8

Punctuated Entropy as Culture-Induced Change

The Case of the Exxon Valdez *Oil Spill*

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There was not food, the corn was trampled down
The flocks and herds had perished; on the shore
The dead and putrid fish were ever thrown;
The deeps were foodless, and the winds no more
Creaked with the weight of birds, but, as before
Those winged things sprang forth, were void of shade
The vines and orchards, Autumn's golden store,
Were burned;—so that the meanest food was weighed
With gold, and Avarice died before the god it made.
—Shelley, *The Revolt of Islam*

Disasters are playing a growing role in shaping the social and cultural fabric of the human condition. Disasters include global changes that are brought on by human abuse of the biosphere and compounded by demographic realities of an expanding world population. As human populations expand, stressing available resources, they enter into new and often precarious states with their environments that increase risk and leave many vulnerable to disaster. Meanwhile, developed economies put marginal human populations and environments at risk as they strive to increase productivity and create new markets for the juggernaut of world capitalism. With the UN Division of Humanitarian Assistance declaring the 1990s the "decade of disasters," providing solutions to the dislocation of human communities in the global village has become a vital task. This task requires a holistic approach that takes account of cultural differences while recognizing common causes of disaster.

Anthropology—the most holistic of the social sciences—provides a framework for understanding worldwide cultural dislocations brought on by disasters. Anthropologists are latecomers to the disaster scene, however, and their voices have yet to receive significant attention from disaster managers and policy makers. Moreover, in their struggle to cope with the increasing severity and frequency of contemporary disaster events, disaster managers and organizations require rapid, practical advice that recognizes the complexity of the problems they face and offers timely and appropriate solutions. Anthropologists have yet to provide such advice. In particular, anthropologists and other students of disaster have failed to consider the "interaction of the social, technological, and natural processes that produce hazards and disasters in our accounts of human environmental adaptations" (Oliver-Smith 1996:304). Anthropology *has* begun an in-depth ethnography of disaster that spans the cross-cultural range of disaster adaptation and response (Oliver-Smith 1996). The present challenge is to apply such ethnographic knowledge to the conceptualization, testing, and application of general theories and models of disaster response and mitigation.

This chapter grew out of the observation (echoed in Shelley's poem, above) that as disaster events increase in frequency and severity, recovery from certain kinds, or combinations of, disasters becomes increasingly difficult, if not impossible. This phenomenon is not new; throughout history, civilizations have faced ecological and cultural collapse resulting from drought, disease, or earthquake (see Moseley, this volume). It is made more cogent, however, by the rapidity of modern culture change and the increased risk associated with human-induced catastrophes, also known as technological disasters. Debacles such as Love Canal, the *Exxon Valdez* oil spill, Three Mile Island, and Chernobyl threaten the very sustainability of industrial society and call into question the adaptive value of modern technology.

Developing societies, meanwhile, are in a precarious state as they face natural and technological events that put them at risk. The increasing severity of contemporary disaster events can exceed the local adaptive resources of societies and communities, requiring some external response to achieve recovery. Developing populations experiencing a disaster are frequently at the mercy of externalities that interfere with crucial aid, and over which they have little or no control.

Populations experiencing disaster are often (1) dependent on media constructs (Benthal 1993) ("it's not a disaster until we say so"), (2) jeopardized by practices that threaten environmental sustainability (e.g., the recent peat fires of Indonesia), (3) blackmailed by a Western political ecology that links aid to "democratic correctness" (e.g., the famine in "Marxist" Ethiopia), or (4) ignored (or receive inadequate assistance) due to oversaturation of aid agencies working in a climate of increasing stress to the human-environment relationship (Benthal 1993). Outcomes include rising mortality from disaster events in the developing world, ecological collapse of life-sustaining systems, and overwhelming recovery costs from both natural and technological-induced events worldwide.

Disasters may exceed the capacity of developing societies to recover without enormous outside assistance (Torry 1978b). Average income losses from recent disasters in some developing countries (e.g., Sri Lanka, Bangladesh, and Nicaragua) are ten to twenty times greater than in disasters in the United States (Haas et al. 1973). In some cases, such as the 1972 earthquake in Managua, Nicaragua, postdisaster recovery was hampered by a predisaster imbalance in the relationship between the built infrastructure and the resources necessary to recover those infrastructures.

The most severe cases of nonrecovery come not from loss of built infrastructure but from degradation of the natural environment, which poses an unmitigated hazard to human survival. Hazard is defined as anything that threatens the health and survival of a human population. Global warming, eutrophication of the oceans, deforestation, and destruction of the planet's biodiversity are symptomatic of unmitigated hazard brought on by biophysical disruption.

In this chapter I define the nonrecovery of human systems from disaster events as *punctuated entropy* and apply the concept to the case of the *Exxon Valdez* oil spill. This technological disaster is one of only four such catastrophes (the others are Three Mile Island, Chernobyl, and Bhopal) for which long-term data exist on the impacts to culture, community, and economy. It thus provides an invaluable opportunity to examine the ongoing effects of a catastrophe that has laid bare the core human-environment relationship that is now so threatened by the contemporary abuses of our global village.

In the context of this volume on anthropology of disasters, we can place this case study along a continuum of time and adaptation. Michael Moseley's chapter on the effects of drought on coastal civilizations of Peru is punctuated entropy writ large. In Moseley's example, forces of political ecology interact with long-term environmental change to dictate patterns of settlement, expansion, and depopulation. The combined disasters of drought, earthquakes, and landslides shifted the balance of power in the region and also shifted the centers of population growth from the highlands to coastal areas and back again. Adaptations occur as rational responses to shifts in precipitation and population, with more dramatic punctuated changes associated with disasters bringing equally rapid changes in human settlement patterns. Working in an archaeological context, Moseley can be a detached observer of human consequences of disastrous long-term changes, thus providing us with an appreciation of the relevance of temporal scale in the study of the cultural consequences of disasters.

While Moseley tracks changes in the archaeology of disasters across centuries, J. Terrence McCabe views adaptations among pastoralists in East Africa across the span of yearly drought and seasonal cycles. His perspective places us in the field as firsthand observers of present-time populational adaptations to cyclic drought hazards. However, unlike the case study of technological disaster and its aftermath presented here, the vulnerability created by drought is part of a natural repeating cycle that lies within the intergenerational memory of Turkana pastoralists. Moreover, the demonstrated culture of response and recovery from hazard is part of the adaptive tool kit of these pastoralists, whereby natural events associated with drought are treated as part of the normal functioning of ecosystems (i.e., as "normative disasters").

The Turkana pastoralists' ability to survive repeated drought gives them the power to mitigate their own vulnerability to hazardous conditions, with the certainty that droughts, even though debilitating, are seasonal and cyclic, and will end. Sharon Stephens's work on the vulnerabilities created by radiation hazards in the post-Chernobyl environment reflects the extreme of uncertainty from an unending threat. Control over the mitigation of the hazards rests not in the hands of at-risk populations, but rather within a "club" of experts—the

International Commission for Radiological Protection (ICRP) and other agencies that together make up the "radiation protection community" or, as perceived by the public, the "nuclear establishment" (Caufield 1989:167).

Unfortunately, these scientific experts do not speak the same cultural language as those who are at risk: the public. Decisions they make affect people's long-term vulnerability to radiation, but their decisions give no control to those at risk. Rather, they set standards of radiation exposure that are politically inflected and tend to feed into people's fears and psychological problems in coping with radiation hazards. There is no opportunity to adapt to such hazards, which creates a persistent and high "dread factor" connected to public conceptions of risk. Part of the issue of dread comes not from the degree of actual hazard of nuclear plants under normative operating conditions but from the public sense of risk and the stress such uncertainty generates. In responding to this dread, the public is treated by the radiation protection community as an undifferentiated group to be kept at a distance and managed by public relations experts, with no distinctions made regarding age, gender, ethnicity, or class. In contrast, many members of the public are specifically concerned about risks to men, women, and children as individuals. Questions as to who decides what level of risk is socially acceptable, and how that averaged risk may impact groups such as children, speak to the lack of control by the public of its vulnerability to long-term risks from radiation hazards and disasters.

The most emically focused and individualistic of these contributions is Susanna Hoffman's. Combining the role of both victim and anthropologist, she gives us a perspective on what it is like to lose and regain control, to suffer complete loss and rediscover self after a disaster—the Oakland firestorm that destroyed her home, her personal belongings, and her social and psychological past. The temporal context is the day of the event and the ensuing weeks, as Hoffman and her fellow victims cope with the disaster aftermath and work toward recovery. By going with her on this personal journey, we view the changing adaptive context of individuals and neighbors becoming recovery groups, at times pitted against outside aid agencies and frustrated by the inability of mitigators to understand the character of their loss and needs for recovery.

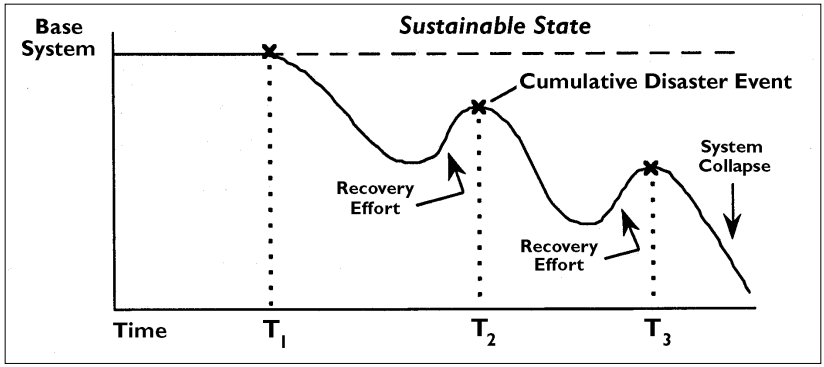

FIGURE 8.1

Punctuated entropy as it affects the adaptive flexibility of a human ecosystem.

Within this framework of time and adaptation is the case of the *Exxon Valdez* oil spill. The study context here is over five years of community-level attempts at adaptation, attempts overwhelmed, I argue, by punctuated entropy.

THE PUNCTUATED ENTROPY PARADIGM

Punctuated entropy is defined as a permanent decline in the adaptive flexibility of a human cultural system to the environment brought on by the cumulative impact of periodic disaster events. It predicts and explains the nonrecovery of human systems after a disaster. The accumulation of impact means that the opportunity for recovery is compromised by repeated disruptions to the human system (fig. 8.1).

The system consists of built and biophysical environments and their dynamic interaction. The biophysical environment includes such elements as the air, soil, vegetation, and water that provide the natural setting for human communities. For noncumulative events such as chronic ecological problems of drought, earthquakes, or floods, societies possess adaptive flexibility, also described as "equilibration" (Torry 1978a). Equilibration—adjustment to changed environmental conditions in the face of new sociotechnological exigencies—is well documented in the ethnographic literature (Dirks 1980; Torry 1978a; Waddell 1975; Brookfield and Brown 1967; Lee 1969; Spencer 1959).

In cases of punctuated entropy, adaptive flexibility is lost due to the severity and cumulative impact of the disaster events. As punctu-

ated entropy takes hold, traditional adaptive strategies fail, the social fabric is deconstructed, and existing patterns of culture disintegrate or are severely modified or replaced by altered systems. In the long term, there is no cultural solution to the ensuing disruption, and system collapse ensues.

Disasters are conceptualized here as either technological or natural. Natural disasters arise from the biophysical environment, and most documented cases of successful adaptation are in response to natural disasters. Technological disasters arise from failures of technology resulting from either human error or system breakdown. Adaptive responses to this class of disaster are not integrated into the tool kits of most human cultures.

Cumulative natural disasters can also induce punctuated entropy, and may include serial earthquakes followed by landslides or tsunamis, extended droughts followed by sandstorms (see Moseley, this volume), or repeated severe flooding events (Piers et al. 1994:27). Technological disasters can have cumulative effects known as "secondary disasters" (Erickson 1976), which include cultural, social, and economic impacts that persist long after the event and that negatively alter or destroy affected communities (Freudenberg and Jones 1991; Dyer 1993; Hirsch 1997; Rodin et al. 1997).

Social stratification and the politics of environmental control can also result in punctuated entropy effects for politically and environmentally marginalized populations. In a socially stratified polity, exploitation of marginal populations following repeated natural disruptions can depress adaptability for those dispossessed of their resource base. Zaman (1988) describes how repeated flooding can induce the downward spiral of punctuated entropy for marginal peasants living on the floodplain. Land lost to flooding by politically marginal groups is bought out by the elite, making recovery for flood victims a difficult if not impossible task. In his study of the political ecology of northeastern Tanzania, Giblin (1992) illustrates a similar phenomenon wherein relations of production between patrons and clients determined whether precolonial farmers succeeded in controlling disease, accumulating livestock and food reserves, and preventing drought from causing famine.

While politically, socially, and economically more powerful groups

may resist cumulative natural disasters such as repeated severe flooding, poverty creates vulnerability:

> On the eve of Bangladesh's massive floods in August 1988, this relatively powerless group [landless squatters] was living in an economically marginal situation but close to the city, on low-lying land prone to flooding. Their economic and political marginality meant they had few assets in reserve. It also meant that their children were unusually malnourished and chronically ill. This channeled the dynamic pressure arising out of landlessness and economic marginalization into a particular form of vulnerability: lack of resistance to diarrheal disease and hunger following the flooding in 1988. Factors involving power, access, location, livelihood, and biology mutually determined a situation of particular unsafe conditions and enhanced vulnerability. (Piers et al. 1994:27)

Another consequence of punctuated entropy is the acceleration of negative systemic change, thus increasing risk to life, health, and social, cultural, and economic sustainability. Negative consequences to the human condition include amplification of perceptions of risk and declining capacity of society to effectively adapt to the rapid changes in human-environment interactions.

Punctuated entropy is most apparent when the natural resource base is compromised, external recovery assistance is misdirected or withheld, and the postdisaster political economy of the region hinders restoration of traditional patterns of human-environment interaction. Punctuated entropy is counteracted most effectively when the natural resource base is uncompromised, external agencies aid community recovery, and the political economics of the region does not unconsciously or purposefully hinder the recovery process.

COMMUNITY MODELS, RISK, AND PUNCTUATED ENTROPY

Since the community is the unit of impact to be examined, a review of relevant paradigms of community will lay the foundation for applying punctuated entropy to the *Exxon Valdez* disaster. A community paradigm found to provide an explanation for the consequences of the

oil spill on the human ecosystem of Prince William Sound is the Natural Resource Community (NRC), defined as a population of individuals living in a bounded area whose primary cultural existence depends on the utilization of renewable natural resources (Dyer et al. 1992).

Social and cultural characteristics of the NRC are based on the recognition of limits to nature, embracing values of sustainable resource use and avoiding risks that would jeopardize a pattern of life intimately dependent on the renewable cycles of nature. This model of community has application to traditional societies worldwide—those peasant and tribal people who are the primary subjects of anthropological endeavors. Thus, conclusions derived from this study have application wherever small-scale communities with localized agricultural, fishing, or subsistence-based economies are faced with intrusive industrial technologies and the risks and hazards they bring. Threats posed by technological hazards prompt strong risk-aversion strategies and behaviors best understood in the cultural context of community. The cultural context of the NRC community (Dyer 1993) can be characterized as follows:

1. Residents of NRCs are strongly linked to their resource base by traditions that integrate them into the natural order.

2. To the extent that cultural activities may destroy renewable resources, NRC residents practice folk management of resources to maintain their sustainability.

3. Because natural resources are utilized and renewed within bounded areas, they are viewed as limited and limiting in the variety of opportunities they provide their human stewards.

4. Progress is resisted to the extent that it threatens the sustainability of core traditions and the natural resource base on which they are structured.

The human-nature relationship of the NRC model can be conceptually linked to the ecological-symbolic approach (Kroll-Smith and Couch 1991), which recognizes the existence of culturally based responses to environmental disruptions (Dyer 1993). Its basic tenets are that people exist in exchange relationships with their built, modified, and biophysical environments, and that disruptions in the

ordered relationship between individuals, groups, and communities are labeled and responded to as hazards and disasters (Kroll-Smith and Couch 1991). Critical to the maintenance of the human-nature relationship proposed by Kroll-Smith and Couch and central to the NRC paradigm is a social structure based on kinship and cooperative sharing of extracted resources. Dynes (1976:24) asserts that these core features are inadequate to the task of withstanding severe disasters: "Such societies possess such a delicate relationship with the environment that when it is disturbed the whole social and cultural structure is threatened."

Torry (1978b) counters Dynes's assertion by reviewing the adaptive strategies of a cross section of traditional societies suffering system disruptions. In all his cases, core traditions based on kinship and sharing adapt and persist in the face of calamity. Disintegration of the core results only from the kind of disasters wrought by cumulative events such as repeated or prolonged drought followed by severe famine (Dirks 1980). The punctuated entropy paradigm predicts that the increasing number of severe and cumulative disasters in the contemporary world will lead to the loss of core traditions and cultural patterns, such that social networks and cooperative relationships will break down, and communities and the traditions that hold them together will become extinct.

Natural Resource Communities are by definition dependent on renewable biological resources. Fixed, nonrenewable resources such as natural gas and oil are thus not included; they represent the primary nonrenewable resources for Dominant Social Paradigm (DSP) communities, the core extractive community model of the industrial world (Dyer 1993). An outcome of the DSP model that also conflicts with NRCs is the increasing risk associated with an extractive strategy unconstrained by concerns for environmental degradation. This Euro-Christian ideal of dominance over nature, manifested as global capitalism and driven by first-world technology, pushes communities toward a world economy at the expense of cultural diversity, environmental sustainability, and social justice (Greider 1997). In this process the perils for developing countries and traditional (tribal and peasant) societies come both from without and within as new technologies are adopted by central governments in an effort to "get ahead," while multinational corporations take advantage of cheap labor markets and

weak or nonexistent environmental regulations in the global export of hazards and risk. The fundaments (Catton and Dunlap 1980) of the DSP paradigm are:

1. People are fundamentally different from all other creatures on earth over which they have domination.
2. People are masters of their destiny; they can choose their goals and learn to do whatever is necessary to achieve them.
3. The world is vast, and thus provides unlimited opportunities for humans.
4. The history of humanity is one of progress, for every problem has a solution, and this progress need never cease.

DSP strategies of resource extraction create an environment that promulgates conditions for disaster such that "with the passage of new generations, the cultural identity of severely impacted communities may be lost and the process of cultural extinction complete" (Curtis 1992:68). Douglas and Wildavsky (1982:21) describe the unmitigated risk of uncontrolled change promoted by the DSP strategy as "irreversible risk": "Irreversible changes are explosive and unstable, each deviation growing larger until the environment is so altered it can never return to its original state."

Irreversible changes of the DSP strategy are also a reflection of the mostly unchallenged use of natural resources through technological manipulation, the outcome being a "risk society" (Beck 1992) that imposes its doctrine of technological dominance on the global community with little regard for future sustainability. NRC residents in Prince William Sound were aware of the risks to culture and community a decade prior to the *Exxon Valdez* spill. Over a decade later, they have yet to recover from the secondary disasters spawned by this event.

THE DISASTER

On March 24, 1989, the *Exxon Valdez* tanker collided with Blight Reef in the Valdez Narrows, resulting in the worst oil spill in US history (fig. 8.2). Over 11 million gallons of North Slope crude poured into the waters of Prince William Sound, devastating the ecosystem and creating a disaster for local communities and residents who had built their lives

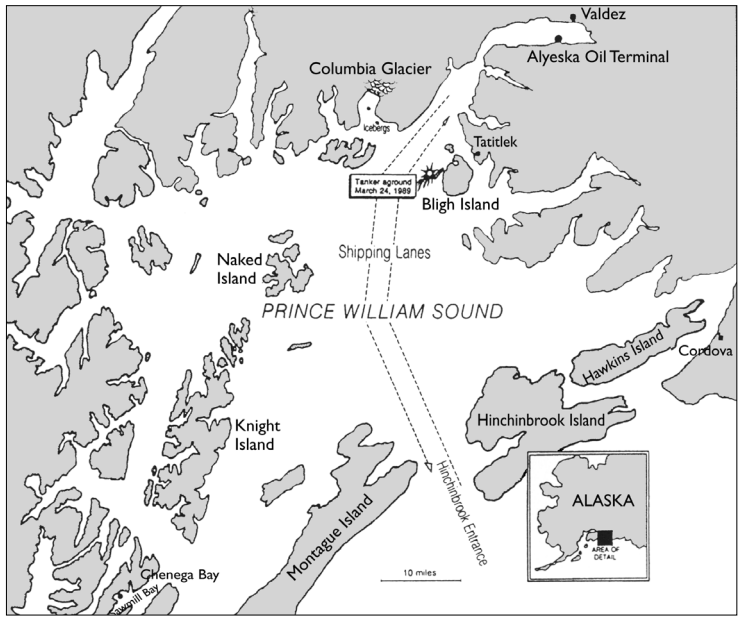

FIGURE 8.2

Prince William Sound, Alaska, site of the Exxon Valdez *oil spill.*

and culture around extracting the renewable natural resources of the region. Cumulative impacts of this event persist as "secondary disasters" (Dyer 1993; Picou, Gill, and Cohen 1997) whose ongoing impacts have permanently altered the adaptive flexibility and character of regional commercial fishing and subsistence communities.

Prince William Sound and the adjoining Copper River Delta estuary are one of the most biodiverse regions in North America. For millennia this biodiversity has maintained Native Tlingit, Chugach Eskimo, Eyak, and other cultures inhabiting the shores and rivers of the region (Davis 1984). Facing accelerated culture change from development interests, contemporary communities continue to subsist along thousands of miles of Alaskan coastline. Resources exploited include seabird eggs, beaver, seals, whales, sea otters, fish, shellfish, kelp, seal, moose, deer, bear, and a variety of berries, roots, and other plant resources. Seven species of *anadromous salmonids,* shrimp, black cod, halibut, herring, and other fish species have provided the basis for a rich subsistence culture and a multimillion-dollar commercial fishery.

Native communities in the region include Tatitlek, Chenega Bay, Nanwalek, Port Graham, Akhiok, Karluk, Uizinkie, Old Harbor, and Larsen Bay. Major towns in the sound include Cordova, Whitier, Valdez, and Kodiak. Many of the Native Alaskans in the region live in the towns but maintain kin and resource-sharing networks with Native villages. Sharing subsistence resources is a tradition that survived centuries of human abuses at the hands of external commercial interests. During the domination of Alaska by Russian fur traders in the eighteenth and nineteenth centuries, Native populations were forced into slave labor arrangements to hunt marine mammals for the European fur market. The Russian Orthodox Church was a mitigating factor in this process, and intermarriage between Russians and Native Alaskans was common (Davis 1984). Many Natives carry Russian surnames, and some can even trace their Russian ancestry back to the aristocracy. Before Alaska was purchased by the United States, depopulation from disease, outmigration, and even enslavement was ongoing. Native populations faced cultural and linguistic extinction, as in the case of the Eyak of Cordova. The last resident speaker of Eyak, Sophie Borodkin, died in 1994 at the age of eighty-nine. Even as Russian traders and immigrants imposed their religion, economy, and material culture on Native communities, they adopted their subsistence strategies, and by this process assumed syncretic lifestyles that mirrored the cultural patterns of their Native hosts.

Alaska became the forty-ninth state in 1967, and gold mining, lumber companies, and a growing salmon canning industry opened up the new frontier. In the late 1800s, Natives served as a cheap source of labor for the Alaskan canning industry, and at the turn of the century also provided labor for mining, construction, and road building. Despite this exploitation, support and respect for Native lifeways resulted in the Native Allotment Act of 1906, which allowed individual Alaskan Natives to claim 160 acres of land. This act was supplanted in 1971 by the Alaska Natives Claims Act (ANCSA). ANCSA has had a significant, and mostly negative, impact on Native communities, which were reorganized as corporations under the new law. Corporate organizational structure did not fit well with the subsistence lifestyles of traditional Native villages, and by 1990, twenty-three out of twenty-five of the existing ANCSA corporations were bankrupt (Jorgensen 1990).

ANCSA also led to dependence relationships between the state and Native villages, many of which did not cope well under their status as "welfare corporations." Such welfare status promoted vulnerability and maladaptations, including unstable marital relationships, chronic alcoholism, and persistent poverty. Countering this was the renewable and renewing subsistence lifestyle, the cultural glue that holds the community together and represents the best hope for social and cultural reproduction of the Native lifestyle:

> Down through the ages we have come to understand nature's comings and goings. We are attuned to her subconsciously. There is no way around nature. We do not try to conquer nature. We live by her rules and act accordingly. Our instinct to survive keeps time with her seasons. When nature's time for fish arrives, we fish; when she says hunt, we hunt. When she says, "It's berry picking time," we pick berries joyously. (Active 1992:2)

Yet, after 1992, subsistence culture was undermined by a sunset clause in ANCSA that allowed outside corporations access to Native resources. Such arrangements potentially result in minimal compensation to Native corporations eager to get anything they can for resources previously held as common corporate property. This accelerating process is contributing to poorly managed cutting of timber, mining exploration, and other activities that are transforming the natural landscape of Alaska.

The negative social and cultural changes promoted by ANCS prompted a resistance movement based on the desire of Alaska Natives to retribalize and sever their relationship with the corporate model (Berger 1985). Despite this movement, the model remained intact, and its persistence coincided with the intrusive and transforming development of Alaskan oil and gas resources. The *Exxon Valdez* oil spill was symptomatic of this transformation process.

The communities most severely impacted by the oil spill are Chenega Bay and Tatitlek, whose local ecosystems experienced significant loss of natural resources from oil pollution. Although it escaped the oil, Cordova, the primary fishing community, also suffered significant and ongoing impacts. Unlike residents of traditional Native villages,

the 2,100 residents of Cordova comprise a diverse mix of old and new immigrants, whose lifestyles revolved around commercial fishing. An important component of the town's fishing strategy is the Prince William Sound Aquaculture Corporation (PWSAC). The PWSAC aquaculture of pink salmon supplements wild stock harvests, allowing increased catch effort and profits. The economy of Cordova also includes various fishing support businesses such as gear and electronic supply shops, grocery stores, bars, restaurants, and a smaller segment of scientific, civic, and environmental groups that together form this environmentally aware Natural Resource Community.

Cordova exists on the site of the historic Eyak Village, which persists as a "village within a town," with Native members of the Eyak Corporation scattered throughout various neighborhoods. Natives maintain important kin and sharing networks with the nearby villages of Tatitlek and Chenega Bay, and specific disaster effects in one Native community have social, cultural, and economic ripple effects in others. These communities—Chenega Bay, Cordova, and Tatitlek—are the focus of this case study of the effects of the *Exxon Valdez* oil spill. My goal here is to assess that disaster as a case of punctuated entropy, compare it with similar disaster events, and place it within a wider context of anthropological discourse on culture change. Because of the central importance of natural resource extraction to community livelihood, the loss of natural resources and the cultural consequences of loss are of primary concern.

Disaster outcomes that qualify the oil spill as a case of punctuated entropy are (1) the natural resource base is compromised, (2) outside recovery assistance is misdirected or withheld, and (3) the postdisaster political ecology of the region hinders restoration of traditional patterns of human-environment interaction.

COMPROMISE OF THE NATURAL RESOURCE BASE

When the *Exxon Valdez* ran aground on Bligh Reef on March 24, 1989, and spilled over ten million gallons of North Slope crude oil into Prince William Sound, it polluted one of the most pristine environments in the United States. A map of Prince William Sound shows the location of the spill in relation to the study communities of Chenega Bay, Cordova, and Tatitlek (see fig. 8.2). Commercial fishing,

subsistence, recreation, and tourism, including sport fishing and hunting, have been lost or reduced in the years since the spill.

The initial biological impacts of the spill were made worse by the timing of the event. March is a period when phytoplankton and zooplankton, the basis of the food chain in the sound, begin their initial bloom. Disruption of reproductive cycles of fish, shellfish, and other marine organisms occurred, and benthic communities of urchins, kelp, and other shallow water species were devastated. Seabirds and marine animals were also heavily hit by oil. Between 260,000 and 560,000 seabirds were estimated lost, along with 5,500 sea otters, 144 eagles, and deer and other wildlife (Lord 1991). The 1989 fishing season for salmon, the primary economic resource, was closed due to oil in the water. Studies later showed that salmon eggs laid in oiled streams suffered 70 percent greater mortality than those in non-oiled streams. Additionally, herring eggs, a traditional subsistence food, showed 90 percent abnormalities in oiled areas compared to 6 percent in non-oiled areas.

As of 1996, some of these natural resources had shown recovery, but most are slow to recover or remain depressed. Only one species, the bald eagle, was considered "recovered" in 1996, while intertidal and subtidal communities, pink salmon, sockeye salmon, mussels, and common murres were "recovering" (Exxon Valdez Oil Spill Trustee Council 1996a). Among the animals labelled "not recovered" were three species of cormorants, harbor seals, and Pacific herring, sea otters, harlequin ducks, and killer whales. Recovery for other species, such as clams, rockfish, cutthroat trout, and the common loon, were "unknown." Surface and subsurface patches of oil still remain in many places. About 1.4 million gallons are estimated to remain in the mud, sand, and sediment in the Gulf of Alaska and Prince William Sound (Clark 2001).

Benthic organisms, such as urchins, starfish, and clams, suffered high mortality from both oiling and cleanup efforts. Scouring of beaches with hot water to remove the oil killed many benthic organisms through thermal pollution. Clams, an important subsistence food, have been slow to recover, and most shellfish beds in waters off of Tatitlek and Chenega Bay remain contaminated and unfit for human consumption.

The herring population, a major cash fishery and source of her-

ring roe for subsistence, completely collapsed in 1993 and shows no sign of recovery. Pink salmon runs failed in 1992 and 1993 and were depressed in 1994, while sockeye have not recovered to their pre-spill numbers. Although the runs of hatchery salmon are recovered or recovering, wild stocks are still down from years prior to the spill. Evidence exists that potentially lethal doses of oil are still leaching into Prince William Sound streambeds where wild stocks of salmon spawn, and aquatic birds and marine mammals continue to show signs of exposure (Clark 2001). Killer whales, seabirds, and deer and seal populations have also not recovered from the spill. Harbor seals, an important subsistence resource, have declined about 6 percent per year (Exxon Valdez Oil Spill Trustee Council 1996a).

As two Native residents of Chenega Bay said of their resources:

> Seals are scarce. When you go out on a boat, you seldom see seals or sea lions like before. Man, the water is just dead. Along the eighteen miles of Knight Island where we used to harvest, I didn't see even one. Now we have to go thirty miles by boat to find seals. We used to get them less than two miles away from the village." (Fall and Utermohle 1995:IV-9)

> I still hunger for clams, shrimp, crab, octopus, gumboots. Nothing in this world will replace them. To be finally living in my ancestors' area and be able to teach my kids, but now it's all gone. We still try, but you can't replace them. (Fall and Utermohle 1995:IV-16)

Any disaster that substantially disrupted the commercial harvest of marine resources in a Natural Resource Community would predictably result in an increased reliance on subsistence harvesting. Subsistence harvesting acts as an economic buffer in the event of economic disruption, allowing time for households to regain their economic equilibrium. A survey of Alaska Natives in Cordova indicated that by 1991 over half of all respondents could no longer obtain previously consumed subsistence foods (Picou and Gill 1995). This significant decline in subsistence viability is contributing to long-term pernicious effects on the NRCs of Prince William Sound. Thus, the documented ongoing compromise of the natural resource base of Prince William Sound by the

Exxon Valdez oil spill disaster fullfills condition (1) of the punctuated entropy model.

Also "not recovered" are the NRC residents of Cordova, Chenega Bay, and Tatitlek, whose reliance on the natural resource base was disrupted by the spill:

> Living in a place like this ties you into a cyclic view of life because your daily work is tied directly from where your food and water and survival comes from. You have to be tied into the cycles of nature. For Natives, a lot of their daily work is getting food and I don't want to say that it's better than the way other people live. It's just when you have an oil spill maybe you and I can get by fine. I don't have to go fishing. Pay me some money and I'll go find something else. But if you live in some of these villages, and you're not used to using money so much to get your food, and all your culture is completely interwoven with the natural system—an oil spill is real trouble. (Key respondent, Cordova, quoted in Dyer 1993)

Nonrecovery of culture and communities parallels the nonrecovery of the natural resource base. No predictions have been made on when the ecosystem as a whole will recover to its predisaster condition, but it is certain that permanent damage has been done to the human-environment connection. The cultural and community impact of nonrecovery from natural resource loss is further compounded by a series of ongoing secondary disasters (points T-2 and T-3 in fig. 8.1), including the misdirection and withholding of external assistance.

MISDIRECTION AND WITHHOLDING OF EXTERNAL ASSISTANCE

The premise of this section, taken as condition (2) of three driving processes in the punctuated entropy paradigm, is that nonrecovery is linked to input of culturally misdirected (inappropriate) exogenous capital into economically fragile communities. This capital disrupts patterns of traditional adaptation and recovery from disaster, including social networks that provide needed psychological support and sharing of resources (Davis 1984; Dyer 1993; Picou, Gill, and Cohen 1997; Rodin et al. 1997). It further added to disruption of the natural

resource base from ecologically destructive oil cleaning and removal practices. While the capital infusion was directed at cleaning the environment, the social and cultural needs of communities received inadequate support, resulting in the depression of adaptive flexibility and the occurrence of "secondary disasters" (points T_2 and T_3 of fig. 8.1).

The initial response of the Exxon Corporation to the spill was to engage in a massive cleanup campaign. The VECO Corporation, a regular provider of special services to the Alaska petroleum industry, hired locals for cleanup at wages of more than $16 an hour (Cohen 1997). For Natives, this often meant abandoning or missing cycles of traditional subsistence and village ritual. Employed as captains, rock scrubbers, beach cleaners, boat washers, and animal caretakers, they had to leave their families for months at a time. The cessation of commercial fishing, the workers' extended absence from home, and the stress associated with the cleanup began a process of family, cultural, and community disruption that continues today.

Further community disruption was caused by the thousands of outsiders seeking employment opportunities in the cleanup. At the height of the summer of 1989, some 11,000 workers were on the spill cleanup payroll (Cohen 1997). Exxon officials moved into the communities of Prince William Sound with millions of dollars in cleanup equipment, paid up to $2,000 a day to rent fishing boats, and drafted residents and transient workers throughout the region to participate in the grand gesture. As one Exxon official declared, in a tone of extreme confidence, "Just watch and see what we are going to do."

The cleanup effort, part of a regional $2.5 billion post-spill infusion of capital by Exxon, was heavily criticized. The hot water used to remove beach oil proved deadly to nearshore intertidal organisms. Cleanup workers trampled ecologically sensitive beaches, and news reports alleged that cleanup workers in some areas were looting cultural artifacts from previously secret sites of spiritual significance to Alaskan Natives (Cohen 1997). Such "cultural pollution" added to the trauma of Native communities already in shock from the devastation of their subsistence resource base. The intrusive presence of a "cleanup army" stressed the cultural patterns and cooperative networks so useful in the harvesting of salmon and subsistence activities. With fishing activities suspended in 1989, residents faced a choice to participate in

an economic boon or wait it out and hope for a good fishing season in 1990.

The "money spill" that followed from the cleanup created an artificial economy with corrosive effects on the social networks of communities, particularly the Native communities. Cash from cleanup earnings provided short-term "improvements" in their material culture. At the same time, the sudden presence of readily available cash was socially destructive, fueling social instability by allowing for unmitigated access to drugs, alcohol, and firearms. Natives were ill-prepared to manage either the money or its social consequences:

> In village X, a brother of a local resident always brought in a seal to be shared by the village. He would land in his seaplane and leave the seal on the beach for them to pick up. We flew over X about a week after he dropped off the seal last summer (1989). It was still on the beach where he had left it—rotting. Everyone was so drunk because of the spill crisis they hadn't bothered with it. (Cordova resident, quoted in Dyer 1993)

Residents who traditionally generated social capital by sharing resources from commercial fishing and subsistence were engaged in an activity for which they gained no traditional prestige but an inordinate amount of cash. As Morton Fried (1967:66) has observed, the prestige associated with natural resource harvesting amounts to privilege of access and is a form of ownership, where "ownership…really means that the man who fulfills the social requirements of 'owner' is one to whom prestige will accrue as the distribution proceeds."

Prestige prevails in societies where people are chronically reliant on products that others labored to obtain, and whose procurement was backed by strong positive inducements (Ingold 1988). Prestige in subsistence cultures is tied more to respect for traditional patterns of intercommunity sharing between extended families than to individual success at accruing economic capital. Kruse (1991) notes that exposure to cash income is not sufficient to alter patterns of subsistence use. Besides prestige, the subsistence lifestyle also nurtures well-being by providing "psychic income" (Neale 1971) that outweighs the economic capital lost by participating in a culture of nature.

When the oil spill altered this culture of nature, psychic income

and prestige were lost, sharing broke down, and those who most benefited from working on the cleanup or renting out their vessels were identified by others as "Exxon whores." Sudden wealth for some created anomalous relationships between friends, neighbors, and working partners:

> I've known X for years, and he was never worth very much as a fisherman. He was a good neighbor, and we used to help each other out when something needed fixing, or some work on the boat needed an extra hand. But since he made that money on the spill, he doesn't even talk to me anymore. They're building a new house even in Whiteshed, and I guess they'll be moving out altogether. (Key respondent, Cordova, quoted in Dyer 1993)

Subsistence sharing, a strong tradition in past years (Stratton 1989), has been compromised by the disaster event. Sharing is a core tradition of Native community and culture in Prince William Sound, but has deteriorated with time (Fall and Utermohle 1990) as the Native culture of nature is marginalized by intrusive patterns of DSP economy. Sharing commonly ensures a distribution of resources in seasonally harsh environments and reifies labor and kin ties. Sharing of labor is another adaptive strategy, and another tradition compromised by the spill:

> Before the spill, we [fishermen's wives] used to get together and help each other out with childcare, and just support each other. We would get together and visit—have tea, or drink a bit. It was nice when your husbands were out fishing. After the spill, it just seemed like everybody was too busy trying to make money, or find out what was going on. Nobody felt like getting together to just socialize. Some of our husbands were making real good money, but others weren't doing so good. It made it hard to talk to each other. And we just never really have gotten back together. Some of us just don't talk to each other at all anymore. (Fishermen's wife, Cordova)

Another telling impact was wrought by household participation in the cleanup. Native workers on cleanup crews complained of perceived mistreatment and abuse from crew chiefs. They felt the working

environment was antithetical to their traditions of cooperative work. For example, one married couple, who left their children with relatives to work on the spill, reported:

> We wanted to work to clean up our water, but they took away our enthusiasm. One rule they had was "No talking." This made it very hard on us. When we work, it is a shared experience. We weren't even allowed to socialize after work. This really bothered us, this hurt our marriage. (Key respondent, 1992, Cordova)

Wives complained of husbands returning traumatized and withdrawn because of what they saw out on the water (HUD worker, Eyak Village). Parent-child relationships did not escape the disruption. Many children in Cordova, accustomed to home care and nurturing from parents, found themselves estranged from their parents in child-care centers. When parents participating in the cleanup did return, the household routine was less than normal:

> People didn't have family lives during the first period [of the cleanup] because they worked so many hours a day. And in most cases it was a man and a woman and they were so tired when they got home that they went straight to bed. They were up and gone early in the morning…there was no social life. There was no place to go. You didn't want your kids playing on the beaches. (Field notes, July 1991, Cordova)

In an example of withholding assistance, parents in Tatitlek choosing to work on the cleanup completely lacked child-care support (Rodin et al. 1997). The community requested a grant of $40,000 from Exxon to be used to provide child care for cleanup workers. Despite support from the North Pacific Rim, a social service organization dedicated to the assistance of regional villages, Exxon ignored the proposal. This prompted the village administrator to remark, "It was pretty incredible that Exxon would spend $80,000 to save a sea otter but they weren't willing to spend any money on children" (Impact Assessment, Inc., 1990:81).

Some escaped from the trauma of the disaster by squandering their spill earnings on drugs and alcohol (Rodin et al. 1997). Increases in the rates of domestic violence and violations of the law, as well as

substantially increased demand on mental health services, stressed support workers and communities alike (Dyer 1993):

> People who worked on the spill are still having problems. When a social service person comes in from the outside, they're either in love with the place, or gone in six weeks. And when they fall in love with the place, it's a love affair like you wouldn't believe. These people were damaged by the spill, just like everybody else. They tried to cope, their workload went up, but it was like the hurt helping the hurt. It was very difficult for them. And we would not accept at all a stranger coming in from Fairbanks, or Juneau, or Nome, to sit there and say: "Yes, I know how you feel." No you don't know how I feel, because you were not there. You did not go through the scare, the trauma, the fright, and the financial disaster. There was nothing a social worker from anywhere else can say to help us. We have got to heal from within.

Healing has been hard to achieve. Visits with mental health workers four years after the event confirm the persistence of postdisaster stress. Subsequent efforts to help mitigate stress have included "talking circles" to allow people to share feelings and provide support for those who continue to struggle with the spill aftermath (personal communication, social worker, Cordova, 1997).

Picou and Gill (1997:226) measured the persistence of stress among commercial fishers in Cordova, and their conclusions are consistent with nonrecovery as predicted by punctuated entropy:

> Without mitigated human restoration, the persistent threat, uncertainty, and lack of ecological and economic resolution resulting from the spill will continue to produce patterns of chronic stress. In summary, the restoration of renewable resources must be accompanied by the restoration of the quality of life in communities negatively affected by the *Exxon Valdez* oil spill.

A CORROSIVE POSTDISASTER POLITICAL ECOLOGY

Cordova, Chenega Bay, and Tatitlek were bombarded with outsiders in the postdisaster environment. The political reaction to the

spill event included the expensive cleanup, most of which occurred in the two summers (1989 and 1990) after the spill. Residents also engaged in years of community meetings, legal deliberations, and state and federal hearings. They continue to live with uncertainty as to when, if ever, their fishing and subsistence lifestyles will return to normal. The mechanism identified to restore victims of this technological disaster was litigatory restitution. Restitution was seen as the solution to recover lost subsistence and fishing resources. In order to achieve it, hordes of lawyers locked up the communities, fishermen, and Natives in a prolonged legal process that hindered social healing.

For many Natives, being legally isolated from the outside meant losing regular contact and communication with social networks and supporting organizations that were core to the cooperative and therapeutic basis of subsistence culture. For example, a longtime director of the Subsistence Division of Alaska Fish and Game went to Tatitlek to talk to an elder about shellfish pollution, asking for help in making a safety video. Despite many years of trusted association, the elder refused to communicate with him, saying that any questions would first "have to be cleared through my lawyer" (key respondent, Alaska Department of Fish and Game, Anchorage).

While a code of legal silence descended on Chenega Bay and Tatitlek and intruded into the communities and lives of spill victims, the media focused on a battle between environmental concerns and industry that virtually ignored the needs and NRC worldview of Native Alaskans. Instead of spurring a reexamination of the development process, the preponderance of press coverage favored government and industry officials (Daley and O'Neill 1997). Understanding the impact of the technological disaster on Native communities was not a priority of the media culture of response. Rather, the disaster was promoted as an *inevitable* technological accident, part of the price for maintaining an oil-based economy:

> The disaster narrative overtly moved the discourse away from the political arena and into the politically inaccessible realm of technological inevitability. Many of the media-contested disputes between industry and state officials were *post hoc* assessments of what kind of oil spill contingency plans had been

> considered acceptable for various hypothetical spills. (Daley and O'Neill 1997:246)

The years following the spill saw the litigatory process winding its way toward the goal of "restoration." Restoration, as agreed upon by Exxon and the federal government, in no way meant restoration of community, culture, social networks, or physical and mental health of disaster victims. Instead, it was restricted to settlement of "damages to publicly owned natural resources affected by the spill" (Piper 1993:261). Also excluded were various claims from private parties, the most prominent being Alaska Natives and Alaska Native corporations, owners of nearly all the private land in the spill area.

Among the most corrosive secondary disasters contributing to the punctuated entropy process were court decisions to deny compensation for impacts to community and way of life (Hirsch 1997). There is simply no value recognition for the cultural markers that define Native communities under the Western legal system. If we accept the premise that the NRC model holds for most of the village world of developing cultures, the potential for lasting social and cultural damage—secondary disasters—in the face of exported technological hazards is enormous.

An important lesson for anthropologists is that the legal system of Western society is poorly designed to accommodate cultural diversity and associated human needs in the face of technological disaster. Twelve years after the spill and seven years after a trial culminating in $5 billion in punitive damages, legal battles for compensation are still being waged.

While this legal dance continues, the social and cultural fabric of the communities remains largely unrestored. One social worker, having spent several weeks in one village, expressed exasperation at the lack of adequate social and mental health services for communities he described as "completely dysfunctional." Chronic alcoholism, domestic violence, sexual abuse of children, and all other social ills have been magnified by the loss of subsistence resources and the unending corrosive legal process.

Depopulation through suicide and outmigration threaten the sustainability of these communities, and no legal moves have been made

to mitigate these outcomes. Meanwhile, a 1992 sunset clause in the 1972 legislation establishing the Native corporation system in Alaska opens up vast areas of Native corporate holdings to oil and mineral development. Selling out to outside investors may be a last-gasp response for these communities suffering the brunt of a severe case of postdisaster punctuated entropy.

CONCLUSIONS

The case has been made that the *Exxon Valdez* oil spill is a technological disaster arising from a process of punctuated entropy for severely impacted commercial fishing and subsistence-based communities of Prince William Sound. This has occurred because (1) the natural resource base has been compromised, (2) external assistance has been misdirected or withheld, and (3) the postdisaster political ecology of the region has hindered restoration of traditional patterns of human-environment interaction.

There may be no way at this point to reorder the symbolic ecological relationship that has been so completely altered in the impacted NRCs. The end point of this punctuated entropy process can be conceived of as "cultural chaos," in which neither the rules for normal behavior nor the rules for coping with the unexpected—the cultural "emergency system" (Corlin 1975)—apply. Successfully mitigating the punctuated entropy process engulfing the victims of the *Exxon Valdez* oil spill may be an exercise in futility. The present worldview on technological disaster, as reflected in the case of the *Exxon Valdez* oil spill, tends to minimize differences rather than respect them. This allows for expansion of development processes with little regard for cultural or environmental sustainability (Greider 1997).

In the absence of innovative, culturally sensitive forms of mitigation and validation of the NRC paradigm by the DSP cultural brokers, there is cause for pessimism. Innovation, to be successful, must validate the human, cultural, and social capital that gives diversity to the social patchwork of our global village. Such capital includes skills, knowledge, social networks, and means of sustainable utilization of renewable natural resources (Freudenberg and Gramling 1992). As the natural resource base from which cultures reproduce themselves is destroyed,

the loss of adaptive flexibility can result in the emergence of "corrosive communities" with little opportunity for recovery.

Preserving communal cohesion and combating community corrosion in the face of technological change has been realized elsewhere (Wybrow 1986). In cases of disaster by forced eviction from technologically intrusive structures (e.g., large dam projects), recovery is possible (Torry 1978). This requires that opportunities for adaptation of previous cultural systems are present in the new environment.

What have we learned as a society from this technological disaster, other than how a powerful legal system can deny or delay justice until the victims of the event are reduced to a nonrecoverable state of cultural and spiritual despair? If the NRC model represents a culturally appropriate one for sustainable communities, then we should seek to emulate and conserve such communities rather than marginalize them into nonexistence. And what roles can anthropologists play in this drama, given the lack of impact they have had on similar disaster outcomes?

These questions may speak to the very survival of the human species. Global warming, coastal eutrophication, desertification, depletion of the ozone layer, deforestation, and worsening impacts from flood, drought, and other catastrophes all reflect a decrease in the adaptive flexibility and environmental sustainability of human systems. It is time for anthropologists to go beyond the study of disasters as simply another intellectual exercise in the study of culture. It is critical to bring the holistic dynamism of the discipline to combat punctuated entropy by creating culturally appropriate innovations to disaster preparedness, response, and mitigation. If punctuated entropy is a real phenomenon, as proposed here, then its potential pervasiveness is a warning to humankind to listen carefully to the voices of vulnerability; for, as Pogo once said, "We have seen the enemy, and he is us."