

## **Scenario Planning for Wildlife Management: A Case Study of the National Elk Refuge, Jackson, Wyoming**

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*Since the 1980s, scenario planning has increasingly been used in business and military settings to integrate an appreciation of uncertainty about the future into planning processes. There is a growing precedent to use it in ecological management decision making. Although well suited for the purpose, the technique has not been adequately applied to wildlife management. This article presents a case study of a wildlife management dilemma at the National Elk Refuge in Jackson, Wyoming, as an example of a situation in which stakeholder disputes make management changes difficult to enact. Building from that example, this article lays out a theoretical justification for the use of narrative scenarios as a tool for engaging diverse stakeholders in disputes over social–ecological system management. The storylines created in the process serve as malleable and negotiable objects, helping to build common understanding of longer-term system dynamics, uncertainties, and management goals among stakeholders.*

**Keywords** scenario planning, social–ecological systems, National Elk Refuge, chronic wasting disease, wildlife management, resilience

Narrative scenario planning is a technique for integrating diverse sources and types of knowledge into decision-making processes while acknowledging the propensity for systems to behave in unpredictable ways. The process involves creatively assembling storylines describing possible futures for the system of interest and analyzing proposed management alternatives in terms of how well they might perform under different potential future conditions. Plans that break down under some alternative futures are rejected in favor of those robust to multiple possibilities. The technique was originally developed for military and industrial application and is credited with numerous planning successes (Ringland, 1998; van der Heijden, 1996). When used for natural resource management, the storylines help decision-makers cope with uncertainty by providing a framework from which to begin discussions of ecological dynamics and possible implications of proposed management alternatives (Peterson, Beard Jr. et al., 2003). By refocusing debates from present concerns to future ones, scenario planning can help stakeholders identify commonly held long-term goals and generate consensus in previously intractable disputes.

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This article presents a case study of a wildlife management dilemma at the National Elk Refuge in Jackson, Wyoming as an example of a seemingly intractable dispute in which scenario planning could be applied to great benefit and where other, more linear approaches to planning have failed to defuse contention. The narrative scenario planning exercises advocated in this article are distinct from quantitative scenarios about individual ecosystem components, which are more commonly used in wildlife management. For example, Loomis and Caughlan (2004) surveyed visitors to Grand Teton National Park and the National Elk Refuge to determine likely visitation patterns under various wildlife management scenarios. Their scenarios addressed only the direct effects of wildlife management on the economy, did not account for system complexity and uncertainty, and failed to address the concerns of many stakeholders. Thus, they are not likely to help stakeholders move beyond their current disputes. In contrast, narrative scenario planning treats the system as a whole, providing diverse stakeholders with opportunities to begin identifying shared longer-term goals for the system.

### **Case Study: The National Elk Refuge, Jackson, Wyoming**

The Jackson Hole elk herd consists of approximately 16,000 migratory elk, 8,000–10,000 of which winter on the National Elk Refuge adjacent to the town of Jackson, Wyoming, where they are artificially fed pelleted alfalfa. Most of the remaining elk winter on feedgrounds operated by the Wyoming Game and Fish Department (Clark, 2000). Over the past 150 years, ecosystem management practices and development of former winter range have gradually made the elk herds dependent on artificial feeding (Smith, Cole, & Dobkin, 2004). The feeding programs concentrate the herds, however, making them more vulnerable to outbreaks of diseases (Smith, 2001). Just as elk are now dependent on artificial feeding and management, the regional economy depends on a healthy elk herd for tourism, wildlife viewing, hunting, and outfitting (Loomis & Caughlan, 2004). The elk herds, the ecosystem in which they reside, and the local economy are interdependent components of a social–ecological system. Feeding programs that increase elk herd vulnerability to disease also increase economy vulnerable to such threats. Social and economic pressures make it difficult for managers to make proactive changes to the management regime that would increase the resilience of the system; any change is likely to be challenged by stakeholders who perceive that their short-term interests are harmed.

### **Background**

The southern Greater Yellowstone Ecosystem has undergone significant changes since European-Americans first explored the area in early 1800s. Prior to the end of the nineteenth century—when settlers built Jackson, Wyoming—most of the southern Yellowstone elk migrated up to 450 kilometers south to more favorable winter range in the Green River basin, the Little Colorado Desert, and the Red Desert. There was likely a small herd that stayed in the Jackson Hole area year round, although the size of the former resident population is not clear (Smith et al., 2004).

By 1909 most of the potential winter range for elk in the Jackson Hole bottomland was occupied by ranches, the grass was harvested for livestock, and development began to block the migration corridor (Boyce, 1989). At the urging of local residents, who saw elk as critical to the economy, the federal government purchased 1,760 acres of private lands just north of Jackson, Wyoming, and established the National Elk Refuge (Smith et al., 2004). The purpose was to (a) prevent elk from depredating ranches, and (b) stem the

collapse of the Jackson herd (which, after intense market hunting nationwide, accounted for an estimated 20,000 of the 50,000 elk remaining in North America; Halverson, 2000). There is no mention of feeding elk in the Act of Congress that created the refuge, but rather “feeding elk became policy out of repeated practice” (Smith et al., 2004). The State of Wyoming began feeding elk in the early twentieth century to help protect the herds after a series of harsh winters led to large winterkill events. Managers initially assumed the elk would only use the feedgrounds during abnormally harsh winters, but the combination of access to artificial feed and development in their migration corridor caused the elk to cease migrating south of Jackson by the late 1910s (Smith et al., 2004). Artificial feeding was believed to offer the “best of both worlds” for the people of Jackson: abundant elk and development in the migration corridor.

The National Elk Refuge, managed jointly by the Wyoming Department of Game and Fish and the U.S. Fish and Wildlife Service, serviced an average of 9,200 elk per year between 1994 and 1998. The state of Wyoming now administers 22 additional elk feedgrounds that service approximately 13,000 elk per year (Dean et al., 2004). Feeding elk helped bring the North American population from an estimated 50,000 animals at the turn of the twentieth century to the current total of approximately 1 million (Smith, 2001).

Although sustaining elk through artificial feeding has never been an explicit purpose of the National Elk Refuge, the charismatic mega-fauna have been fed there for all but a few years since refuge inception. The animals are fed to prevent unpopular winter die-off events and to provide a large and visible herd for a diverse set of stakeholders (Smith, 2001). Kahn (2000) identifies a list of 20 stakeholder groups interested in management issues on the refuge, including: State and federal wildlife management agencies; the U.S. Department of Agriculture’s Animal and Plant Health Inspection Service; hunting, ranching, and environmental advocacy groups; tourists; and Native Americans. These diverse stakeholders desire healthy elk herds and there is consensus that elk are important for the local economy and way of life (“*Jackson Bison*,” 2000).

Despite common interest in the elk, there is little consensus about how elk should be managed because different stakeholders value the herd differently (Clark, 2000; “*Jackson Bison*,” 2000). Each group wants “healthy elk,” but each judges herd health by its own criteria. For example, the tourist industry prefers a large and easily visible herd, ranchers are concerned with the potential for wildlife disease (e.g., brucellosis), and environmental groups are concerned with the overall condition of the ecosystem.

Seeking to protect ranchers’ economic interests, the state of Wyoming recently sued the federal government for the right to vaccinate elk on the refuge with a brucellosis vaccine, based on the argument that the state has the right to manage wildlife within its borders. The efficacy of the vaccine is among the contested issues. Scientists in the state agencies insist that it is effective, whereas those with the federal government claim that it is not (“*State of Wyoming v. United States*,” 1999; “*State of Wyoming v. United States*,” 2002). Vaccination is an effort to convince ranching interests that active steps are being taken to eradicate brucellosis from elk. To some constituents it matters more that the animals are vaccinated than that the vaccine works. Some evidence suggests that brucellosis transmission rates among elk are not high enough to maintain the disease absent artificial feeding (Thorne & Herriges Jr., 1992). Based on these data, environmentally minded stakeholders argue that the ecosystem is over-managed and that both the elk and their ecosystem would be better off if the feeding program were limited and/or the elk population reduced. Ending feeding, however, could result in decreased herd size (undesirable for hunting and tourism-oriented constituencies) and increased intermingling of wildlife with livestock (undesirable for ranchers; “*Jackson Bison*,” 2000).

The existing management regime represents an attempt to optimize the system for a diverse and contradictory set of stakeholder needs and is the result of power struggles and legal proceedings. The present stability of the system is artificial, and attempts to optimize the system through supplemental feeding may make it more vulnerable to change; the feeding program artificially concentrates the elk and creates conditions that promote disease outbreaks (Smith, 2001).

The U.S. Fish and Wildlife Service recently released a final Environmental Impact Statement (EIS) as part of a National Environmental Policy Act (NEPA) planning process to determine the future of the elk and bison feeding programs on the National Elk Refuge (“*Final Bison*,” 2007). The six alternative management plans identified in the EIS included combinations of the following strategies: phasing out or reducing the feeding program, increasing naturally available forage, restoring habitat, supporting migration, adaptively managing the elk, and continuing the current management regime.

Management plans for social–ecological systems should be evaluated in terms of how well they stand up under a variety of system futures. Plans based on an expected continuation of current trends are vulnerable to surprises (Holling, Berkes, & Folke, 1998). Such challenges can stimulate fundamental reorganizations of those systems (e.g., Walker, Holling, Carpenter, & Kinzig, 2004). The Jackson, Wyoming/National Elk Refuge social–ecological system is internally complex and the local economy is intimately tied to the ecosystem through tourism, ranching, and hunting (“*Jackson Bison*,” 2000). Changes throughout the system that affect elk also affect people through economic, aesthetic and lifestyle changes. For example, chronic wasting disease (CWD), a fatal transmissible spongiform encephalopathy affecting deer and elk, is moving closer to the Greater Yellowstone Ecosystem each year (Chronic Wasting Disease Alliance, 2005). Considerable uncertainty exists regarding whether or not CWD will reach the elk in the ecosystem and the potential effects of the disease on the artificially dense herd. Feeding elk on the National Elk Refuge could exacerbate the severity of disease outbreaks there (Smith, 2001).

Although the magnitude, likelihood, and economic effects of a CWD outbreak in the Jackson region are unquantifiable, managers must weigh the threat of CWD against the current stakeholder demands, and anticipate management changes that are likely to meet with stakeholder resistance. Precautionary planning, however, is necessary because the disease could fundamentally reorganize the nature of the relationship between the Jackson economy and the local elk herds.

## Scenario Planning

Scenario planning involves identifying factors that could drive change in a system, and then systematically varying those factors in narrative storylines about the future development of that system (Fahey & Randall, 1998; Peterson, Cumming, & Carpenter, 2003). Scenarios help decision-makers cope with uncertainty by providing a framework from which to begin a discussion of uncertain and nonlinear ecological dynamics and potential futures (Peterson, Cumming et al., 2003; Wollenberg, Edmunds, & Buck, 2000). By creating storylines that cover a range of possible trajectories, planners can evaluate current policies in terms of how well they would perform under potential future situations and identify plans robust to a number of possibilities (Bennett *et al.*, 2003). The process can defuse stakeholder contention by refocusing debate on the long-term well-being of the system as a whole (Wollenberg et al., 2000).

Based on established scenario planning methodologies in industry and lessons learned from adaptive management, Peterson et al. (2003) identify six steps in the scenario planning process for application in natural resource conservation:

1. Identify the focal issue—a specific question should be identified. Knowable aspects of the future should be separated from those about which uncertainty remains. Problems should be defined in a way that they represent the views of a broad range of stakeholders. For the case study presented in this article, the focal issue might be the long-term well-being of the Jackson Hole social–ecological system, and unknowable aspects might include disease, climate variability, and the economy.
2. Assessment—This step involves assessing the workings of the social–ecological system, including the people, institutions, ecosystems, and linkages that define the system. Internal and external drivers of system dynamics are defined. Special consideration should be paid to those uncertainties that could potentially have a large impact on the focal issue.
3. Identification of alternatives—Determine ways in which the system could evolve, taking into account what is known about system dynamics and the uncertainties that remain. The focus should be on those uncertainties that are not locally controllable. Potential system perturbations in the present case study might include outbreak of chronic wasting disease, a prolonged drought, or economic boom or bust.
4. Building scenarios—The alternatives generated during the previous step are crafted into storylines by adding narrative descriptions of external forces and peoples' responses. The progression of events should be plausible and logically coherent. To help make the scenarios accessible to potential users, each storyline should be in narrative format and have a title that suggests the main features.
5. Testing scenarios—The scenarios should be reexamined to verify that they are plausible and consistent with what is known about system dynamics and actor behaviors.
6. Policy screening—Current policies are screened to determine how well existing or proposed policies would fare in different scenarios. Participation in this step allows stakeholders to break through their preconceived notions of system dynamics and allow consensus-building around policy options.

Oglivy and Schwartz (2004) endorse including a “wild card” scenario to fully portray the range of potential futures. For the National Elk Refuge situation, this might include a discovery that humans are capable of contracting CWD; a development that could fundamentally change the local relationship with elk.

### **Why Scenario Planning?**

The dispute over elk management policies on the National Elk Refuge is unlikely to end with the current NEPA planning process because it does nothing to move stakeholder focus beyond disputes over short-term needs. The selected option is likely to be challenged. In this highly contested system, even a decision to manage the refuge with the principles of adaptive management, an approach intended to address system dynamism and complexity, would likely fail in the face of strong stakeholder resistance. Kai Lee (1999) argues that unless there is a consensus among stakeholders early on as to the goals of management, “adaptive management is no more than a way to justify trial and error in the midst of a political free-for-all.” The political free-for-all would likely lead to continued disputes unless a genuine consensus arises about the ultimate goals of management.

Lessons learned from successful stakeholder collaborations provide some insight into how managers might begin to generate consensus management goals in contested situations. Two common themes appear in reviews of successful collaborative efforts: (a) Stakeholders need to have a commonly agreed-on definition of an end goal that goes beyond superficial agreement on vaguely defined objectives (Gray, 1985; Julian, 1994), and, (b) The dispute needs to be symmetrical, meaning that all participants have something to gain through compromise (Wondolleck & Yaffee, 2000).

The ongoing dispute over the management of the National Elk Refuge is understandable when assessed according to the aforementioned criteria. Stakeholders have been focused on their short-term interests, which precludes consideration of threats to long-term system health and makes consensus over management options difficult. Many feel that they would lose ground were they to compromise their short-term position. Because the stakeholders in the management of the National Elk Refuge are focused on their short-term needs, they fail to see what may be a significant benefit of collaboration: increased long-term well-being of the social-ecological system through creating management systems resilient to surprise. Traditional planning techniques, such as cost-benefit analysis and scenarios that address only single system components, provide evidence for stakeholders to argue their short-term goals but fail to refocus debate on the long-term well-being of the whole system.

Scenarios, even when not initially created through a stakeholder process, may serve as boundary objects—objects that can have different meanings for each stakeholder, but which provide a framework and justification for further deliberation (Star & Griesemer, 1989). For these purposes, it is not necessary that the scenarios conform to scientific predictions. Rather, the storylines must address the fears and hopes of the stakeholder groups while remaining plausible, thus providing each stakeholder a reason to focus on the long-term well being of the system rather than on short-term interests. Experiences with scenario planning in other situations suggest that it is a valuable tool for helping stakeholders and managers break through entrenched positions and find common ground by focusing on desired futures (Bonnett & Olson, 1998).

The storylines created in scenario planning are more complex and sophisticated than simply describing the possible effects of a CWD outbreak; they include changes in a number of potential system drivers. Drought, changes in the national economy, and technological innovations are examples of many dynamics that may affect social-ecological systems like the National Elk Refuge. An ongoing dialogue about possible system futures may enable stakeholders in the National Elk Refuge social-ecological system and other similar systems to help create resilience to all types of changes.

## Conclusion

To create resilient systems, plans must consider to a variety of possible futures. In the Jackson Hole/National Elk Refuge social-ecological system, making changes to elk management in the name of an abstract concept such as resilience would be difficult. Past decisions about elk management have been marked by lawsuits between various groups including state and federal agencies and interest groups trying to serve the needs of their constituencies. The proposed alternatives described in the Environmental Impact Statement that change current management would likely benefit some stakeholders at the expense of others, suggesting that the outcome of the current planning process will be similarly contentious. Traditionally, decision-makers in such situations have relied on science to reduce uncertainty with the assumption that more information will make

decisions less contentious. Experience has shown, however, that simply doing more research rarely reduces contention in environmental disputes (Sarewitz, 2004). Decisions that change the management regime from one optimized for short-term elk production to one more resilient to surprises will require building a common awareness of potential future threats to the system. In scenario planning, scientific knowledge can be combined with stakeholder knowledge and concerns to create stories about the future against which proposed plans can be evaluated. Were it applied to this contentious system, the process might help to generate the type of consensus that would allow for anticipatory management.

## References

- Bennett, E. M., Carpenter, S. R., Peterson, G. D., Cumming, G. S., Zurek, M., & Pingali, P. (2003). Why global scenarios need ecology. *Frontiers in Ecology and the Environment*, 1(6), 322–329.
- Bonnett, T. M., & Olson, R. L. (1998). How scenarios enrich public policy decisions. In L. Fahey & R. M. Randall (Eds.), *Learning from the future: Competitive foresight scenarios* (pp. 308–324). New York: John Wiley & Sons, Inc.
- Boyce, M. S. (1989). *The Jackson elk herd: Intensive wildlife management in North America*. Cambridge: Cambridge University Press.
- Chronic Wasting Disease Alliance. Retrieved 12 December 2005, from <http://www.cwd-info.org/index.php/fuseaction/news.main>
- Clark, T. W. (2000). Wildlife resources: The elk of Jackson Hole, Wyoming. *Yale School of Forestry and Environmental Studies Bulletin Series*, 104, 171–187.
- Dean, R., Gocke, M., Holz, B., Kilpatrick, S., Kreeger, T. J., Scurlock, B., et al. (2004). *Elk feedgrounds in Wyoming*. Cheyenne: Wyoming Game and Fish Department.
- Fahey, L., & Randall, R. M. (Eds.). (1998). *Learning from the future: Competitive foresight scenarios*. New York: John Wiley & Sons, Inc.
- Final Bison and Elk Management Plan and Environmental Impact Statement for the National Elk Refuge/Grand Teton National Park/John D. Rockefeller, Jr., Memorial Parkway*. (2007). Washington, DC: US Department of the Interior.
- Gray, B. (1985). Conditions facilitating interorganizational collaboration. *Human Relations*, 38(10), 911–936.
- Halverson, A. (2000). The National Elk Refuge and the Jackson Hole elk herd: Management appraisal and recommendations. *Yale School of Forestry and Environmental Studies Bulletin Series*, 104, 23–52.
- Holling, C. S., Berkes, F., & Folke, C. (1998). Science, sustainability, and resource management. In F. Berkes, C. Folke, & J. Colding (Eds.), *Linking social and ecological systems* (pp. 342–362). Cambridge: Cambridge University Press.
- Jackson Bison and Elk Herd Management: Situation Assessment and Process Recommendations*. (2000): The U.S. Institute for Environmental Conflict Resolution.
- Julian, D. A. (1994). Planning for collaborative neighborhood problem-solving: A review of the literature. *Journal of Planning Literature*, 9(1), 3–13.
- Kahn, H. B. (2000). Uses and valuation of the National Elk Refuge, Wyoming. *Yale School of Forestry and Environmental Studies Bulletin Series*, 104, 139–170.
- Lee, K. N. (1999). Appraising adaptive management. *Conservation Ecology*, 3(2), Article 3. Retrieved from <http://www.consecol.org/vol3/iss2/art3/>
- Loomis, J., & Caughlan, L. (2004). Linking intended visitation to regional economic impact models of bison & elk management. *Human Dimensions of Wildlife*, 9(1), 17–33.
- Oglivly, J., & Schwartz, P. (2004). *Plotting your scenarios*. Emoryville, CA: Global Business Network.
- Peterson, G. D., Beard Jr., T. D., Beisner, B. E., Bennett, E. M., Carpenter, S. R., Cumming, G. S., et al. (2003). Assessing future ecosystem services: A case study of the Northern Highlands Lake

- District, WI. *Conservation Ecology*, 7(3), Article 1. Retrieved from <http://www.consecol.org/vol7/iss3/art1/>
- Peterson, G. D., Cumming, G. S., & Carpenter, S. R. (2003). Scenario planning: A tool for conservation in an uncertain world. *Conservation Biology*, 17(2), 358–366.
- Ringland, G. (1998). *Scenario planning: Managing for the future*. New York: John Wiley & Sons.
- Sarewitz, D. (2004). How science makes environmental controversies worse. *Environmental Science and Policy*, 7, 385–403.
- Smith, B. L. (2001). Winter feeding of elk in Western North America. *Journal of Wildlife Management*, 65(2), 173–190.
- Smith, B. L., Cole, E., & Dobkin, D. (2004). *Imperfect pasture: A century of change at the National Elk Refuge, Jackson, Wyoming*. Moose, WY: Grand Teton Natural History Association.
- Star, S. L., & Griesemer, J. R. (1989). Institutional ecology, “translations” and boundary objects: Amateurs and professionals in Berkeley’s Museum of Vertebrate Zoology, 1907–39. *Social Studies of Science*, 19(3), 387–420.
- State of Wyoming V. United States, 61 F. Supp. 2D 1209 (US District Court of the District of Wyoming 1999).
- State of Wyoming V. United States, 279 F. 3D 1214 (US Court of Appeals for the Tenth Circuit 2002).
- Thorne, E. T., & Herriges Jr, J. D. (1992). Brucellosis, wildlife, and conflicts in the Greater Yellowstone area. *Transactions of the North American Wildlife and Natural Resources Conference*, 57, 453–465.
- van der Heijden, K. (1996). *Scenarios: The art of strategic conversation*. New York: John Wiley & Sons.
- Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. (2004). Resilience, adaptability and transformability in social-ecological systems. *Ecology and Society*, 9(2), 5. Retrieved from <http://www.ecologyandsociety.org/vol9/iss2/art5/>
- Wollenberg, E., Edmunds, D., & Buck, L. (2000). Using scenarios to make decisions about the future: Anticipatory learning for the adaptive co-management of community forests. *Landscape and Urban Planning*, 47(1), 65–77.
- Wondolleck, J. M., & Yaffee, S. L. (2000). Why collaboration. In *Making Collaboration Work: Lessons from Innovation in Natural Resource Management*. Washington, DC: Island Press. pp. 23–45.