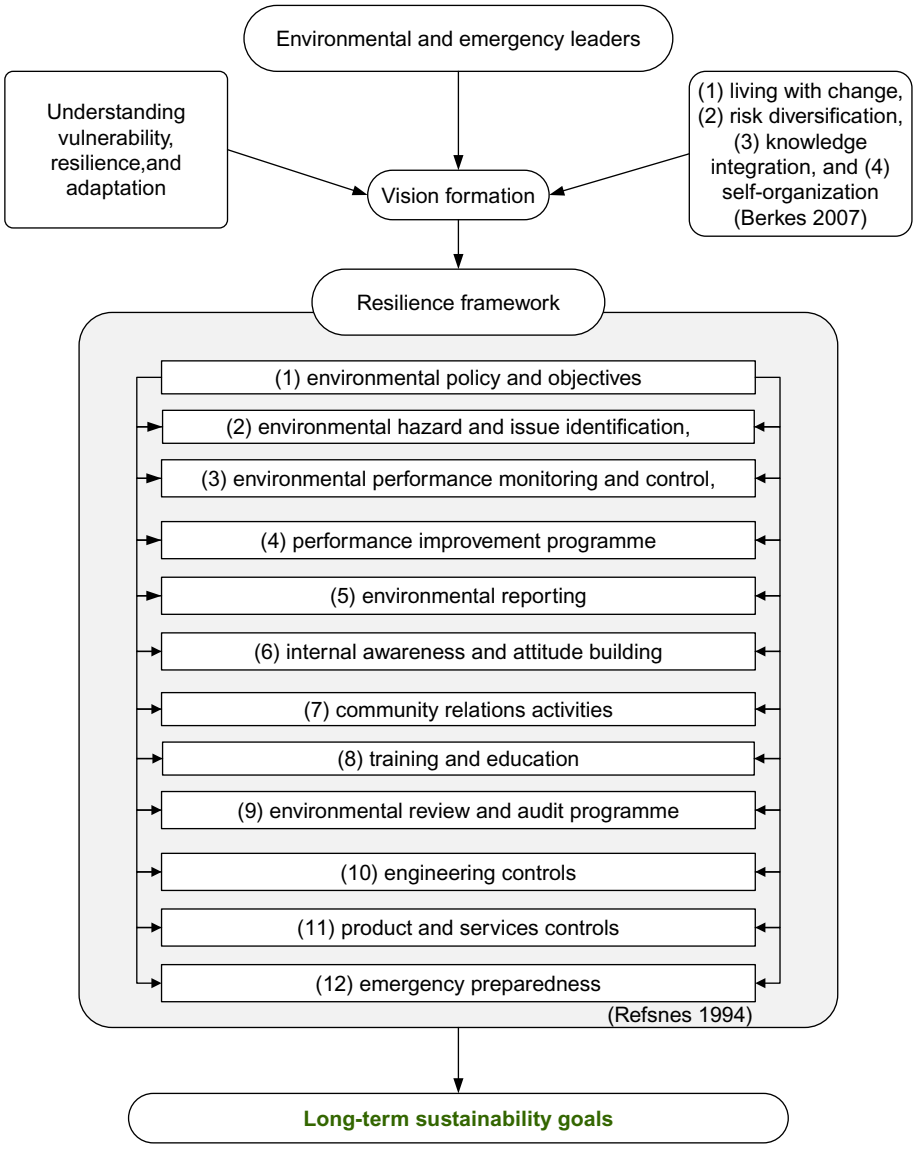
Appendix



Source: Author's creation

Figure A1.
Emerging environmental and emergency system