Session One.
When Wildlife and Human Interactions Lead to Crisis

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Learning from the Past and Preparing for the Future: Managing Wildlife Crises

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It is a sign of the times that professional crisis management firms exist, ready to assist individuals, organizations and agencies in proactively preventing potential crises or in managing current ones. These firms provide crisis simulation training, 24-hour access to professional crisis management staff and crisis communications assistance. They, and their services, exist because we live in a

complicated world. Crises can and do occur, and there are consequences to our actions and inactions in response to these crises.

Crises come in many flavors. It is a crisis, however short-term, when accounting fails to deliver paychecks on time, when a vehicle breaks down when transporting wildlife or, tragically, when a fatality occurs while operating state equipment. On a larger scale, Hurricane Katrina in the Southeast, the 1991 Oakland Hills fire in California and the New York Love Canal tragedy all can be considered major socioenvironmental crises.

By definition, a crisis is an unstable condition involving potential change. It involves uncertainty. Managers tend to expect some degree of uncertainty in their programs, but we often underestimate both the potential for and the impact of factors contributing to uncertainty. Ecologist C. S. Holling (1978:7) noted, "however intensively and extensively data are collected, however much we know of how the system functions, the domain of our knowledge of specific ecological and social systems is small when compared to that of our ignorance." More complex systems are assumed to have the potential for greater uncertainty. However, it would be untrue to state that a simple system has little or no uncertainty. Certainty of uncertainty is the key management consideration (Salmon and Schmidt 1986).

Between the certainty of uncertainty and the knowledge that ecological systems are inherently complex and, thus, full of uncertainty, the occurrence of crises during the management of natural resources systems is predictable in the broad sense and a surprise in the narrow sense. We know crises will occur, but we can't predict them with precision and accuracy. When you live in Oklahoma, you know tornadoes are possible. Identifying where they will occur and the type of property damage and human suffering that will result is impossible. However, you can be prepared with general tornado-readiness programs, tornado insurance, disaster-response teams and emergency medical and safety programs. Although not always possible, we usually can prepare for some crises.

Crises also have occurred in wildlife management. In the past, these included the extinction of passenger pigeons (*Ectopistes migratorius*) and the near extinction of bison (*Bos bison*); although, they were not recognized widely as crises at the time. The accidental or purposeful introduction of sea lampreys (*Petromyzon marinus*), zebra mussels (*Dreissena polymorpha*) and quagga mussels (*D. bugensis*) in the Great Lakes, of nutria (*Myocastor coypu*) in eastern and southeastern coastal waters, and of European cheatgrass (*Bromus*

tectorum) and yellow star thistle (*Centaurea solstitalis*) in western states clearly has reached or exceeded the crisis stage because of their ecological and economic impacts. Estimates of the economic costs associated with nonindigenous species have been $120 to 137 billion per year (Pimentel et al. 2000, 2005). However, the presence of common pigeons (*Columba livia*) and house sparrows (*Passer domesticus*) in the North American landscape, although very abundant and pestiferous (Pimentel et al. 2005), generally are not considered a crisis. Likewise, although deplorable and a valid concern, the endangered status of the Santa Cruz long-toed salamander (*Ambystoma macrodactylum croceum*) is considered by few to be of crisis proportions.

There are serious but temporary crises that may affect the social, biological or political landscape. For example, consider this editorial from a western newspaper on the shooting of a black bear (*Ursus americanus*) cub by a wildlife officer in Utah: "Maybe, as a state official [said] this week, a wildlife officer didn't violate any state law when he shot a bear cub and left it to die a painful and slow death in front of a group of hunters that had expected something more humane. But he clearly violated sensibilities. Cruelty has no place in the Department of Wildlife Resources, and the department has a responsibility to take some sort of action to restore public trust" (Deseret News 2002).

With hundreds of thousands of wild animals being killed in the state every year, why did this one event put extreme political pressure on the director, who expressed regret on the way the incident was handled, and result in a new wildlife board policy on handling similar occurrences? "The court of public opinion demands accountability," one critic told state legislators (Israelson 2002). We suggest that evolving value and attitude shifts toward wildlife play an important role here.

Five-year-old Laura Small was not the first person ever attacked by a mountain lion *(Felis concolor*) in California (Mansfield and Charlton 1998, Anonymous 2004, Baron 2004:89, California Department of Fish and Game 2004), but this attack in Ronald W. Caspers Wilderness Park, and the successful $1.5-million civil lawsuit against Orange County, resulted in park rules and programs detailing potential risks: "This is a wilderness area characterized by certain inherent dangers. These dangers may include mountain lions, rattlesnakes, poison oak, poisonous insects, extremes in weather and rugged terrain. Your safety cannot be guaranteed. Stay alert to potential danger" (Caspers Wilderness Park 2004).

In addition, human fatalities also caused the California Department of Fish and Game to develop specific guidelines for handling lions suspected of threatening, injuring or killing people, for covering public relations, for collecting and preserving evidence, and for determining lines of authority (California Department of Fish and Game 2006). For example, the procedural guidelines for officials dealing with lion attacks include: "Secure the area as needed. Treat the area as a crime scene. In order to expedite the capture of the offending animal and preserve as much on-scene evidence as possible, the area of the incident must be secured immediately by the initial responding officer. The area should be excluded from public access by use of flagging tape or similar tape (e.g., 'Do Not Enter') utilized at crime scenes by local law enforcement agencies. One entry and exit port should be established. Only essential authorized personnel should be permitted in the excluded area. A second area outside the area of the incident should be established as the command post. . . .If an animal is killed, the [Incident Command Center] will notify Sacramento Dispatch. Treat the carcass as evidence. Use clean protective gloves and (if possible) a face mask while handling the carcass. Be guided by the need to protect the animal's external body from: loss of bloodstains or other such physical evidence originating from the victim; contamination by the animal's own blood; and contamination by the human handler's hair, sweat, saliva, skin cells, etc. Tape paper bags over the head and paws, then tape plastic bags over the paper bags. Plug wounds with tight gauze to minimize contamination of the animal with its own blood. Place the carcass inside a protective durable body bag (avoid dragging the carcass, if possible)" (California Department of Fish and Game 2006).

For lions killed as suspects in human attacks: "It is important that you treat the dead lion with respect after it has been caught. Remember all of us are interested in animal welfare and we care that the animal is killed humanely and handled with respect. Don't drag the carcass on the ground. Don't show the carcass for photography. Don't smile while you are around the carcass. Cover the carcass with a canvas or put it in a body bag before you carry it out" (Schmidt 1996).

Clearly, both Orange County and the California Department of Fish and Game have learned from their experiences and have evolved programs to increase public safety, to reduce financial risk and to maintain the appropriate level of professionalism while working with highly stressful human attack cases.

As individuals and agencies, we react to, and learn from, the crises we face. Unfortunately, the uncertainty inherent in complex systems again comes to

haunt us. For example, Holling (1978:29) discussed impact trends resulting from initial ecological perturbations, such as dams or oil spills. Conventional wisdom favors a dilution-of-impacts paradigm, in which the further one gets from an impact event in time or space, the intensity of the impacts decreases. For example, the massive spill of benzene and nitrobenzene into the Songhua River in China had unknown ecological effects but great sociopolitical effects (Anonymous 2005), with the most intense impacts near the spill site and close to the initial time of the spill. Downstream and over time, the spill's effects were reduced (Feng 2006). Holling's alternative view was an uncertainty-of-impact paradigm. In this model, there is no simple spatial or temporal relationship between an event and its impacts. The local impacts of a pipeline may be overshadowed by later inputs of capital and workers, resulting in social consequences that may overshadow any initial environmental impacts. This is similar to the law of unintended consequences (Merton 1936, Norton 2002) that notes unintended or unanticipated effects may follow actions, well intentioned or not.

It is our thesis that the combination of the certainty of uncertainty, along with unintended or unanticipated effects, will always lead to crises in natural resources management programs. As you reflect on past crises, and on the potential of new ones, consider that crises rarely are subject to replicated experiments. They often are a juncture leading to paths unknown, and ecological systems may not return to their expected equilibrium. Below we discuss some candidate crises that require study and reflection.

Invasive Species

As mentioned earlier, the economic cost of invasive species was calculated at $120 to 137 billon per year (Pimentel et al. 2000, 2005), with the majority of these costs as losses and damages. The route a species has to go through to become invasive includes an introduction, an establishment and an expansion or invasive phase. Although earlier researchers believed this was a rare event, with only 1 out of 100 introduced species becoming invasive as a rough generalization (Williamson and Brown 1986), recent work by Jeschke and Strayer (2005) indicated a much higher rate of success for introduced vertebrates (1 in 4). From a crisis perspective, the strategies used to predict, prevent, control or manage one invading species may be inappropriate for another. Eradication of

an invasive species is a very rare event except on islands (Krajick 2005), so forecasting invasions, assessing management or control strategies, and preventing known invaders from being transported and getting a toehold is critical. Once invaders become established, the difficulty of eradication precludes the preservation of the *status quo* (Vander Zanden 2005). The potential of existing and future invasive species to reach crisis proportions is high as trade, travel and transport of people and goods expands (Meyerson and Reaser 2003). U. S. Executive Order 13112 was written, "to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause" (Clinton 1999:6,183), recognizing these harmful and potentially catastrophic effects and ordering the development of a National Invasive Species Management Plan. There are decision-making models available to policy makers and managers to determine whether new species should be introduced (Bomford 1991, Office of Technology Assessment 1993). In a similar vein, the impact of exotic densities of native wildlife must be considered a management challenge (Caughley 1981, Alt et al. 2006).

Climate Change and Land-use Patterns

Climate change is a real phenomenon. "The issue of climate change respects no border. Its effects cannot be reined in by an army nor advanced by any ideology. Climate change, with its potential to impact every corner of the world, is an issue that must be addressed by the world" (Bush 2001). Whatever the cause, the effects of global and regional climate modifications are the relevant points to this discussion of crises. Small climatic changes have the potential for large ecological effects (Grebmeier et al. 2006), increased disease risk (Harvell et al. 2002) and catastrophic storms (Kerr 2005, Webster et al. 2005), all of which can shift an existing ecosystem into a new equilibrium state (Holling 1978:30). Although modification of climatic changes is beyond the control of most agencies, there is increasing recognition, particularly from nongovernmental organizations, that this threat must be addressed (Dudley 2003). Unfortunately, the effects of gradual climate change may be invisible to many natural resource professionals, given a 30-year career length and the shifting baseline syndrome phenomenon, where we unconsciously measure how much an area has changed compared with what we claim is its starting or baseline condition. More often than not, this baseline is when we arrive on the scene (Sheppard 1995:766). Sheppard

suggested that, "each generation of scientists, or each new team of consultants brought out to do the [environmental impacts analysis] for the next development on that bit of coast, might be dealing with a 'baseline' which is drifting ever further away from its original starting point. There comes a point in this trend when the baseline area which is being used for a particular study has itself reached a condition which the original investigators of say, 25 years earlier, might have recognized as being disturbed." Nevertheless, climate changes will lead to natural resource management crises of unknown proportions. Their impacts will affect populations, communities and ecosystems.

Land-use patterns also have profound effects on wildlife and other natural resources, both on local and global scales (Foley et al. 2005). Increasing urbanization (deruralization) affects land-use patterns in a variety of ways, but intensive agriculture also has had, and will continue to have, major effects. The continuing loss and, more insidiously, the fragmentation of habitats affects some species more than others. Legally, the threshold of, "any species which is in danger of extinction [or likely to become endangered] throughout all or a significant portion of its range" (16 USC 1531 et seq.; the Endangered Species Act) is a threshold requiring action. We do not know the thresholds that initiate crises here, but our ability to sense these effects again is affected by the shifting baseline syndrome.

Human and Wildlife Health

Although we would have predicted that fatal mountain lion attacks on humans would have provoked citizens to demand greater protection, this did not seem to be the case in California. In 1990, California voters passed Proposition 117, which designated mountain lions as, "specially protected mammals" (Mansfield and Charlton 1998), even though most biologists believed lion populations had been increasing over the past 25 years (Mansfield and Weaver 1989, Mansfield and Charlton 1998). High profile fatal attacks on two women in San Diego and El Dorado counties in 1994 helped to prompt the development by the state legislature of Proposition 197 in 1996. Proposition 197 would have repealed the specially protected mammal status of lions and would have required the California Department of Fish and Game to implement a mountain lion management plan promoting health, safety, and livestock and property protection. It did not pass, with 57 percent of voters rejecting it. Fatalities did not seem to be enough to swerve a protectionist public.

Human fatalities by mountain lions, black and grizzly bears (*U. arctos*), and coyotes *(Canis latrans)* (Timm et al. 2004) are not new, and we suggest that crises associated with attacks are best considered short-term crises yet long-term management dilemmas (Baron 2004). However, we suspect that this would change given an attack on a high profile victim.

Wildlife attacks are not the only human safety consideration. Zoonoses are a public-health concern, with some, such as rabies and plague, a constant but manageable threat. In the past two decades, Lyme disease and hantavirus pulmonary syndrome were identified as public-health concerns, and recently West Nile Virus and avian influenza (H5N1) have become major public health issues. Infectious diseases are of particular concern in a world where people are mobile (Dowell and Levitt 2002:6): "It is not possible to adequately protect the health of our nation without addressing infectious disease problems that occur elsewhere in the world. In an age of expanding air travel and international trade, infectious microbes are transported across borders every day, carried by infected people, animals, and insects, and contained within commercial shipments of contaminated food. . . .Moreover, unforeseen disease problems continue to appear." These diseases affect not only humans; wildlife also is impacted, as seen with West Nile virus (Malakoff 2003, Stokstad 2004, Raloff 2005). In addition, climate change will also affect the distribution and transmission of diseases. For example, diseases requiring mosquito vectors will move into areas of higher latitude or altitude as warming trends continue (Harvell et al. 2002). Harvell et al. (2002:2,161) predicted: "The most detectable effects of directional climate warming on disease relate to geographic range expansion of pathogens," and suggested (1) collecting baseline data on disease in wild populations, (2) separating the effects of multiple climate variables on disease, (3) forecasting epidemics through modeling and (4) evaluating the role of evolution. Of these, the development of monitoring programs to provide a current baseline while establishing surveillance programs for emerging pathogens probably is of greatest short-term importance. The ability to predict crises is of great assistance in the management of crises, and "Emerging diseases are a major challenge to the biological safety of the world in the 21st century" (Kuiken et al. 2005:1,681).

Wildlife Management

The wildlife management strategies of 100 years ago are not the strategies of today, and today's strategies may not be similar to those 100 years

from now. Wildlife management programs will change as conditions change, and those conditions may be ecological, social, political or economic (Schmidt et al. 1992). For example, the ongoing, value-laden leghold trap wars (Hamilton et al. 1998, Andelt et al. 1999) will continue to drive the evolution of trapping strategies, techniques and regulations as much as the economics of the fur industry.

Until 20 years ago, most wildlife managers were trained to produce, monitor and harvest wildlife. You harvest what you produce. Modern wildlife harvest techniques were centered around the gun, the bow and the trap. It was not part of the wildlife manager training process to consider alternatives to these techniques, nor were managers (or researchers) trained to put the brakes on burgeoning wildlife populations without the gun, the bow and the trap. Managers are now struggling with overabundant populations of Canada geese (*Branta canadensis*) and white-tailed deer (*Odocoileus virginianu*) (Alt et al. 2006) and with the social, economic, political and biological impacts of these populations. We passed through a period of more is better and introduced nutria, multiflora rose (*Rosa multiflora*), autumn olive (*Eleaganus umbellate*) and saltcedar (*Tamarix ramosissima*). Agencies now spend millions of dollars to control these species (Pimentel et al. 2000). Ironically, our early journals published articles extolling these species, and now they document the damage caused by these species.

Obviously, mistakes happen. However, it is essential to remember that the mainstream management philosophy of today may be gone tomorrow. Gray wolves (*Canis lupus*) have gone from a predatory pariah to an acceptable (to many) keystone species in 75 years. Managers 25 years ago had no comprehension that global positioning systems, all-terrain vehicles and cell phones would be standard operating equipment for many hunters and trappers. And, the valued collaborator of today may be the difficult stakeholder of tomorrow (Freddy et al. 2004).

Again, we suggest that there are crises related to wildlife-management strategies on the horizon, whether related to funding, stakeholders, management systems, invasive species, disease, techniques, the demographics of hunters and trappers, evolving values and attitudes, and support for traditional wildlife management methods. The recent publicity regarding Vice President Dick Cheney's hunting errors and subsequent wounding of a hunting companion (Thomas 2006) will probably have little effect on the future of hunting. A fatality may have had different impacts, as could have a higher profile victim. The

discovery of chronic wasting disease prions in skeletal muscles of mule deer (*O. hemionus*) (Angers et al. 2006) has unknown effects on the recruitment and retention of deer hunters.

Our suggestion is to encourage an agency climate of creative thinking and to anticipate and prepare for these uncertainties. There is a thought in agencies that professional judgment, not public opinion, should drive wildlife management decisions. We agree but warn against the exclusion of public opinion (Freddy et al. 2004). Perhaps this is a weak recommendation, but we recognize the wisdom within Abraham Lincoln's statement that "Public sentiment is everything. With public sentiment, nothing can fail; without it nothing can succeed" (Goodwin 2005:206). Issues that affect public sentiment affect wildlife management. The addition of human dimensions specialists to the staffs of many wildlife agencies demonstrates the recognition of this understanding (Duda et al. 2006).

Wildlife Managers

Finally, we would be remiss if we didn't reflect upon ourselves as wildlife biologists and managers. Surveys document the diversity in background, attitudes and experiences of wildlife and fisheries professionals (Sanborn 1995, Muth et al. 1998). There are clear gender-based differences (Sanborn and Schmidt 1995) as well as those based on age or experience. The managers and biologists moving through the ranks are not clones of those they replaced. Most state wildlife agencies had pretty well defined nongame and the roots of their current wildlife diversity programs in place by the late 1980s. Universities had responded to these major shifts of interest and these demands for new and broader based training. University programs now teach with an even broader ecosystem management focus instead of a game and nongame management concentration. These new age managers will bring new, nontraditional knowledge, experiences, values and attitudes to the table along with the same passions that brought most senior managers to their vocation. Thus, the potential for intra-agency conflict (crisis?) is high. The effect is most obvious for political appointees.

Conclusion

The examples discussed above are not meant to be exhaustive. They are areas in which wildlife management crises should be expected to occur. Some

are crises that can occur in a day while others will appear over decades or longer. We believe invasive species, factors affecting habitat loss and fragmentation, and disease risks will be the major issues affecting wildlife and will precipitate continuing crises. The continuing evolution of the wildlife management profession, its practitioners and the public's perception of and demands for particular management strategies will shape our approaches to these crises. Surveillance and monitoring programs to detect and track diseases and invasive species, and new management strategies to deal with current and future issues in both wildlife and habitat management are needed. The crises associated with wildlife attacks, although significant at the moment, will dissipate over time. The crises associated with habitat loss and change and with biological invasions of plants, animals and pathogens will remain for much longer periods of time.

The precautionary principle is one approach to uncertainty, and it focuses on actions to avoid environmental harm prior to obtaining more complete scientific knowledge. Stated another way, "the scientific certainty of environmental harm is not required as a prerequisite for taking action to avert it" (Cooney 2004:6). Invasive species, the crises of infectious parasites and diseases, and climate change will continue to shape our ecosystems whether we act or not. The precautionary principle suggests a method for working to prevent some of these. A focus on precautions in the face of uncertainty, and crises, must be considered a wise course of action.

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