

**SUSTAINABLE DEVELOPMENT  
AND  
NATURAL HAZARDS MITIGATION**

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## **SUSTAINABLE DEVELOPMENT AND NATURAL HAZARDS MITIGATION**

### **Living Beyond Our Means**

The United States of America is fast growing beyond its limits. Our growth-acclimated society has exceeded the Earth's capacity to sustain us while we continue to follow a growth-at-all costs life style. We are consuming natural resources and producing wastes at ever-increasing rates. Non-renewable resources are being used faster than renewable substitutes are being found, and pollutants and toxins may soon reach the assimilative limit of the oceans. Clearly, these patterns of consumption and over-use are unsustainable; many believe we are approaching a point of "no return" in our relationship with the Earth. There are also those who believe that our current patterns of behavior regarding natural resources are a derelict of duty, a duty which is imposed on all living things to live within the carrying capacity of their environment.

These unsustainable patterns permeate nearly every aspect of our collective lives. We are even transgressing the limits placed upon us by the natural world in our choices of "habitat," and have pushed development into areas which are inappropriate or dangerous for human settlement. Human activity is routinely located so that it creates a serious threat to ourselves as well as to a wide variety of natural resources and functions, many of which are beneficial to people as well as valuable in and of themselves as part of an inter-related living ecosystem.

Level, dry, and stable construction sites are long gone in many communities, yet the pressure to build more commercial venues, production facilities, employment centers,

and residential units continues to be steady and strong in much of the country. Left to develop are only previously unused lands - wetlands, mangroves, oceanfront beaches and dunes, floodplains, steep slopes, fault zones, fire-prone areas, and other wild spaces. Many are altered to suit the builders' needs - wetlands are drained, dunes are leveled, vegetation is planted in fire-break zones - and the natural integrity of the area is forever impugned. In choosing these building sites and changing the landscape, we not only lose the inherent value of these areas, but we also expose ourselves to forces beyond our control.

### **Natural Hazards and Disasters**

The forces to which our development decisions expose us often present themselves as "natural hazards," including such recurring extreme events as floods, earthquakes, hurricanes, erosion, wildfires, tornadoes, and volcanic eruptions. These occurrences are indeed tragic for the people living in the area who lose homes, farms, businesses, family and loved ones. However, despite the magnitude of a particular disaster from the human perspective, most such incidents themselves, while perhaps unusual, are not an aberration of nature or "freak" occurrence.

True, these events can result in massive damage to the ecological environment - fire can destroy grasslands and forests, coastal storms can move barrier islands, tornadoes can uproot trees, earthquakes can alter the landscape. Yet these occurrences, as well as their destructiveness, are part of the natural system. Mother Nature is amazingly recuperative from the forces of wind, rain, fire and earth, and the natural environment can regenerate with remarkable resiliency, often restoring habitats and ecosystems in time for

the next generation of plant and animal life to begin anew in a continuous cycle of destruction and renewal.

For instance, a flood, even one as monumental as that which occurred in the Midwest in 1993, is a naturally occurring, inevitable, largely unstoppable geophysical phenomenon. Since the dawn of time, riverine systems of the world have dealt with water flows that exceed the capacity of their channels by allowing the excess to spread out over the adjacent floodplain. Such events are an integral aspect of the life of a river, and occur as a result of rainfall, snowmelt, and other intrinsic components of the Earth's hydrological cycle. The floodplain is designed to absorb the overflow of its river, dissipating the impact of flooding over a wider area. This process has resulted in riparian soils that are rich in alluvial deposits, highly beneficial for the growing of crops and attractive for the establishment of settlements on the river's banks.

It is not until the crops are planted and the communities built that flooding can be characterized as *hazardous*. It is only when the man-made environment intersects with the extreme events of nature that "disasters" result. *Disasters* occur when human activity, such as construction and agriculture, take place in the path of the forces of nature. The human environment, particularly the built environment, is not nearly as resilient or recuperative as the natural environment, and the occurrence of a natural hazard can result in the debilitation or destruction of an entire community for many years following the event. In typically anthropocentric posture, then, we consider the naturally occurring geophysical processes of the Earth as hazardous when they prove detrimental to *human* lives and property, rather than examine our own behavior.

## **Human Geohazards**

To a large degree the level of vulnerability of a particular community to hazard events can be attributed to the recognition and acceptance (or lack thereof) of the dichotomous relationship between natural geophysical events, such as floods, and human activity, such as development. In addition to a tendency to underestimate the forces of nature, the relationship between these geophysical events and human activity is often more complex than humans merely “getting in the way” of naturally occurring phenomena. In some instances, human activities can themselves exacerbate or even cause hazards and create disasters. “Human geohazards” is a term that describes human enterprise that accelerates or interferes with an otherwise innocuous natural process.

For instance, not only does inadequately planned and designed development often place people and property in harm’s way, such development can also negatively impact the natural environment within which structures are built. The natural functions of the ecosystem can thus become greatly impaired, reducing the ability of the environment to absorb the impact of future hazard events. A cycle of lowered protection and higher levels of loss ensues in these communities. Consider buildings located on the site of leveled or reduced ocean front dunes. While providing a lovely view and easy beach access to the occupants, such ill-advised structures are subject to the full impact of coastal storms as well as the ravages of normal rates of shoreline erosion. Not only has this type of development placed people and property in harm’s way, it may have ramifications beyond the immediate and obvious dangers; pollution runoff and exacerbated sedimentation rates can damage nearby wetlands and coral reefs, reducing their ability to deflect some of the stresses associated with wave action, flooding, and hurricane impact.

Furthermore, the structures themselves can become floating battering rams or wind-borne missiles during violent storm events, creating an increased risk of damage to neighboring buildings and imperiling human lives.

### **Structural Solutions**

Traditional attempts to manage the intersection of geophysical events and human behavior have focused on physical manipulation of the natural environment. While in some instances structural activities are the most practicable and provide the greatest degree of protection, ironically these engineering methods sometimes worsen the very problems which they were designed to solve (if not at home, then downstream), creating their own “geohazard.” For years, property owners along the Atlantic coast have attempted to slow down the rate of erosion which in some areas steadily eats away at their lots and threatens their cottages, condominiums, and hotels by setting up hardened structures perpendicular to the shoreline. These groins and jetties are designed to “capture” the downshore drift of sand that occurs naturally along the coastline. Happy owners find “their” beach accreting nicely with the captured sand, protecting their investment for a few more years (or at least until the next big storm). However, just a short walk down the beach will reveal that lots on the downshore side of the groin or jetty are experiencing accelerated erosion. These lots have been deprived of the sand that would have naturally been deposited on the beach by the longshore current, sand which is now lying on the beach of upshore neighbors. These downshore property owners are thus put at increased risk from storm damage and rapid erosion. Clearly, this irresponsible

method of preventing a natural hazard has only served to make the condition more hazardous for others.

A similar problem has occurred in some river communities, which have built extensive levees to prohibit riverine floodwaters from encroaching upon their settlements. By doing so, however, discharge in excess of the river channel's normal capacity is prevented from reaching its floodplain. In such a case, the flood waters have not been eliminated, they have merely been transferred elsewhere; the flow of water has no alternative but to continue until such place as it can dissipate, often into the nearest community without containment works, or to breach the levee and flood the community it was designed to protect.

Not only do structural engineering methods have the potential to create a "human geohazard," the level of damage that results is often greatly exaggerated as well. By encouraging intensive land uses to take place in the floodplain or on oceanfront beaches, for example, protection via engineering devices may create a false sense of security, leading to further development in these hazardous areas and contributing to an increase in the community's vulnerability to future hazard damage.

### **A New Approach to Development Decision-Making**

It is clear, then, that our current modus operandi cannot be continued indefinitely. Human use (over-use) of the world's resources, including our methods of staking out new territory, are "unsustainable." That is, we cannot expect to carry on at this rate with the same returns forever, and without irreparable damage to ourselves and future generations. In fact, children alive today will in all likelihood face a very different world when they are

adults and making development decisions of their own. We must do what is in our power now to see that we do not limit their choices through thoughtless decisions we make.

Fortunately, *sustainable development* has emerged as a paradigm with the potential to give human beings the perspective and the power they need to rediscover our proper niche in the Earth's panoply. Indeed, sustainable development may be seen as a moral imperative, that we must pursue more thoughtful ways, must change our values and assumptions, must consider beyond the here-and-now.

The concept of *natural hazard mitigation* falls neatly under the broader umbrella of sustainable development as one of the ways by which we can change our current self- and eco-destructive habits. With hazard mitigation as one of the pillars of sustainable development, we can make our development decisions in such a way as to make the built environment more resilient to the impacts of natural hazards, thereby decreasing the future vulnerability of human life and property while bolstering the long-term viability of natural ecosystems and human communities.

### **Defining Sustainable Development and Hazard Mitigation**

While the literature is replete with definitions of sustainable development, the one that is nearly universally accepted today emanates from the report published in 1987 by the United Nations' World Commission on Environment and Development entitled *Our Common Future*, commonly referred to as the Brundtland Report. *Sustainable development* is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."



There are also myriad interpretations of what constitutes hazard mitigation, but one standard definition used by the Federal Emergency Management Agency (FEMA) describes *natural hazard mitigation* as “*any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards.*” This can involve a variety of activities ranging from minor structural changes to an existing building that make it more resistant to the impacts of natural hazards (such as extra nails to hold roofing material in place during high winds) to major avoidance policies which permanently remove particularly hazardous areas from the development marketplace (such as public acquisition of hazardous sites).

### **The Shared Principles of Sustainable Development and Hazard Mitigation**

Neither sustainable development nor hazard mitigation are brand new ideas. Yet it is not until recently that these concepts have become widely recognized as legitimate, “doable” principles to be incorporated into decision-making. And it is not until even more recently that that the two concepts have been coupled as complementary methods for reaching the same broad goals. While the concept of sustainable development may be wider in scope, both concepts clearly have many salient aspects in common.

The first such important common element is the recognition that these are *qualitative* concepts, and do not necessarily involve quantitative measures. Sustainable development communicates a concern with *what kind* of development, rather than how much, while hazard mitigation encourages development that is built to standards designed to withstand likely hazard impacts and is located in areas that minimize those impacts. Neither principle necessarily proposes a “no growth” policy for communities to become

less vulnerable and more sustainable. Rather, these concepts advocate for the safe accommodation of future population rise through conscientiously controlled growth and development.

The second common bond between the concepts of sustainable development and hazard mitigation involves an ethic of conservation and preservation. Natural hazard mitigation calls for conservation of natural and ecologically sensitive areas, such as wetlands, floodplains and dunes, features which enable the environment to efficiently and cost-effectively absorb some of the impact of hazardous events. These ecosystems also serve as important pollution filters, as well as provide habitat for a number of species of fish and wildlife. In this way, preservation and protection for mitigation follow one of the fundamental premises of sustainable development: that we respect our natural heritage and allow its systems to operate as designed, without alteration or interference. By allowing the environment to perform its functions unimpaired, mitigation-through-preservation programs can help communities attain a level of sustainability, ensuring public and environmental health for the community as a whole.

Third, proponents of sustainable development theory recognize that our economic structure and the natural environment are not necessarily in conflict, but instead are irrevocably interconnected and interdependent. Despite our seeming “dominance” over the natural world, humans are still dependent upon the bounty of Mother Nature for our own viability. This is clearly evident in our reliance on the Earth’s natural resources for survival. However, natural ecosystems that are not operating at optimum levels due to pollution or other human-induced trauma do not produce the staples of a firm economy. In turn, economies that are faltering do not allow people the “luxury” to invest wisely and

consider the long-term, which can often put natural resources in peril as they are exploited for immediate gain. A vicious cycle of environmental degradation and economic decline may then be established, producing a severely lowered quality of life for people, and an uncertain future for the vitality of the area's ecosystems.

Hazard mitigation can play a vital role in maintaining a balance between a community's economic condition and its natural setting. A core assumption of mitigation strategy is that current dollars invested in mitigation will significantly reduce the demand for future dollars by lessening the amount needed for emergency recovery, repair and reconstruction following a hazard event. A greater degree of community resiliency to the impacts of natural hazards enables local businesses and industries to re-establish themselves in the wake of a disaster, getting the economy back on track sooner and with less interruption in the flow of goods and services.

Mitigation can also provide a degree of socioeconomic continuity in the community by reducing the social upheaval that often accompanies a hazardous event. Damage to transportation and communication systems, dislocation of people, loss or interruption of jobs, and closing or disabling of businesses, schools and social centers often create personal and family stress for disaster victims in addition to financial hardship. By minimizing the causes of these stress factors, untold repercussions of disasters may be avoided, including such human tragedies as domestic violence, child abuse, depression and anxiety, and even suicide, all of which have been shown to increase in the aftermath of severe disasters.

Fourth, sustainable development implies a change in values, and speaks in terms of *needs* not desires. Adherence to the principles of sustainable development does not

guarantee a life of luxury for all, but neither does it demand major sacrifice. We must be willing to give up the oceanfront homesite when a structure there is clearly in a fragile and hazardous location. We must cease to view ourselves as merely consumers of the world's goods, and instead we must recognize our role as stewards of the planet.

Fifth, to bring these measures of sustainability to fruition, sustainable development theory requires that we focus on intergenerational equity: we must meet the needs of the present generation, but not at the expense of what future generations may need. In similar forward-looking fashion, hazard mitigation requires that we build, rebuild, and plan for today's development while considering the impact of hazards yet to come on inhabitants in the years ahead. A community's future vulnerability can be determined by projecting various development scenarios, and assessing the number of people that would experience harm and amount of property that would be damaged were a hazard event to occur. Armed with such knowledge, proactive communities can take action to reduce this level of vulnerability, strengthening the community as a whole for today and tomorrow.

### **Implementation at the Local Level: Controlling Growth and Development**

While these shared principles of sustainable development and natural hazard mitigation intimate that the focus is solely directed toward global concerns, the very nature of the concepts makes them decidedly local in nature. It is at the local level that most land use patterns are determined, infrastructure is designed and provided, and many other development issues are decided. It is also at the local level that hazards are experienced and losses are suffered most directly. Because of our decentralized approach

to many of these types of issues, there is much within the power of a typical unit of local government to bring about a sustainable and mitigative approach to growth and development within its jurisdiction.

Many American communities have already instituted programs designed to influence various characteristics of growth within their planning jurisdictions, such as the type, amount, density and timing of new development that will be permitted. Local measures are also routinely employed to control the overall mix of land uses to ensure that incompatibility and inefficient use of resources are minimized. Other tools available to local governments are used to reduce or distribute the costs of growth. This includes reducing economic costs, referring to avoidable financial outlays associated with new development, as well as distributional costs, which entails distributing the economic costs of growth among current and incoming residents fairly and equitably. Environmental costs are also influenced by local action, in order to reduce the damage to natural ecosystems that can result from ungoverned development. These local growth management activities can be used to promote a higher quality of life, a safer built environment, and sustainable patterns of growth and development in the communities which choose to engage in them.

### **Controlling Growth and Development: The Tools of Local Government**

There are many opportunities open to communities that wish to guide their growth and development in a principled and responsible fashion. The police power, which is bestowed upon local governments by the State in which they are located, authorizes local government actions that protect the public health, safety and general welfare. In fact, it

can be argued that local governments are under an *affirmative duty* to promote the health, safety, and general welfare of their citizens; it can be further argued that refraining from managing growth and development in a responsible manner is a dereliction of that duty.

As a general rule, local governments have four major areas of authority, all of which can be infused with the ethics of sustainable development as that community expresses and implements them, and carried out so that the principles of mitigation are followed. The first such category of government activity is *regulation*, which includes regulation over land uses, as well as other human activities. Regulation of land uses can take many forms, including the enactment of zoning ordinances, subdivision regulations, planned unit or cluster development provisions, floodplain management ordinances, critical area management laws, and numerous other regulatory activities.

Of all the local regulatory options, zoning is perhaps the most ubiquitous. A zoning ordinance authorizes the government to divide its jurisdiction into various zones, and designate which types of land uses will be permitted in each zone. Zoning can be used as an effective tool for achieving a wide variety of mitigative goals, such as easing congestion on public roadways, thereby augmenting evacuation capacity; reducing undue concentrations of the local population which may be at risk from natural hazards; limiting the density and/or increasing the minimum lot size of parcels located in designated hazard areas; restricting development in areas with inadequate access to protection services, such as fire or emergency medical services; and zoning to preserve natural areas that mitigate against hazards, such as wetlands and dunes.

In addition to zoning, many local communities enact subdivision ordinances as a method to control development. Subdivision regulations are activated upon the division

of land for development or sale, and while they do not control the type and quality of development as directly as does zoning, they can serve several mitigation objectives. Subdivision ordinances can be quite effective in controlling flooding, by prohibiting the subdividing of land that lies within mapped floodplains. When other types of hazard areas are officially mapped by the local government, subdivision ordinances can prohibit subdivision of parcels located in these areas as well. Many communities also include standards for infrastructure and facilities provided by developers in their subdivision regulations, as well as performance standards for the buildings. These provisions can be quite effective for ensuring that infrastructure and facilities are adequate for the hazard risk posed in that area, including such fundamentals as sufficient drainage and stormwater management facilities. Subdivision ordinances can also require that buildings be sited away from hazard-prone sections of land parcels, such as shoreline erosion points, or that developers undertake specific mitigative activities, such as protecting or creating wetlands, augmenting dune systems, or planting vegetative buffers.

Local ordinances that regulate planned unit developments or cluster development can be another useful legal tool when enacted with sustainable development and hazard mitigation as a guide. These ordinances typically allow density of new development to be concentrated at higher than normal levels in certain parts of the parcel being developed. The remaining land is then designated for less-intensive uses. This approach can effectively preserve open space and protect sensitive natural areas or high-hazard areas.

Environmental quality and hazard mitigation through regulation can be implemented by local communities through management of critical or sensitive areas within their jurisdictions. For instance, many governments have realized the value of

wetland preservation and estuarine or riparian habitat protection, and have enacted ordinances that prohibit development in or around areas that serve as essential habitat, pollutant filters, and storage areas for flood waters. Other communities restrict the grading of hillsides and limit development on slopes prone to landslides through soil conservation and steep slope preservation programs. Such measures can control erosion and stabilize slopes by prohibiting inappropriate land disturbance processes, or by requiring terracing or planting of vegetation. Shoreline communities may choose to call for preservation of beaches and dunes through shoreline setbacks that establish a minimum distance between the shoreline and where buildings will be permitted. These measures allow the beach and dune systems to act as a first line of defense against the impacts of wind and waves, as well as keep intact these ecologically critical areas.

By enacting such regulatory provisions, the community is promoting sustainable patterns of development that decrease the level of vulnerability to natural hazards, while at the same time enhancing water quality, preserving wildlife habitat, conserving the natural environment, and enhancing the quality of life for citizens.

The second major power of local government in addition to regulation is *taxation*, which extends beyond the mere collection of revenue, and can have a profound impact on the pattern of development in the community. For instance, some communities use a preferential or use-value assessment system for taxing certain types of property that are environmentally sensitive or otherwise valuable to the community, including farmland, forestland, historical properties, open space, wetlands, or riparian areas. Under this type of program, certain parcels of land are assessed according to their current income-producing capacity, rather than their value on the open market. This results in a reduced



tax burden on lands that are under development pressure, but which are valuable in their current low-intensity state or would be hazardous to develop.

Land gains taxation involves assessing property in inverse proportion to the amount of time the land is held, thereby discouraging speculation. Similar taxation devices include transfer taxes, assessed against the sellers of land of certain types of uses, and development taxes, which are charged against developers upon the conversion of land to uses of greater intensity. Although these taxation methods may not provide for long-term protection, they can provide a disincentive to convert land to a higher density thereby slowing rapid growth in a community, particularly in high-hazard areas, such as floodplains. Land transfer taxes have been used to fund *land banks*, allowing the community to purchase open space or other types of conservation easements, protecting the land from inappropriate development.

Some communities have instituted impact fees or system development charges that require developers to contribute to the financial outlays imposed upon the local jurisdiction to support the new development. The amount charged is proportional to the cost of the impact that that development will cause. Such fees are typically used to provide for improvements such as roads, water, sewer, and schools, but can also be employed to provide hazard mitigation features, such as flood storage facilities in areas where new development will contribute to an increase in flood heights.

While impact fees are a use-based charge against new development, exactions require developers to directly invest in the facility and service needs created by their projects. Cash exactions can be put towards on or off-site improvements, including such mitigative uses as post-storm reconstruction funds, while exactions in the form of a land

dedication or grant to the community can be used to acquire open space in floodplains or other hazard-prone areas.

The power of *acquisition* is a third useful government tool for pursuing sustainable development goals as well as hazard mitigation in a community. This includes the power of eminent domain, as well as the authority to purchase property on the free market. The community can thus proactively acquire land to absolutely control its use, thereby removing the property from development potential. The community may also acquire easements in sensitive or hazardous lands, including negative easements, which prevent the owner of the property from building or engaging in other specified uses, and affirmative easements, whereby the public is granted a right to use the property in a specified manner, such as for beach access. In many areas of the country non-profit land trusts and conservancies have played a vital role in the acquisition and management of environmentally sensitive, hazardous, or other important lands, often in cooperative ventures with local governments. Land trusts can be used to promote farmland conservation, provision of sites for low-income housing, public recreation, nature areas, and other sustainable uses.

*Spending* is the fourth major power, whereby local governments make expenditures of public funds that impact on the community. Government expenditures include payment for public infrastructure such as parks, roads, water and sewer lines, and public buildings, as well as payment for public services, such as police and fire protection. The decision of when and where to provide infrastructure and services in large part determines where, when and how intensely development will take place in the jurisdiction. The spending decisions made by local governments can be effective in

directing new development away from hazardous and otherwise inappropriate areas, and maintaining a level of growth that is conducive to the long-term viability of the community.

Capital improvements programming is one method local governments can use to define when, where and what level of municipal services will be supplied. Setting up a capital improvements spending timetable can be very effective at managing growth, since few developers can afford to provide all the facilities and services that their projects will require without some public investment. Development can therefore be effectively limited in hazard or otherwise sensitive areas if the community does not extend infrastructure to these places.

Some communities have imposed concurrency or adequate public facilities requirements on new development as part of their spending program. These provisions are implemented to ensure that public services are provided simultaneously with the demand for those services (concurrency) or that a certain level of services be made available upon completion of the development project or within a designated time period following (adequate public facilities). These practices can be used to direct development into areas that are less hazard-prone, although if not implemented carefully they can also produce the opposite effect. Creation of urban service districts in conjunction with concurrency and adequate public facilities requirements can help shift the direction of growth into appropriate locations, by defining where certain services will and will not be provided within the community.

### **Windows of Opportunity**

Despite the wide array of tools and techniques that are available to governments to operationalize the principles of sustainability and mitigation, one of the roadblocks to implementation is the fact that much of the land within local jurisdictions has already been developed according to practices and traditions that are far from sustainable. Ironically, the time immediately following a natural disaster provides a community with a unique window of opportunity for inserting an ethic of sustainability in guiding development and redevelopment in high-risk areas. With forethought and planning, communities that are rebuilt in the aftermath of a natural hazard can be built back so that they are more resilient to future hazards, breaking the pattern of repeated hazard-destruction-rebuilding. At the same time, the community is given the opportunity to incorporate other attributes of sustainability into its “second chance” development, such as energy efficiency, affordable housing, use of recycled building materials, reduction of water use, and environmental protection.

### **A Moral Obligation**

The holistic approach of infusing hazard mitigation into the major tenets of sustainable development and using the principles to guide future decision-making is considered by some to be our ethical obligation to future generations, our children, and grandchildren. At the very least, we have some duty to refrain from detracting from the long-term viability of our living places. Many would say we have an affirmative duty to increase their safety over time, a duty which can only be fulfilled through hazard mitigation. We must do what is within our power to make the future safer. We have control in terms of land use, the direction and nature of economic development, capital

facilities and societal infrastructure, and all these will impact the vulnerability of our descendants. It is therefore incumbent upon us as thinking, reasoning beings to minimize those impacts.

We do not imply that answering this ethical call to duty is as simple as doing what's "right." Once the moral issue is raised, often even more questions arise than before regarding the duties and obligations that are owed, by whom, and to whom. Indeed, there are many and disparate players in the movement towards sustainability, each with a valid role to play, but often at odds with one another.

### **Competing Values**

In the context of hazard mitigation we can see the tensions between ethical responsibilities. Government agencies and regulators; the private sector, including building owners, corporations, and merchants; professionals in architecture, construction, engineering and related fields; as well as individuals such as homeowners, consumers, farmers, residents and tax payers all play a role in affecting our present and future vulnerability. Although all these players may act with the best intentions, each may have a limited view of what sustainability or mitigation should involve, according to its own interests.

Sometimes judgments must be made as to relative priorities between values such as protection of public health and safety versus protection of property. Most people would probably choose human lives over financial concerns in an emergency situation; however, arguments for property protection where the danger to life and limb is not immediate can (and have been) made.

The precedence of protection of the natural environment over protection of development may also cause a series of “tradeoffs” among values that appear to be incompatible. We are duty-bound to pass on a natural legacy to future generations. This we cannot do if the physical manifestations of such a legacy are allowed to be destroyed by impacts which we can take steps to lessen. Yet many feel these steps are taken at the expense of private property rights, which, in this country, are deemed by some to be nearly inviolate. Setback lines, for instance, commonly prohibit construction in oceanfront erodible areas, areas which are very vulnerable to coastal storm and erosion hazards. While an effective mitigation technique, such regulations prevent developers from creating jobs for local residents, increasing the local tax base, realizing their own economic gain, and providing housing consumers the opportunity to purchase property there.

A moral quandary may also arise when choices appear to pit environmental protection against public health and safety. For instance, while a community may expand its road and bridge system to increase the efficiency and capacity of evacuation routes in the event of a natural hazard, the construction may prove detrimental to fragile ecosystems. It could also lead to unanticipated impacts if such road work encourages denser development in areas that hitherto had been of limited accessibility.

### **Multi-Objective Solutions**

Despite the many differing ethical priorities involved, there are often alternative solutions that can protect people, property, and the economy as well as advance our role as stewards of the natural environment. In fact, the most effective mitigation strategies

involve protecting and restoring the natural functions of the ecosystem, with the dual purpose of environmental protection *and* life and property protection. For example, conservation of wetlands promotes flood control, and preservation of the coastal dune system provides a natural seawall. In turn, these protected areas will withstand the impacts of natural hazards much more steadfastly, thereby safeguarding both the public and private investments made in improvements in proximity to these natural features, and preventing the economic calamity that can occur when development takes place on sites where natural mitigation measures have been removed.

Some scholars have expanded the ethic of conservation and protection to include a “restorative” value. According to this view, it is not enough to maintain the existing natural environment. Since the destruction and degradation of the environment that has occurred already in many places has led to many of our worst disasters, we are not carrying out our duty adequately by merely continuing the status quo. We must instead act upon the moral duty to rectify the damage that has been done, and enhance, not just preserve our natural defense mechanisms.

### **Defining Our Ethical Obligation: To Whom Is Our Duty Owed?**

Solutions such as these are more likely to emanate from a milieu of expansive thinking about the ethics of our development decisions. In particular, we must throw open wide the definition of to whom our moral duty is owed. Not only must we consider our temporal wards - those future generations whose well-being is entrusted to us - we must also expand our sense of spatial responsibility. We can no longer take a parochial attitude with regards to our moral obligations; the geographic scope of hazard mitigation

and sustainable development theory requires that we consider much more than the immediate vicinity in which we live. Because the consequences of pollution and misuse of natural resources transgress jurisdictional lines, a wide-angle view is critical to overcome the artificial limits that are imposed by the politically delineated boundaries which separate our communities. Actions taken and decisions made in one jurisdiction can have profound ramifications for neighboring towns, states, and regions. In a ripple-like effect, even the world at large is impacted by individual and collective behavior. Our “neighbors” are citizens of the world, some of whom are not yet born. When we consider our alternatives, development decisions should always be made for the wider moral community.

### **A Dynamic Duo**

It is clear that there is much that can be done at the local level to promote development that is sustainable, including land uses that help mitigate the impacts of natural hazards. However, the local implementation of various tools and techniques does not imply a quest to reach nirvana. Sustainable development is process-oriented, and does not focus on a static world order; instead, it involves a dynamic, evolutionary continuum of action that will forever need readjusting to fulfill its mission. As a part of this movement, hazard mitigation must also be seen as more than an end-state. We do not merely nail shutters over the windows when gale force winds are predicted. Instead, hazard mitigation involves a constant search for ways to incorporate mitigative concepts into development decisions to reduce our vulnerability to natural hazards for today and tomorrow.