Reference Guide to Resilience Elements and Benchmarks

The eight basic elements of CCR represent desired conditions that must exist to support resilient communities. Each element also has four benchmarks associated with it that can help determine to what extent the element is addressed or operating to enhance resilience. In this section, each element is described in detail along with the benchmarks that evaluate the element. Field examples are also provided to connect the elements and their benchmarks to real situations.

A. **Governance:** Leadership, legal framework, and institutions provide enabling conditions for resilience through community involvement with government.

B. **Society and Economy:** Communities are engaged in diverse and environmentally sustainable livelihoods resistant to hazards.

C. **Coastal Resource Management:** Active management of coastal resources sustains environmental services and livelihoods and reduces risks from coastal hazards.

D. **Land Use and Structural Design:** Effective land use and structural design that complement environmental, economic, and community goals and reduce risks from hazards.

E. **Risk Knowledge:** Leadership and community members are aware of hazards and risk information is utilized when making decisions.

F. **Warning and Evacuation:** Community is capable of receiving notifications and alerts of coastal hazards, warning at-risk populations, and individuals acting on the alert.

G. **Emergency Response:** Mechanisms and networks are established and maintained to respond quickly to coastal disasters and address emergency needs at the community level.

H. **Disaster Recovery:** Plans are in place prior to hazard events that accelerate disaster recovery, engage communities in the recovery process, and minimize negative environmental, social, and economic impacts.

Enhancing Coastal Community Resilience in Hilo, Hawaii: Overview

The Hawaiian Islands of the United States have experienced numerous tsunamis in their history. The location of the Hawaiian Islands, in the middle of the Pacific Rim, makes them susceptible to distant tsunamis generated from earthquakes thousands of miles away. Since 1837, the Island of Hawaii, the largest of the Hawaiian islands, has experienced over 20 damaging tsunamis generated from tectonically active regions along the Pacific Rim, including Alaska, the Aleutian Islands, Chile, Japan, and Tonga. In addition, the Hawaiian Islands are located on a "hot spot" of earthquake activity caused by the local volcanic conditions that generated the island chain. This local earthquake and volcanic activity makes the Hawaiian Islands susceptible to local tsunamis in addition to the distant tsunamis. Based on historical data, on average, a damaging tsunami reaches the shores of the Island of Hawaii every 7 years (Fletcher et al 2002).

The Town of Hilo, pronounced (hee-low), is located on the windward (eastern) coast of the Island of Hawaii, situated between the flanks of the volcanic peaks Mauna Kea and Mauna Loa. Hilo was impacted by 17 tsunamis during the period from 1837 to 1975. The tsunamis impacting Hilo ranged from minor tsunamis of 1.5 feet to devastating tsunamis of 35 feet (Fletcher et al 2002). The Town of Hilo was devastated by a 26-foot tsunami in 1946, generated by a 7.8 earthquake in the northern Pacific near the Aleutian Islands. Following the devastation, the town recovered and rebuilt without taking tsunami resilience into consideration and without incorporating any lessons learned from its experiences into its redevelopment plan. Catastrophe again struck Hilo in 1960, when a 9.5 earthquake in Chile resulted in tsunami run-ups of 35 feet. The 1960 tsunami caused 61 deaths and over $26.5 million in damages. Following the 1960 tsunami, Hilo undertook a concerted effort to enhance its resilience to the impacts of tsunamis.

Throughout this guide, you will learn more about the actions taken by the town of Hilo to enhance resilience in each element to tsunamis.

Governance

The desired outcome of this element of resilience is that leadership, legal framework, and institutions provide enabling conditions for resilience through community involvement with government.

What Is Governance?

Governance is a process through which government institutions, organizations, communities, or any group of people with a mandate or with a common purpose make decisions that direct their collective efforts. Local governance is governing at the local level, viewed broadly to include not only the machinery of government, but also the community at large and its interaction with local authorities. Good governance is about achieving desired results and achieving them in the right way, in compliance with laws and policies and shaped by cultural norms and values of an institution, organization, or community.

Why Is Governance an Essential Element of CCR?

Governance provides the enabling conditions for coastal communities to absorb or resist perturbations, bounce back from disturbances, and adapt to change. Governance provides the connection whereby community resilience is guided and nurtured over time through the various interventions of government, civil society, and the private sector in community development, coastal management, and disaster management. Governance benchmarks of resilience are described in Tables 6-1 to 6-4.

A necessary trait of governance for building resilience is to provide an integrating framework for institutions at all levels and various scales, to address the management needs within and surrounding a coastal community. A second essential trait of governance is that it be participatory and encourage engagement of multiple stakeholders, both public and private, within a democratic process for planning. Such participation strengthens community resilience and engenders ownership of processes and outcomes.

A cyclical planning process must be encouraged and maintained that is iterative and allows for learning and improvement over time. Such "adaptive management" addresses the needs of a particular place in time, with its unique circumstances; it can develop a useful management system and plan that is periodically updated. Such an adaptive planning and management process incorporates risk and vulnerability assessments, coastal environment and resource management, land and site use, and disaster management or emergency plans. It will consider the needs for infrastructure (such as a warning system) and critical emergency response facilities among other needs of a community and its setting.

The final essential trait of governance is that it be strong and efficient, and provide effective coordination of the various coastal environment and disaster management tools to build resilience. It needs to constantly promote education and apply appropriate forms of law enforcement. It must support implementation of integrated programs that cut across normal boundaries of authority. Lastly, it needs to ensure that legal, political and financial frameworks are aligned to support broad outcomes.

Enhancing Resilience in Hilo, Hawaii: Good Governance Practices

The redevelopment of Hilo, Hawaii, after two devastating tsunamis was guided by a strategic vision to mitigate future tsunami hazards. After the 1960 tsunami hit, a Hilo Downtown Development Plan was developed that called for major changes in the recovery of the area. The plan identified safe areas to build based on both the 1946 and 1960 tsunamis that affected the downtown area. All new buildings were required to conform to the newly adopted urban design and building design standards.
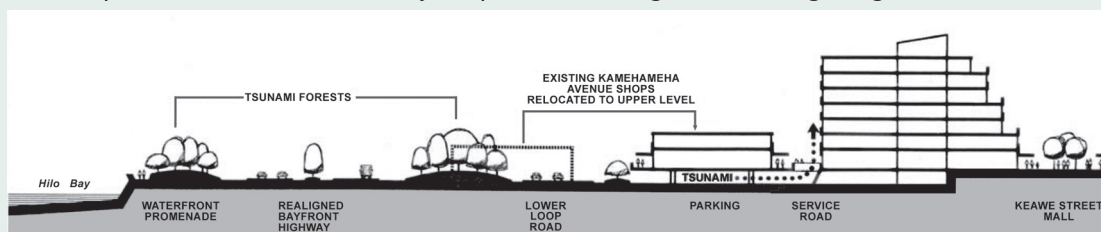
Governance: Good Practices to Enhance Resilience

Strategic Vision: Leaders and stakeholders develop and share a long-term and common vision for sustainable development informed by the historical, cultural, environmental, and socio-economic complexities of the community.

Participation: Opportunities exist for all men and women to have a voice in decision-making. Participation may be direct or indirect through legitimate intermediate organizations or institutions. Participation also means freedom of association and expression, on the one hand, and an organized civil society on the other hand.

Consensus Orientation: Differing interests of stakeholder groups are mediated to reach a broad consensus on what is in the best interest of the whole community and how this can be achieved. Consensus building is needed to establish a long-term perspective for sustainable human development and how to achieve the goals of such development.

Equity and Inclusiveness: All members of society must believe that they have a stake in the governance processes and systems and not feel excluded from them.

Rule of Law: Fair legal and policy frameworks that are enforced impartially protect human rights, particularly those of minorities. An independent judiciary and impartial and incorruptible police provide the enabling environment for communities to prosper.

Transparency: Decisions taken and their enforcement are done in a manner that follows rules and regulations. Information is freely available and directly accessible to those who will be affected by such decisions and their enforcement.

Responsiveness: Institutions and processes are responsive to stakeholders. Institutions and processes try to serve all stakeholders within a reasonable timeframe.

Effectiveness and Efficiency: Processes and institutions produce results that meet needs while making the best use of financial, human, and natural resources.

Accountability: Governmental institutions as well as the private sector and civil society organizations are accountable to the public and to their institutional stakeholders.

Source: Asian Development Bank, *http://adb.org/Governance/gov_toolkits.asp*

How Does Governance Relate to the Other Elements of CCR?

Good governance provides the enabling conditions for all other resilience elements. Leadership, policies and programs, and capable institutions and organizations are needed to enable community involvement and self-reliance. National and local government must have the legal mandate, systems, and institutional capacity to make decisions to warn communities at risk to coastal hazards. Without a legal mandate, standard operating procedures, and clear lines of authority and communication, communities might not receive hazard warnings in time to evacuate. International and local NGOs are instrumental in providing emergency response and disaster recovery services to communities during and after disaster events. These organizations must ensure delivery systems are well coordinated with government entities and appropriate to social norms and cultural values.

Governance: Challenges and Lessons Learned to Enhance Resilience

Reforms should be appropriately sized and sequenced: Governments need to focus reform efforts on what is feasible. Reform programs should be carefully tailored to implementation capacity and available human and financial resources.

Providing basic services is a challenge: Financial, technical, and human resource capacity of local government authorities to deliver basic services to all sectors of society is often the single greatest challenge to coastal community resilience. Without a full range of services (e.g. adequate water, sanitation, education, etc.), communities, especially marginalized sectors, are vulnerable to coastal hazards.

Improving governance requires commitment: Governments need to build constituencies and engender a commonality of support for reforms. To ensure the necessary support for change, it is necessary for governments to appoint individuals with vision and the ability to spearhead efforts. Governance reforms require shared commitments and ownership across the political spectrum.

Decision makers often lack sound information and data: Informed decisions require open processes of data collection and information exchange to support adaptive planning and management processes.

Changes in political or organizational leadership present a major challenge: Guidelines, standard operating procedures, and plans that are accessible to the public are needed to ensure that institutions sustain good governance practices in times of change.

Importing recommended practices should be done cautiously: The lead organizations' readiness for change needs to be assessed. Organizational culture, management style, staff and systems capacities, internal processes, and external linkages all require careful analysis before embarking on redesign.

Capacity building requires broad-based interventions: Effective capacity building needs to be based on in-depth, sound institutional analysis, and requires training that acknowledges the complex factors influencing institutional development. Organizational re-engineering must include an assessment of the capacity of staff and their senior management to learn new ideas, behaviors, and rule systems and adapt them to the existing culture of the institution.

Source: Asian Development Bank, *http://adb.org/Governance/gov_practices.asp*

Benchmarks for Resilience in Governance

Table 6-1. Governance Benchmark on Policy and Planning Capacity

A1. Community development policies, plans, and programs are implemented and monitored in a participatory and transparent manner.	
Benchmark Description	***Potential Assessment Questions***
Resilient coastal communities plan for and take deliberate action to incorporate resilience practices in all aspects of community development. Community development plans and programs need to be based on knowledge of hazards and consider all elements of resilience. National and local government policies, plans, and programs need to support community development goals.	Are coastal hazards and associated risks routinely assessed and evaluated by a cross section of the coastal community?
	Has the community been engaged in identifying measures to reduce risks from coastal hazards and learn from experience?
	Are there community goals for livelihoods, natural resources, and hazard resilience?
	Is there a shared vision for resilience in the community?
	Are specific actions to enhance resilience incorporated in community plans and programs?
	Do local decisions on development, infrastructure investment, social programs, and other activities consider potential risks from natural hazards?
	Do programs support long-term sustainability and resilience?

Resilience in Action: Governance Support in Southern Thailand

A tambon district government and several villages in Ranong Province of southern Thailand have fully endorsed the process of providing governance support for building resilience by facilitating village-level planning for evacuation procedures, improved land use management, and maintenance of warning towers. They have endorsed a donor-assisted program for alternative income development that relieves dependence on near-shore fisheries and mangroves. Such governance practices are being shared with and adopted by other local governments and villages in Thailand.

Table 6-2. Governance Benchmark on Physical and Natural Resource Capacity

A2. Basic services (i.e. water, transportation, security, etc.) are accessible to all sectors of society.	
Benchmark Description	***Potential Assessment Questions***
The delivery of basic services to all sectors of society is an enabling condition for CCR. Basic services may include water, sanitation, health, education, security, transportation, and other services that support the health and welfare of a community. Such basic services need to be responsive to the needs of a community and provide means for participatory planning in their development.	Has an assessment of basic service needs been conducted? Are needed basic services provided efficiently and reliably? Are all sectors of society reached by these basic services? Has institutional capacity for basic service delivery been assessed? Are risk reduction measures incorporated into basic service delivery mechanisms? Are critical facilities and infrastructure sited outside of hazard areas and capable of operating during hazard events? Do critical facilities and services have backup (redundant) systems in place to provide basic services, such as health and water during hazard events? Are contingency plans in place to address disruptions in basic service delivery based on various hazard scenarios? Do budgets incorporate maintenance and upgrade of facilities and infrastructure for basic service delivery and mitigation of future damage?

Resilience in Action: Basic Services Enhanced in Southern Thailand

Local governments in southern coastal Thailand have focused in recent years on providing key basic services to improve the social and economic status of rural towns and villages through improvements to roads, schools, health services, and electrical service, as well as governance support for localized planning and development. The Thai Central and Provincial governments have invested heavily in these efforts so that rural basic services have improved substantially.

Table 6-3. Governance Benchmark on Social and Cultural Capacity

A3. Participatory planning and collaboration mechanisms among different sectors and various levels of government are established and used to manage for resilience.

Benchmark Description	Potential Assessment Questions
CCR is characterized as the intersection of three domains: community development, coastal management, and disaster management. Collaboration among the various stakeholder groups from these domains is needed to share information, plan for resilience, and implement actions that enhance resilience. Collaboration mechanisms may include councils, coordination bodies, working groups, or committees composed of members from each domain that meet and review policies, plans, and programs at national and local levels. The expected outcome is that data and information, lessons, and good practices are shared and used to adapt policies, plans, and programs for enhanced resilience in each domain.	Are there interagency (national and local) and multisectoral coordination bodies that meet to review policies, plans, and programs? Have resilience strategies and activities been developed that require several agencies to work together? Do socioeconomic development programs incorporate hazards issues? Do coastal resource management programs incorporate hazards issues? Do disaster management programs consider community cultural and natural resource elements and goals? Are programs in place that link sectors and institutions?

Resilience in Action: Coordination and Participation Working in Sri Lanka

After the 2004 tsunami, the national government in Sri Lanka established its national disaster management agency together with a coordination body comprising national agencies, national NGOs, and major donor organizations such as the United Nations Development Programme (UNDP), USAID, Canadian International Development Agency, Australian Aid, and a few others. This body, working with the national disaster management organizations was able to coordinate the development of a "road map" for disaster preparedness and recovery that also engaged the local governments in the country. The disaster road map has been distributed to local governments in an effort to encourage them to set up their own coordination bodies that can assist in strengthening resilience at the local level.

Table 6-4. Governance Benchmark on Technical and Financial Capacity

A4. Technical and financial support mechanisms are transparent, accountable, and available to support planned community actions.	
Benchmark Description	***Potential Assessment Questions***
Technical and financial resources are needed to enable communities to plan and implement actions to build resilience. Technical resources are needed to provide guidance on basic services, natural resource management, and coastal hazard mitigation. Financial resources are needed to enable communities to implement planned actions.	Are there regular budget allocations and grants to support activities that reduce risks to future damage from natural hazards? Do community leaders have resources and tools available to build resilience for day-to-day activities? Does community budget incorporate priorities for management, upgrade, or mitigation of critical facilities and infrastructure? Have local governments identified options to supplement these funds? Do community projects include those that mitigate future damage from natural hazards? What resources, tools, and technical assistance are available to build community resilience? Are these resources geared toward a proactive planning and preparedness mode or disaster recovery mode?

Resilience in Action: Indonesian Devolution Supports Local Resilience

Indonesian local governments have very recently been given increased jurisdiction over their coastal areas and resources. The central government is now in the process of providing budget through a devolution process so that local governments will have financial resources to address community needs and to provide for basic services. Although this will take time, it will eventually encourage the local government planning processes to be participatory together with the community. Plans can be responsive to local needs, which will allow for public participation. As local government budgets become transparent, they can support community-level projects. Such a system will be more efficient at providing basic human services and in building community resilience to the extent that resources are available.

Society and Economy

The desired outcome of this element of resilience is that communities are engaged in diverse and environmentally sustainable livelihoods resistant to hazards.

What Is Society and Economy?

Changes in the economy and people's quality of life are often the main criteria upon which a community's resilience is judged after a disaster. The strength of the economy and the diversity of livelihoods greatly influence the community's ability to prepare for disasters, quicken the recovery process, and adapt to changes that make them less vulnerable in the future. Despite changes in coastal ecology, health, laws, governance frameworks, or hazard response programs, it is the improvement or decline in a person's livelihood that directly affects resilience.

Why Are Society and Economy an Essential Element to CCR?

Society and economy serve as an essential element of resilience because of the direct relationship between economic activity (markets and commerce) and social life (culture, family, recreation). Changes in the local and regional economy such as new industries, specific jobs, or manufacturing technology have positive and negative impacts on individuals and communities through life expectancies, employment, wealth, and quality-of-life issues. Similarly, the culture of the community, family structure, and gender roles influence economic activities. Social, cultural, and economic conditions provide the enabling environment for self reliance in a community. Society and economy benchmarks of resilience are described in Tables 6-5 to 6-8.

Every community is different with regard to factors that are most important in determining vulnerability and resilience. Diversity affects how resilient a community is. If an entire fishing community uses the same fishing gear and catches the same species, its vulnerability is likely to be higher. By diversifying the types of fish caught and gear technology, or even diversifying beyond fishing as the sole livelihood, the community increases its resilience to hazards. Communities that have a mix of fishers, farmers, manufacturing, and tourism are less likely to suffer broad impacts, since each industry depends on different clients, resources, and markets. Communities and industries can work together to diversify the local economy.

P. RUBINOFF

Resilient coastal communities are employed by diverse economic sectors not dependent totally on coastal resources

Factors that can predetermine a community's vulnerability as well as future resilience based on economic and social factors are shown in the table below.

Society and Economy: Good Practices to Enhance Resilience

Good Practices	Absorbing Shock	Bouncing Back	Adapting to Change
Society			
Establish programs that assist livelihood development for the poor and other vulnerable groups.	Help families create informal businesses to spread risks; focusing on the most vulnerable community members reduces vulnerability.	Help families be self-reliant during the recovery process.	Create new business opportunities that the poorest sector is well positioned to act on.
Develop community-driven planning activities.	Build support, trust and volunteerism to implement a plan; more likely to address the needs of all vulnerable groups.	Recovery will occur quicker with less conflict; meet the needs of the most vulnerable.	Community development that addresses the core needs of vulnerable populations for future hazards.
Establish financial services for families that need access to savings accounts, payment services, insurance, and small loans.	Encourage families to store fewer assets in homes located in vulnerable areas.	Extended family can send payments to those in need, Proivide insurance coverage to rebuild and loans to rebuild personal property.	Small loans restart and change livelihoods; place savings in interest accounts for next hazard or emergency.
Form community volunteer groups to increase awareness and response.	Make more of the community, including the most vulnerable, aware of and ready to react to hazards.	Enable community to become self reliant to respond and recover using core volunteer community groups; outside aid is well managed.	Learn from experience of everyone and from the different livelihoods in the community.
Resolve conflicts between segments of the community regarding equity of services and redevelopment focus.	Make hazard warnings and response serve everyone including the most vulnerable.	Less time is spent on disagreements and political fighting; faster transfer toward recovery and rebuilding.	Shared vision for increasing community resilience; all of the community can benefit from changes.
Address the needs of the weaker segments of the public such as elderly, sick, and poor.	Minor hazard events are less likely to impact community since the weakest segments are protected or serviced.	Weaker members of society are in greatest need during recovery process; having plans in place before a hazard creates more effective recoveries.	Future hazards will not be isolated to a few people; these weaker members of society will have a fair chance to get out of poverty.

Society and Economy: Good Practices to Enhance Resilience *(continued)*

Good Practices	Absorbing Shock	Bouncing Back	Adapting to Change
Economy			
Establish social and ecological limits on resource extraction and allowable impacts.	Resources are in a healthier state to absorb the shock to the system and protect community assets and lives.	Community has local resources available to seek food, shelter, and clean water during the recovery phase, and businesses can resume.	Economy and social pressures at levels to allow major political changes to increase sustainable development goals.
Use existing businesses to mitigate current vulnerabilities.	Exposure and vulnerability of assets are reduced.	Less to clean up, replace, fund and close operations.	Expenses for recovery diverted to proper redevelopment and spread good practices to other businesses.
Prepare business response and redevelopment plans.	Vital assets and workers are protected as much as possible.	Less recovery work; faster responses due to coordination, preparations and partnerships.	Knowledge of good practices and options available to act effectively during crises.
Establish microfinance institutions at the local/regional level to provide financial loan services.	Having institutions offer services prior to disaster increases likelihood that small businesses are prepared for impact.	Existing institutions allow quicker processing of applications, knowledge of local business members.	After donor aid is gone, microfinancing provides the needed capital for long-term redevelopment.
Establish microfinance loans for formal and informal businesses (focus capital to reduce hazards).	Small businesses can make necessary mitigation actions to protect assets.	Access to vital credit that gets them back quickly to production; small businesses recover quickly.	Loans at reasonable rates enable small businesses and families to improve their assets.
Establish startup grants, technical assistance, and loans for new and alternative enterprises.	Diversifies the economy to spread risk vulnerabilities.	Small businesses can recover and service local community as other businesses rebuild.	Technical assistance guides small business owners toward options and new market potential.
Increase community input on economic development strategies.	Businesses develop based on community input; shared vision for development decreases vulnerability of businesses and citizens.	Recovery process can get local support and volunteers to rebuild quickly and appropriately.	Social and environmental criteria included in development plan for community; greater support and trust possible.
Increase awareness of risks to businesses.	Locate and build appropriately based on risks.	Results in less damage to repair and enhanced ability to begin preplanned recovery process.	Adapt business plan and strategy based on known risks.
Change laws, policies, and regulations to facilitate the creation and operation of microenterprises.	Diversification of the formal business sector reduces vulnerability to economy and spreads risks.	Businesses that are registered can get aid; new businesses can form quickly and legally.	Innovative business ideas can be acted upon to build a stronger community.

Enhancing Resilience in Hilo, Hawaii: Good Society and Economy Practices

The devastation caused by the 1960 tsunami in Hilo resulted in destruction and disruption of many businesses along and near the waterfront. In an effort to lessen future impacts to the local economy, the town chose to relocate retail shops to a safer location, further from the coast and at higher elevations. In addition, many of the areas where the former retail shops had been located were converted into public parks, enhancing access to recreational opportunities for society. In recognition of the importance of education, a school located in the tsunami impact zone was relocated outside the zone, to minimize potential deaths as well as avoid the potential disruption of education services.

In an effort to ensure that future generations remember the past and learn from the mistakes of being inadequately prepared for tsunamis, the Pacific Tsunami Museum was created in Hilo. The goal of the Pacific Tsunami Museum is to promote public tsunami education for the people of Hawaii and the Pacific Region. The museum also preserves the social and cultural history of Hawaii and promotes economic development on the island of Hawaii as well as statewide. The museum serves as a living memorial to those who lost their lives in past tsunami events. It provides an enriching experience not only for tourists, but for local residents as well. Approximately 35 percent of museum visitors are residents of Hawaii, and many come to reconnect with their family and community history in Hilo.

How Does Society and Economy Relate to the Other Elements of CCR?

The social and economic characteristics of resilience are often the drivers of change and development in coastal communities linked with planning and governance. The resilience of socio-economies and livelihoods are strongly connected to the governance, land use, and infrastructure elements.

The type and strength of the local economy, as well as the culture, drive the pattern of land use and infrastructure. The type of industry will often dictate where a community must build its infrastructure (e.g. on the waterfront, in the coastal waters, near major ports and road networks). A strong economy can also make the financial investments to upgrade facilities to reduce their exposure and vulnerability to natural hazards. If the local business community is organized and has strong leadership, there may be support services to assist businesses in taking hazard mitigation actions. Thus, the link between business leadership and hazard mitigation actions influences where and how infrastructure is built.

Most coastal communities are highly dependent on natural resources which make them particularly vulnerable to changes in resource conditions (Pomeroy et al., 2006). Livelihoods and business influence how resources are used during normal times as well as during the recovery period. In addition, healthy resource conditions influence the business opportunities and costs of resource extraction. Coastal livelihoods also influence where people live and how they build.

Finally, the strength and type of culture and economy will influence whether a community learns from its hazard experiences and redevelops in a wiser and safer way. If the business community considers hazard issues and is committed to sustainable development, then the community is more likely to implement such programs during the stressful and politically charged times after a disaster.

Society and Economy: Challenges and Lessons Learned in Enhancing Resilience

- Changing a community's culture and economy is very difficult. They are often based on the realities of a place.

- Businesses must compete locally as well as regionally. Therefore, preparing and conducting good practices is not a priority for businesses unless incentives are provided.

- Coastal communities exist in a dynamic environment and have developed their livelihoods based on these conditions. Asking them to change for a potential risk without support and incentives is difficult.

- There are also preexisting power balances within communities, so that advancing approaches that attempt to assist the poor and vulnerable may face significant challenges from the entities that hold power.

- Improvements in the economy and livelihoods depend upon the other resilience elements to create an overall increase in resilience. A strong local economy needs to be supported by linkages to the regional economy, both for customers and for aid.

- A diversified economy depends on key infrastructure services, like roads, electricity, and water, that almost all businesses and livelihoods require. Business opportunities and costs are also affected by the health of natural resources.

Benchmarks for Resilience in Society and Economy

Table 6-5. Society and Economy Benchmark on Policy and Planning Capacity

B1. Development policies and plans build social capital and skills for economic diversity and self reliance.	
Benchmark Description	*Potential Assessment Questions*
Community development policies, plans, and programs are important in building the capacity for economic diversification and self reliance. Community goals identified through a transparent and participatory process are used to guide development policies, plans, and programs that are socially responsible and promote environmentally sustainable livelihoods in a diversified economy.	Do community development plans exist? Are there skills-training programs for alternative livelihoods? What types of social safety nets exist to help vulnerable sectors of society?

Resilience in Action: NGOs in Sri Lanka Capacitate Coastal Communities

Sevelanka Foundation and several other NGOs have taken the lead to develop coastal community social and economic capacity to enhance their level of resilience. Such activities focus on organizing communities into functional groups that enhances their social capital and supports livelihood development to enhance small-scale businesses among community members. Such programs are coordinated through a joint NGO and government coordination body that endorses community level work of local and international NGOs and development projects. The community level NGO led projects also focus on addressing other issues in communities, such as coastal resource management and ensuring that warning and evacuation systems are in place and linked to the national warning system of the country.

Table 6-6. Society and Economy Benchmark on Physical and Natural Resource Capacity

B2. Local economies are characterized by diverse and environmentally sustainable livelihoods.	
Benchmark Description	***Potential Assessment Questions***
Resilient coastal communities have local economies characterized by environmentally sustainable and diverse livelihoods. Sustainable livelihoods are based on sound management of natural resources and the environment and do not result in degradation of the natural resource base upon which the livelihood depends. Local entrepreneurs, businesses, farmers, and fishers are knowledgeable of the risks of coastal hazards that may affect their livelihood and take steps to reduce these risks by planning and preparedness activities. Diverse livelihoods are characterized by employment across a range of economic sectors with multiple sources of external and internal revenues to the community. No one economic sector dominates the local economy and there is a vibrant internally driven economy that is fueled by the regular infusion of external sources of revenue.	Is the local economy dominated by one sector (e.g. tourism)? Are local economies and livelihoods linked to internal and external markets? Are resource-extracting livelihoods based on a managed and sustainable natural resource base? Are the socioeconomic and environmental impacts of planned economic development projects assessed? Do businesses mitigate current vulnerabilities to coastal hazards? Do community development plans promote environment-friendly and diverse livelihoods and incorporate strategies to address risks from natural hazards? Are there pre-established strategies to address economic recovery resulting from a disaster, including loss of employment, loss of services, and products and impact to the tax base?

Resilience in Action: Diversifying Livelihoods in Ranong, Thailand

Rural villages of Ranong, Thailand rely on both agriculture and fisheries, making them accustomed to balancing risks between the two. While post-disaster recovery is not an effective time to diversify, tsunami "bounce-back" actions complemented livelihood recovery. Provincial programs capitalized on marketing value-added fish products. Projects geared toward local women focused on production of soap, batik, and Muslim scarves, and provided the women with supportive networks, new skills, and supplemental family income, all critical in community rebuilding.

Table 6-7. Society and Economy Benchmark on Social and Cultural Capacity

B3. Social and cultural networks promote self-reliant communities and have the capacity to provide support to disaster-stricken areas.	
Benchmark Description	***Potential Assessment Questions***
Social and cultural networks may be formal or informal mechanisms involving community, cultural, private, and nongovernmental groups that support a range of resilience-related activities. These can include poverty alleviation, gender and minority equality, conflict resolution, peace, cultural preservation, livelihood diversification, financial and food assistance, housing, environmental management, health programs, emergency response, disaster management, and other social and cultural needs. These networks promote self-reliant communities through a variety of strategies such as self-help programs, capacity building, and sharing of lessons learned. Social and cultural networks can also serve as safety nets for disaster-stricken communities through emergency medical supplies, shelter, and food.	Is a significant portion of the community economically and/or socially marginalized?
	Are there social networks that address the needs of the weaker segments of the public such as elderly, sick and poor?
	Are social networks or organized civic groups established with the capacity to assist communities during or after disaster?
	Are there conflict resolution mechanisms to support peace and order in the community?
	Are mechanisms used to increase community participation in community development planning?

Resilience in Action: Promoting Self Reliance and Sustainability in Thailand

Thailand's coastal residents have a strong sense of building self reliance, as demonstrated through the King's leadership. "His Majesty's sufficiency economy philosophy emphasizing moderation, responsible consumption and resilience to external shocks is of great relevance to communities everywhere during these times of rapid globalization. The philosophy's middle path approach strongly reinforces the United Nation's own advocacy of a people-centered and sustainable path towards human development. His Majesty's development agenda and visionary thinking are an inspiration to his subjects, and to people everywhere." *Kofi Annan, UN Secretary—General, May 26, 2006*

Table 6-8. Society and Economy Benchmark on Technical and Financial Capacity

B4. Technical and financial resources are available to promote stable and robust economies, reduce vulnerability to hazards, and aid in disaster recovery.	
Benchmark Description	*Potential Assessment Questions*
Resilient local economies require an enabling environment to prosper. Technical resources are needed to provide guidance on natural resource management, coastal hazard mitigation, technological developments, market linkages, and other topics to promote environment-friendly economic diversification. Financial resources, such as grants, credit, and investment capital are needed at various scales from micro- to macrofinance to promote environmentally sustainable economic diversification. Finally, national and local laws, policies, and programs are needed to provide incentives and disincentives that encourage local economies to develop in an environmentally sustainable manner, to incorporate a knowledge of risks and plans to reduce risks from coastal hazards, and to plan for emergencies and disaster recovery.	Are there technical resources, such as local universities, government programs, or donor projects, that provide assistance to communities in developing environment-friendly livelihood diversification? Are startup grants, technical assistance, and loans available for new and alternative enterprises? Are small business development or micro-financing programs or institutions (e.g. assistance, extension, and training) providing support to the community to promote sustainable livelihoods? Are businesses owners and employees aware and informed of coastal hazards (including long-term effects to businesses from erosion and sea level rise)? Are small business loan programs established to recapitalize for disaster recovery? Are there business response and redevelopment plans in case of a disaster? Are there insurance services for production losses in the event of a disaster?

Resilience in Action: Financing Schemes for Economic Diversification in Sri Lanka

Initiated in 2002, the self-funded financial scheme of Shakthi Farmer Organization in Hambantota district, in Southern Sri Lanka, has helped members meet their financial needs, given that no other formal government or private financial schemes were willing to help in good times or bad. Mainly controlled by women, the program generates loans to diversify member livelihoods beyond traditional fishing and agriculture. The money is also utilized to help member families face climate hazards such as floods and droughts, and also climate-related situations like communal diseases. Beyond financial benefits, members have gained a sense of confidence and security that they did not have before.

Provided by Priyangi Jayasinghe, Munasinghe Institute for Development (MIND), Colombo, Sri Lanka. From a Munasinghe Institute for Development (MIND) study. Provided by Priyangi Jayasinghe, MIND, Colombo, Sri Lanka, URL: *http://www.mindlanka.org*

Coastal Resource Management

The desired outcome of this element of resilience is that active management of coastal resources sustains environmental services and livelihoods and reduces risks from coastal hazards.

What Is Coastal Resource Management?

Coastal resource management (CRM) is a process to develop and implement a coastal management scheme or plan. CRM refers to a formal or informal set of rules, practices, technologies, economies, and interactions between humans and the natural resources (animals, plants, rocks, water, etc.) located both landward and seaward of the coast, that define how resources are utilized and protected. CRM is also a participatory process of planning, implementing, and monitoring sustainable uses of coastal resources through collective action and sound decision making (Philippine Department of Environment and Natural Resources (DENR) et al. 2001). There are generally five phases in the CRM process:

1. Issue identification and baseline assessment

2. CRM plan preparation and adoption

3. Action plan and project implementation

4. Monitoring and evaluation

5. Information management, education, and outreach

Coastal resource management aims to stem overfishing, destructive fishing, pollution, and habitat loss, all of which reduce future fishing or availability of other valuable resources. Good coastal management works with stakeholders and understands the nature of the resources and the impacts of the various ways resources are used on their future availability, and strives to maintain valued resources for future users. Effective CRM ensures that (a) local institutions support coastal management processes, and (b) protection of sensitive coastal habitats is being achieved.

Why Is Coastal Resource Management an Essential Element of CCR?

Coastal resources provide many valuable and sustainable services to communities. These include, among others, a reliable source of food, economic development through the use of renewable resources like mangroves, transportation, protection from coastal hazards (storms, floods, tsunami, erosion, pollution, etc.), biodiversity conservation (a factor in ecological resilience and a source of benefits from nature-based tourism and new potential medicines), and a pleasant lifestyle. CRM protects the source of the "fuel" for the community's resilience in terms of food, economic resources, environmental

A. WHITE

Fisheries need to be managed for sustainable harvests to ensure food security and livelihood for coastal communities

qualities that are central to a culture and lifestyle, and protection from the forces of nature. If managed and protected, coastal resources can continue providing these services. If not managed, many normal events such as storms or fishing can create significant negative, expensive, or tragic consequences on coastal communities. Coastal resource management benchmarks of resilience are described in Tables 6-9 to 6-12.

Potential Results from Unmanaged and Managed Coastal Resources

Resource	Unmanaged Resource (Creates Vulnerability)	Managed Resource (Creates Resilience)
Marine fisheries	Overfishing leads to: • Food insecurity • Loss of income to fishers • Nonlocal communities getting benefits and local community suffering consequences	Marine protected areas (MPAs) and managed fishing, rules (quotas, size limits, etc.) provide: • Food security • Sustainable income • Good distribution of benefits from resource among local community
Coral reefs	Destructive practices lead to: • Food insecurity • Loss of marine tourism income • Loss of habitat for other coral food/ resources • Loss of adaptability of reef ecosystem for other stresses (pollution, climate change, etc) • Loss of biodiversity (medicines) • Loss of coastal protection	MPAs, zoning or managed resource use (pollution control, fishing gear) result in: • Food security of accessible fish • Continuity of nursery for fish and attraction for visitors • Reef ecosystem able to adapt to climate change, recover from a pollution incident • Continued biodiversity for research into sustainable uses (medicines) • Continued shoreline protection from storms

Potential Results from Unmanaged and Managed Coastal Resources

Resource	Unmanaged Resource (Creates Vulnerability)	Managed Resource (Creates Resilience)
Mangrove	Loss of mangrove quality or quantity by converted land use (buildings, shrimp ponds) leads to: ● Food insecurity through loss of nursery grounds ● Food insecurity due to loss of food resource (crabs, clams, fish, etc.) ● Lost absorption of soils that leads to flooding and erosion ● Loss of wood, fruits, and land animals that inhabit mangroves	Mangroves managed through multiple use zoning for sustainable use and conservation leads to: ● Food security of edible organisms ● Provision of ecosystem services (e.g. breeding and nursery area for mangrove dependent species and stabilization of shoreline sediments and prevention of erosion etc.) ● Buffering from storm surge and flooding ● Storage of rich biodiversity
Sea Grass Beds	Destruction of sea grass beds can lead to: ● Food insecurity through loss of nursery grounds for fisheries ● Loss of ecosystem goods and services and loss of biodiversity	Managed extraction and use, and zoning for protection of sea grass beds leads to: ● Grazing habitat for endangered species (green turtles, sea horses, dugong) ● Feeding grounds for many reef fishes and other animals
Beaches and Sand Dunes	Destruction of beaches and sand dunes results in: ● Loss of buffer zones, nesting habitat for turtles, beaches and scenic vistas important for tourism ● Increased shoreline erosion	Protection of beaches and sand dunes results in: ● Resistance to storms and wind ● Increased numbers and diversity of ecologically key species ● Increased values to nature-based tourism and to quality of life

Enhancing Resilience in Hilo, Hawaii: Good Coastal Resource Management Practices

Following the 1960 tsunami, the Town of Hilo took several actions to enhance its resilience through good coastal resource management practices during the recovery and redevelopment process. Prior to the tsunami, a sewage treatment plant had been located in the tsunami runup area. Thus, the potential for having untreated sewage spills into Hilo Bay as a secondary impact of a tsunami were high. This could lead to water quality issues and limit numerous economic, ecotourism, and recreational opportunities. In addition, it could have devastating impacts on the coral reefs located in the offshore waters, which provide critical fishery habitats. To alleviate this potential, the Town of Hilo relocated its sewage treatment facility outside of the tsunami runup area (Dudley 2007).

The town also took other measures to help ensure the vitality of its coastal and environmental resources during the redevelopment process. Hilo created forested areas along the coastline to help lessen the impacts of tsunamis and other coastal flooding. The creation of the forests and other open space along the coast helped to create natural filters for lessening the impacts of non-point source pollution runoff into Hilo Bay.

Coastal Resource Management: Good Practices to Enhance Resilience

Resource assessments: Conducting a community-wide coastal resource assessment to determine the status of resources and what needs to be managed and protected.

Coastal profiles: Developing a coastal environmental profile based on the resource assessment and other sources of information as a precursor to the development of a management plan.

Coastal plans: Developing a coastal resource or an integrated coastal management plan through a participatory process based on available information.

Advisory body: Forming a Coastal Advisory/Management Committee to provide a means for involvement of either scientific experts or the community and stakeholder groups that are essential in the management process.

Zoning: Coastal Zoning (includes marine zones) based on a management plan to minimize conflicts among resource users and to ensure that important resource areas are protected from overuse.

Marine protected areas: Establishing MPAs that encompass defined areas for management and protection within larger CRM or integrated coastal management programs. MPAs may have various zones ranging from no-take and no-entry zones to sustained fishing and use zones or zones designated for tourism and recreation.

Plan refinements: Periodically updating the integrated coastal management plan to address changes in physical, social, environmental, and climate conditions as appropriate for the planning area of concern.

How Does CRM Relate to the Other Elements of CCR?

Coastal management includes the identification of issues and baseline assessment, development of strategies and plans through participation, and implementation of plans guided by best practices. This process is dependent on a functional, efficient, and supportive governance system. CRM is also closely linked to the society and economic element of CCR. To the extent that coastal communities depend on their coastal resources for economic sustenance (e.g. fisheries, marine tourism, and others), they need to protect their coastal resources through a CRM process, and equally, resources that are not managed and protected will erode the socioeconomic base for the community. Finally, coastal resources, such as mangrove forests and coral reefs mitigate potential impacts of certain coastal hazards, such as storm surge, tsunami and other types of flooding, so CRM interfaces with awareness of and planning for mitigation of hazards in many coastal areas.

A. BART

Mangrove areas serve as a natural buffer for waves and a nursery for fisheries

Coastal Resource Management: Challenges and Lessons Learned to Enhance Resilience

Long-term support required: CRM programs are long term and require sufficient buy-in of local and national governments and resources to implement the program.

CRM needs to be considered a basic service of local government: If governments do not adhere to the need for a CRM program and do not incorporate these processes into their normal planning, budgeting, and implementation cycle, the opportunity to build resilience is limited.

Valuation of coastal resources helps build political support: Showing stakeholders and governments the economic and ecosystem services values of coastal resources is necessary to convince governments to adopt CRM as an operating process.

CRM is an opportunity to integrate environmental management with disaster management. CRM presents an opportunity to pursue ecosystem management objectives that are integrated with disaster preparedness through hazard mitigation.

Benchmarks for Resilience in Coastal Resource Management

Table 6-9. Coastal Resource Management Benchmark on Policy and Planning Capacity

C1. Policies and plans are implemented and monitored to effectively manage natural coastal resources.	
Benchmark Description	***Potential Assessment Questions***
The status and condition of coastal resources in relation to threats must be assessed and monitored as a prerequisite to the development of management strategies and plans. Resource assessments and the resulting maps and plans must be appropriate for the community and its local government. Resilient communities need to be aware of their relation with and dependence on coastal resources and to what extent the degradation of coastal resources puts them at risk. They can formulate plans to minimize the loss of resources and to maximize their protection for future uses and benefits. Reconstruction plans need to consider coastal resource issues and include incentives to restore resources to a viable state. Finally, national and local policies and political support must exist to support the planning and implementation processes.	Are coastal resources and priority hazards routinely assessed? Is assessment data used to characterize risks to community and to develop coastal resource management plans? Is the scale of maps and plans appropriate to the local community and government? Are CRM strategies and a CRM plan (e.g., habitats, biodiversity, and hazard mitigation) developed? Is the CRM plan being implemented? Does a community-based or local government forum guide decision making and conflict resolution for CRM? Have local and national governments endorsed policies for CRM? Does a feedback mechanism exist to refine CRM plans as new data is available?

Resilience in Action: National Policies to Support Integrated Coastal Management in Sri Lanka

Sri Lanka has an eroding coastline that has prompted the adoption of coastal management policies that limit development in the shoreline areas. These polices were reinforced in the aftermath of the tsunami by the Coast Conservation Department in coordination with other agencies. The new policies were also part of a more comprehensive "road map" toward building a safer Sri Lanka. The building setback rules were later refined in response to practicalities of implementation and to the clamor of people to allow building in some restricted areas. The decision process for the coastal management plan is institutionalized within national agencies, and a revised plan is formulated and adopted every 5 years to allow adaptation to changing conditions in the coastal areas. Currently, scientific studies are being carried out to revise the existing setback standards to consider all major coastal hazards, including tsunami. Also, the government made a formal policy decision to protect coastal ecosystems as bio-shields against coastal hazards.

Table 6-10. Coastal Resource Management Benchmark on Physical and Natural Resource Capacity

C2. Sensitive coastal habitats, ecosystems, and natural features are protected and maintained to reduce risk from coastal hazards.	
Benchmark Description	*Potential Assessment Questions*
Coastal habitats, ecosystems, and natural features provide protection from coastal hazards and provide various economic benefits to human communities. It is necessary that these important coastal resources are known and mapped, and the threats to them assessed. Use patterns must be determined to develop sustainable use plans. Implementation of the sustainable use plans through MPAs or other approaches is needed to minimize degradation of the resources. Post-disaster pressures from fishing, building, the need for wood, etc., need to be identified and anticipated in plans as possible to minimize degradation. Finally, monitoring provides feedback to management efforts and to assist in identifying additional efforts that may be required for restoration of resources.	Have sensitive coastal habitats been identified and mapped? Have regulations been established for resource extraction based on conservation priorities and risks from hazards? Have management interventions, such as marine protected areas, been established? Does a long-term monitoring program for coastal resource baseline assessment and monitoring exist? Is the monitoring program functional? Have opportunities to reduce risks from coastal hazards through restoration been identified?

Resilience in Action: Marine Protected Areas in Southern Thailand to Protect Vulnerable Coastal Ecosystems

Thailand has several large MPAs along the Indian Ocean coastline and for its offshore islands that help ensure that coral reefs and mangroves are protected and maintained into perpetuity. These MPAs suffered relatively minor damage from the 2004 tsunami and protected human populations living inland from the shoreline areas. At the same time, the government realized that improved management of its MPAs is in order so that they continue to protect the natural benefits accruing from reefs and mangrove areas to fisheries and shoreline protection and to local communities living in the vicinity. Thus, the Joint Management of Protected Areas Project was launched post-tsunami to revitalize 18 MPAs in the southern region. At the same time, these MPAs are increasingly important as tourist destinations that generate income for local businesses and residents to build village-level resilience.

Table 6-11. Coastal Resource Management Benchmark on Social and Cultural Capacity

C3. Communities are actively engaged in planning and implementing coastal resource management activities.	
Benchmark Description	***Potential Assessment Questions***
Stakeholder participation in the coastal management planning and implementation process is important so that communities take ownership of management actions. It is also important that communities and local governments have a good working relationship so that there is an institutional base to support communities once plans are set and being implemented. The participation in implementation is also essential to build sustainable mechanisms for enforcement. Finally, the monitoring and evaluation process also must be highly participatory, so that feedback reflects stakeholder opinions and so that plans can be amended to improve effectiveness.	Have community groups been involved in all aspects of planning for CRM? Do implementation plans call for the participation of community stakeholders in the process? Is the community directly involved in the actual implementation? Are CRM plans responsive to the perceived needs of the communities? Does a process or procedure exist to review plans based on coastal resource issues and community feedback? Do policies and plans have political support for implementation from local government and communities?

Resilience in Action: Post-Tsunami Reef Cleanup and Mangrove Restoration Actions in Thailand

Immediately after the 2004 tsunami in southern Thailand, NGOs working with local government and communities initiated a coral reef and mangrove assessment to determine the damage done to the reefs and mangroves of southern Thailand. This assessment included reef cleanups with local communities that encouraged them to protect their reefs and that informed people that the reefs were important in mitigating the potential impacts of a tsunami. Mangrove replanting was also initiated through community efforts, and a cash-for-work program was facilitated for the replanting activities. The monitoring results were used to educate a broader audience about the importance of coral reefs and mangroves in general. Thailand's business and tourism community was actively engaged in this effort.

Table 6-12. Coastal Resource Management Benchmark on Technical and Financial Capacity

C4. Communities and local governments value and invest in management and conservation to sustain their natural resources.	
Benchmark Description	***Potential Assessment Questions***
The benefits derived from healthy coastal ecosystems are multiple and can often be quantified in monetary terms. It is important that communities and local governments understand the true values of their coastal resources so they will be encouraged to invest in the management and protection of natural resources. Valuation is also important for education to raise awareness about resources, their uses, and their importance. The valuation process may be a precursor to the development of management plans. After plans are developed, valuation is important to justify budget allocation for implementation of management.	Are coastal resources in the area of concern valued by the people? Is there an understanding of the ecological and/or monetary value of the ecosystems and resources? Are communities and their local governments investing in coastal management? Are actions sufficient to protect and management coastal resources? Do management policies and plans have political support for implementation? Do education programs exist that highlight the values of coastal ecosystems and resources?

Resilience in Action: Valuation Studies of Mangroves and Coral Reefs in Indonesia to Justify Protection

In the 1980s and 1990s the Indonesian government, with support from several donors, undertook extensive studies on the valuation of mangroves, coral reefs, and their associated fisheries and tourism benefits. The results of these studies overwhelmingly suggested that the country needed to protect its mangroves and coral reefs. In addition, the results, which showed tremendous economic losses from destroying these important habitats, were used to initiate large national programs in conservation and fisheries management. The studies also highlighted the mitigating role of coral reefs in shoreline erosion. Currently, several NGOs are undertaking the valuation of effectively managed marine protected areas in an effort to increase investment in this conservation strategy.

Land Use and Structural Design

The desired outcome of this element of resilience is effective land use and structural design that complement environmental, economic, and community goals and reduce risks from hazards.

What Is Land Use and Structural Design?

A common characteristic of resilient communities is that they accept that disaster events will occur and they take necessary steps to plan for them. Land use management and structural design are excellent examples of planning activities communities can use to minimize potential impacts of tsunami and other coastal hazards.

Land use management refers to the active use of formal and informal mechanisms for the planning and location of the various land uses, such as agriculture, industry, housing, and tourism in a community. In addition to determining appropriate uses of land, a community can also influence how development, buildings, and infrastructure are designed and built. Structural design refers to how physical structures within a community are engineered and constructed. In order to contribute to a community's overall resilience, both land use management and structural design practices must consider the community's vulnerability to all coastal hazards while minimizing impacts to natural resources. When used in combination, these related risk reduction strategies are very effective mechanisms for enhancing community resilience. Basic indicators for effective land use management and structural design include: (a) Land use plans are prepared and implemented; (b) Structural design minimizes risk; (c) Monitoring and enforcement of policies and codes occurs; and (d) Pre-established redevelopment policies exist.

Why Is Land Use and Structural Design an Essential Element of CCR?

Both land use management and structural design are critical elements of CCR because when implemented effectively, they enable communities to absorb the shock of a tsunami and other coastal hazards. By steering particular land uses away from vulnerable areas and encouraging their development in less hazard-prone locations, a community can reduce the risk to individuals and livelihoods. However, when particular types of development do occur in vulnerable areas, structural design can be an effective way to absorb the shock of coastal hazards. For example, by elevating coastal buildings and using appropriate construction techniques and building materials, a community can greatly reduce the potential impacts from tsunami and other causes of coastal flooding.

Effective land use management and well designed structures also allow communities to recover more quickly after a disaster event. It is clear that well designed and properly constructed buildings and infrastructure lead to less destruction and loss

of life during a disaster event, and thus lead to a quicker recovery. In addition, the existence of land use plans and policies that address critical vulnerabilities identified through hazard risk assessments can expedite recovery. For example, having policies for disposing of debris in place before a disaster event occurs can help prevent secondary impacts to natural resources such as wetlands and mangrove forests.

A. WHITE

Sea level rise causes chronic flooding in coastal areas

The active management of land use and incorporation of best practices for structural design also contributes to community resilience as a means for creating change. Although moving sectors of a community away from vulnerable areas is often politically difficult and cost prohibitive, disaster events present communities with opportunities to learn from their difficult experience. By establishing land use policies and structural design standards that reduce vulnerability, communities can be more resilient during recovery and reconstruction and be empowered to learn and adapt. Land use and structural design benchmarks of resilience are described in Tables 6-13 to 6-16.

What Are Examples of Good Land Use and Structural Design Practices?

Effective land use management empowers communities to realize their development goals while minimizing impacts to natural resources and protecting lives and property. Land use management systems are often established around a land use plan, which represents the social, economic, and environmental goals of a community and addresses risks and vulnerabilities from tsunami and other coastal hazards. In many communities a "land use plan" may be nothing more than a common understanding of where particular land uses should occur. In some communities, this common understanding may be the result of traditional knowledge or practice and may be well engrained in local culture. In communities that are more transient, fragmented, or simply larger, a common understanding may not exist. In these communities a more formal land use plan is necessary that represents shared development goals and has the approval and support of community leaders and institutions. Regardless of community structure, the existence of some type of land use plan is critical to build resilience.

A. WHITE

Coastal land use policies need to incorporate building set-backs and "green" buffer zones to address chronic hazards such as shoreline erosion and sea level rise

Effective land use management systems have plans that are supported by policies that prevent particular land uses from occurring in specific areas and encourage their development in more desirable locations. Regulatory and incentive-based programs are used to encourage compliance with land use policy. Administrative programs are often established to provide oversight to the application and interpretation of land use regulations. In some cases, enforcement programs are also established to ensure compliance. In addition, the most effective land use systems provide multiple opportunities for engaging stakeholders and are characterized by transparency, accountability, and a strong commitment from community leaders and institutions.

An in-depth understanding of the multihazard risk in a community is fundamental for planning, designing, and constructing buildings and infrastructure. Knowledge of the likelihood, magnitude, and frequency of the range of hazard events should contribute toward determining design and construction requirements of infrastructure. Many communities adopt building codes such as the Uniform Building Code (UBC) or International Building Code (IBC), which typically address fire-, wind-, earthquake-, and flood-resistant design and construction practices. The adoption and enforcement of standards and codes is an effective way of developing hazard-resistant buildings and infrastructure.

Unfortunately, many codes and standards (including UBC and IBC) do not address tsunami-resistant design or construction, and it is the responsibility of those communities at risk of tsunami to incorporate additional best practices into local standards. The best practices in the table below are discussed in detail in the United States National Tsunami Hazard Mitigation Program's publication, *Designing for Tsunamis: Seven Principles for Planning and Designing for Tsunami Hazards.*

Seven Principles for Planning and Designing for Tsunami Hazards (J.L. Mintier et al. 2001)

1. Know your community's tsunami risk, hazard, vulnerability, and exposure.

2. Avoid new development in tsunami run-up areas to minimize future tsunami losses.

3. Locate and configure new development that occurs in tsunami run-up areas to minimize future tsunami losses.

4. Design and construct new buildings to minimize tsunami damage.

5. Protect existing development from tsunami loss through redevelopment, retrofit, and land reuse plans and projects.

6. Take special precautions in locating and designing infrastructure and critical facilities to minimize tsunami damage.

7. Plan for evacuation.

Enhancing Resilience in Hilo, Hawaii: Good Land Use and Structural Design Practices

During the redevelopment of Hilo following the 1960 tsunami, the town created a Redevelopment Plan that called for significant changes in the areas impacted by the tsunamis. Many of these changes were guided by land use and structural design practices. The plan called for changes in land uses along the immediate coast to limit the potential for future losses. Through land use practices, many of the areas along the coast were designated as parks, forests, and other open spaces. This action limited the number of buildings located in the areas susceptible to the impacts of tsunamis. Most of these areas area now used for recreational purposes. The town also chose to relocate retail businesses that had been impacted to an area less likely to be impacted in the future, thereby lessening future impacts on the local economy.

The Redevelopment Plan also utilized structural design measures such as building codes and standards to enhance resilience. All new buildings were required to conform to urban design and building design standards. Any building built below the 20-foot elevation contour line had to be able to weather the force of a major tsunami. Parking structures were also designed to block the water from buildings farther inland.

How Does Land Use and Structural Design Relate to the Other Elements of CCR?

The most critical link to land use management and structural design is its connection to risk knowledge. Information regarding hazard risk and vulnerability must be considered and incorporated into land use management practices and structural design to build community resilience. Risk and vulnerability assessments are fundamental to establishing effective land use management strategies and designing and constructing safe structures that can reduce risk. Poor understanding or lack of consideration of community risk limits the effectiveness of land use management and structural design.

Land use management and structural design also have strong linkages with coastal resource management. Both land use management and structural design practices should always consider potential impacts to natural resources and strive to minimize harm to coastal ecosystems. Land use conflicts can be minimized when land use management and coastal management policies align. When land use management and coastal resource management policies do not align, communities

A. WHITE

Shorelines and beaches are vulnerable to erosion as sea level rises and during storm events

may experience the loss of ecosystem services, such as coral reefs and coastal dunes, that actually reduce risk when functioning properly.

Good governance enhances the effectiveness of land use management and structural design and depends on government and private sector institutions. Governance actions such as the establishment of policies, adoption of plans, review of development proposals, and creation of decision-making systems support effective land use management. Government institutions can also support the use of best practices for structural design by creating design and construction standards and adopting building codes. In addition to regulatory mechanisms, government support for incentive-based programs is an effective tool for supporting land use and structural design.

Land Use and Structural Design: Challenges and Lessons Learned in Enhancing Resilience

- Governmental corruption limits the effectiveness of land use management systems, often resulting in the lack of enforcement of land use regulations.

- Poverty and lack of affordable housing contributes to illegal habitation, often in the most hazard risk-prone areas

- The availability of training to build technical capacity of individuals and construction professionals to learn about structural design best practices is critical to successful land use management and structural design programs.

Benchmarks for Resilience in Land Use and Structural Design

Table 6-13. Land Use and Structural Design Benchmark on Policy and Planning Capacity

D1. Land use policies and building standards that incorporate measures to reduce risks from hazards and protect sensitive habitats are established, monitored, and enforced.	
Benchmark Description	**Potential Assessment Questions**
Land use policies and building standards need to be established that incorporate measures to reduce risks from known coastal hazards. Land use and structural design should be based on comprehensive assessments of the risks posed by chronic coastal hazards, such as coastal erosion, and episodic events such as tsunamis and severe storms. Land use policies and structural design must also incorporate the protection of sensitive coastal habitats including beach dunes, coastal vegetation, mangroves, and coral reef ecosystems; these habitats are critical resilience features of a community that lives near the coast and depends on marine resources for food and livelihood. Compliance with these policies and standards must be monitored and enforced uniformly across all sectors.	Are building safety and hazard risk reduction standards and codes supported by law and enforced?
	Are there policies that limit investment in vulnerable land areas?
	Is there institutional capacity to implement land use plans and enforce policies and codes?
	Is information and data on physical and structural development activities available to the public?
	Are land use plans (with hazard areas mapped) used to decide where and how structures are built?
	Have critical facilities been located outside of the hazard area or built to be resistant to the known hazard impacts?
	Have knowledgeable people on coastal resources and hazard management been involved in building siting and design?
	Are hazard resistant building practices taught at the secondary and technical schools?

Resilience in Action: Buffer and No Build Zones in Sri Lanka

Following the devastating tsunami of December 26, 2004, the government of Sri Lanka developed national guidelines to minimize risk to public and private investments within the coastal zone. Through amendments to the Coast Conservation Act, new "buffer zones" or "no-build zones" were declared within coastal areas. The new policy incorporates differences in the tsunami risk between locations and is administered through a permitting system by a government agency.

Table 6-14. Land Use and Structural Design Benchmark on Physical and Natural Resource Capacity

D2. Critical infrastructure are located outside high risk areas and constructed to address risks from priority hazards.	
Benchmark Description	*Potential Assessment Questions*
Risks from episodic events such as tsunamis, earthquakes, and severe storms can be substantially reduced or avoided by proper siting, design, and construction of buildings and infrastructure. This is especially important for life-support functions such as hospitals, fire stations, communication infrastructure, airports, and other features that are needed during disaster. The loss of sensitive coastal habitats from land reclamation, shoreline hardening, construction activities, and inappropriate uses such as landfills erodes community resilience over the long term.	Has an assessment of critical infrastructure been conducted to determine vulnerability to various hazards?
	Are siting and design decisions for housing, hospitals, and other critical infrastructure informed by land use plans and coastal hazard risk assessment?
	Are coastal engineering structures designed to reduce vulnerability to coastal hazards and minimize impacts to sensitive coastal habitats?
	Are policies and institutional arrangements for land use planning and implementation in place, communicated, and understood by developers, builders, and the general public?
	Are there incentives or penalties in place to encourage compliance with land use policies and building standards and codes?
	Does an information campaign operate to inform the public?
	Are sensitive coastal habitats protected from development activities and coastal engineering structures?

Resilience in Action: Relocation of Schools Out of Hazard-Prone Areas in Thailand

The December 2004 tsunami completely destroyed the village school in Ban Talae Nork, Thailand (Ranong Province). During reconstruction, the community did not want the school rebuilt in the same location on the beach. The community worked with government ministers and private land owners to acquire land in an alternative location on which to rebuild the school. With the school now located on higher ground, teachers and students are safe from tsunami, and the school can serve additional uses.

Table 6-15. Land Use and Structural Design Benchmark on Social and Cultural Capacity

D3. Developers and communities incorporate risk reduction into the location and design of structures.	
Benchmark Description	***Potential Assessment Questions***
Developers and communities need to be aware of and adopt risk reduction practices in locating and designing structures.	Are builders and architects in the area knowledgeable of and able to apply the building codes and good practices?
	Do structural engineers factor in risk for designing and constructing safe infrastructure?
	Have building standards to site, design, and build infrastructure in hazard areas been adopted?
	Is there a communications outreach program in place to educate the public in hazard-resilient building practices and designs?

Resilience in Action: Tsunami Safe(r) Houses in Sri Lanka

Using high-tech engineering principles, a joint Massachusetts Institute of Technology-Harvard University team developed a low-tech solution to the problem of how to build homes in tsunami-prone areas. The team produced an architectural model for a Sri Lankan house that essentially would allow a powerful ocean wave to go through the house, instead of knocking it flat. The "Tsunami Safe(r) Houses," which will be built for about $1,200 (U.S.) each using materials available locally in Sri Lanka, will have four core columns made of concrete and rebar, each about 3 meters wide. Between these columns, homeowners can build walls of wood or bamboo to individualize the homes. Engineering simulations indicate that the design will help the core and foundation of the homes to withstand water or wind force over five times greater than a traditional concrete-block Sri Lankan home.

Table 6-16. Land Use and Structural Design Benchmark on Technical and Financial Capacity

D4. Education, outreach, and training programs are established to improve compliance with land use polices and building standards.	
Benchmark Description	*Potential Assessment Questions*
Education and training programs are needed to promote compliance with land use policies and building standards. These programs should address capacity building needs of developers, architects, and builders.	Are there regular training programs for developers, architects, and builders? Is there a certification program on hazard mitigation for architects and builders? Do local colleges or trade schools incorporate courses on land use policies, building standards, and hazard mitigation?

Resilience in Action: Teaching Hazard-Resistant Construction Techniques in Indonesia

Researchers from the Center for Disaster Mitigation at the Bandung Institute of Technology in Bandung, Indonesia, are reaching out to builders and construction workers to promote the use of hazard-resistant construction techniques. Professors and researchers from the center deliver education and training courses to professionals and local laborers on implementing structural vulnerability reduction measures. These outreach activities promote hazard-resistant technology for engineered and (especially) nonengineered construction and provide participants with technical understanding and hands-on experience in retrofitting and rehabilitating buildings in hazard areas.

Risk Knowledge

The desired outcome of this element of resilience is that leadership and community members are aware of hazards and risk information is utilized when making decisions.

What Is Risk Knowledge?

Risk knowledge, a cornerstone of CCR, is the awareness a community has about its potential hazards and its susceptibility to experiencing the negative impacts of those hazards. Risk knowledge requires an understanding of all of the chronic and episodic hazards that threaten the community, including the potential geographic extent of impact and the potential frequency of impact. It also involves knowing how each of these hazards threatens various components of the community, such as the local economy, the built environment, terrestrial and marine natural resources, all segments of the population, critical facilities, utilities, infrastructure, etc. It is essential that access to information pertaining to risk knowledge be open and freely shared among the entire community.

Why Is Risk Knowledge an Essential Element of CCR?

Risk knowledge is the cornerstone for building a resilient community. A community cannot map out its path toward resilience if it does not first know what is at risk. Comprehensive knowledge about the risks to multiple hazards that a community faces enables it to make adaptations to eliminate or lessen the impacts of the hazards. It also allows a community to more easily absorb the shocks associated with the hazards and bounce back more quickly after a hazard event.

> **Risk = Hazard** (frequency and severity) **x Vulnerability** (Exposure/Capacity)
>
> *Source: UN ISDR 2004*

One of the keys to bolstering the resilience of communities to coastal hazards, before they become disasters, is to conduct a comprehensive risk assessment. Communities must identify their exposure to hazard impacts to proactively address emergency planning, response, and recovery, and implement hazard mitigation measures. Hazard mitigation, an important part of resilience, eliminates or minimizes disaster-related damages and empowers communities to respond to and recover more quickly from disasters. Numerous hazards risk assessment methodologies exist and have been applied successfully to communities throughout the world. The key to choosing a methodology is to identify those that have been applied to similar geographies, address similar hazards, and have been successful. Risk knowledge benchmarks of resilience are described in Tables 6-17 to 6-20.

Regardless of whether the risk assessment is performed by the community or an outside organization, agency, or ministry, it is recommended that a steering committee made up of community representatives should be established to provide knowledge, insight, and feedback throughout the risk assessment process. Communities throughout the world have utilized hazard risk assessments as the basis for developing or revising emergency management plans, disaster recovery plans, hazard mitigation strategies, and comprehensive land use plans that foster resilience.

Since many of the other elements of resilience rely on a community's ability to understand its hazard risks, it is essential for a community to be knowledgeable about its risks to episodic and chronic coastal hazards. It is also very important that a community have mechanisms in place to ensure that this hazard risk information is available to all through open access, thereby ensuring that all agencies, officials, decision makers, and individuals will become knowledgeable about the risks. In addition to open access to risk information, it is also important for the community to develop mechanisms to ensure that this risk information is routinely communicated throughout the community. Open access and frequent communication of risk information will encourage the community members to utilize this knowledge when making preparedness, response, recovery, mitigation, and development decisions.

If a community tries to map out a path toward resilience without a comprehensive understanding about all the risks it faces, then it is likely to make decisions that would result in negative impacts from hazards in the future.

Reduce Risk	**Accelerate Recovery**	**Learn from Experience**
The identification of hazards risk enables the community to make well informed decisions to lessen the impacts of future hazard events.	Having access to risk knowledge allows communities to respond more rapidly to the areas at highest risk and thus limit the negative impacts. Risk knowledge also provides the information needed to rebuild properly and in the right locations.	As more hazard events occur, communities update their risk analysis to incorporate the impacts of these events. The updated risk information helps to steer new developments away from high risk areas.

Enhancing Resilience in Hilo, Hawaii: Good Use of Risk Knowledge

The town of Hilo, Hawaii, utilized risk knowledge as the foundation for building a more tsunami resilient community following a devastating tsunami in 1960, caused by a 9.5 magnitude earthquake off the coast of Chile. Instead of just rebuilding in the same manner and in the same location, the community chose to base its redevelopment plans on tsunami risk information. Not only did the community rely on the tsunami impacts information from the 1960 tsunami, but it also considered impacts from past events, such as the 1946 tsunami generated by a 7.8 magnitude earthquake in the northern Pacific, near the Aleutian Islands.

Risk Knowledge: Good Practices to Enhance Resilience

Disaster managers, coastal resource managers, and community land use planners all coordinate on the development of community multihazard risk assessments.

In addition, disaster managers, coastal resource managers, and community land use planners all openly share the results of community multihazard risk assessments.

Risk knowledge information is disseminated throughout the community through formal and informal educational programs.

Risk knowledge is used to guide community development plans.

A community-wide comprehensive multihazard risk assessment is conducted.

A committee comprising multiple sectors, disciplines, agencies, and the general public is utilized to ensure that all aspects of the community are considered when conducting a risk assessment.

The community-wide comprehensive multihazard risk assessment incorporates best available scientific data, combined with traditional knowledge and practices that take into account trends in coastal resource and environmental conditions at a scale appropriate to the community.

Risk assessment information is stored and distributed in electronic formats (databases and Internet mapping applications) to allow continuous updates as physical, social, environmental, and climate conditions change.

The risk assessment is updated periodically to address changes in physical, social, environmental, and climate conditions.

How Does Risk Knowledge Relate to the Other Elements of CCR?

Risk knowledge and its understanding serve as the foundation for all other elements of CCR. Without knowledge about the hazards that threaten an area and the vulnerability of its resources, a community cannot begin to map out its path toward resilience.

- **Governance:** Governmental institutions, strong political will, and effective leadership provide the enabling conditions for incorporating risk knowledge into the decision making process.

- **Coastal Resources Management:** The use of risk knowledge enables communities to manage their coastal and environmental resources in ways that lessen the negative impacts of the hazards on the resources. It also enables communities to make decisions to encourage the restoration and conservation of resources that help to mitigate the potential impacts of hazard events.

- **Land Use Planning and Structural Design:** A community must have access to hazard risk information to ensure that structures are developed in safe locations and with design standards sufficient to withstand any potential impacts.

- **Society and Economy:** Risk knowledge enables a community to identify measures to lessen the impacts of hazards on key societal, economic, and cultural resources.

- **Evacuation and Warning:** Risk knowledge ensures that effective evacuation plans and warning systems are developed that address all aspects of the community at risk from hazard events. Risk knowledge provides a mechanism to evaluate the effectiveness of the plans prior to a disaster occurring.

- **Emergency Response:** Risk knowledge allows first responders to focus their immediate actions in the highest risk areas to lessen the impacts.

- **Disaster Recovery:** Risk knowledge enables a community to develop effective disaster recovery plans that mitigate the impacts of future hazards.

Risk Knowledge: Challenges and Lessons Learned in Enhancing Resilience

- Hazard frequency and severity change over time. Climate change, development patterns, population growth, economic factors, and changes in natural resources (shoreline erosion and sea level rise) heavily influence the risks in a community. The dynamic nature of the physical and built environment and demographics require frequent updates of hazard risk assessments.

- Transient populations such as migrants and tourists may be unfamiliar with particular hazards. As a result, changes in demographics require constant and sustained efforts focused on hazards risk awareness campaigns for the general public.

- Risk knowledge becomes meaningless if it is not utilized to develop and periodically update emergency warning, response, recovery, and mitigation plans and systems.

Benchmarks for Resilience in Risk Knowledge

Table 6-17. Risk Knowledge Benchmark on Policy and Planning Capacity

E1. Coastal hazard risk assessments are completed at a scale appropriate to the community and routinely updated.	
Benchmark Description	*Potential Assessment Questions*
The type, frequency, and magnitude of chronic and episodic hazards needs to be routinely assessed and mapped in order to determine the risk to coastal communities. The scale of the assessment should be appropriate for the community. Resilient coastal communities have an understanding of the hazard threats they face and utilize this information to reduce risk. Sources of information may come from historical data, local experience, traditional knowledge, or model predictions.	Has an assessment of coastal hazards been completed? Did the assessment consider historical events, existing hazards, and potential future coastal hazards? Did the assessment cover chronic and episodic hazards? Was there any community participation in the assessment? Are results of the assessment shared with local and national stakeholders?

Resilience in Action: Mapping of Kelurahan Penjaringan Village, North Jakarta, Indonesia

Working with Action Contre la Faim, the Village of Kelurahan Penjaringan utilized a community mapping exercise to conduct a multihazard risk assessment. To accomplish the assessment, the team utilized a two-step process consisting of mapping using integrated GIS, remote sensing, and field surveys, followed up with community participatory mapping. The benefit of utilizing the community mapping process to supplement the GIS analysis was twofold: First, the community members were able to supplement the assessment with first-hand knowledge on hazards risk and exposure based on previous experiences, thus ensuring that the assessment was comprehensive. Second, the process also enabled the assessment team to increase awareness of the hazards risk to the entire community. The Village of Kelurahan Penjaringan is a coastal community and has many newer residents who have migrated to the area for economic reasons. Many of these newer residents were unfamiliar with the risk associated with living in a coastal area.

Table 6-18. Risk Knowledge Benchmark on Physical and Natural Resource Capacity

E2. Coastal hazard risk assessments are comprehensive and incorporate risks to all elements of resilience (e.g. livelihoods, coastal resources, land use, etc.).	
Benchmark Description	*Potential Assessment Questions*
A community should have an understanding of its potential for experiencing negative impacts from coastal hazards. This understanding of vulnerability needs to include the impacts on social and cultural resources, economies and livelihoods, natural resources, and critical facilities of the community. Resilient coastal communities have an understanding of the potential negative impacts of hazard threats they face and utilize this information to reduce risk.	Does the community have an understanding of how coastal hazards could impact its economic and livelihood assets? Has an assessment of social and cultural vulnerability been conducted that identified areas where individual resources for disaster preparation and recovery tend to be minimal (i.e. areas with high concentrations of poverty, elderly, illiteracy, gender issues, etc.)? Has the community identified areas where cultural differences may bring about special needs to build resilience, such as areas with high concentrations of persons who speak a foreign language? Has the vulnerability of natural resources been assessed? Has the community identified all facilities, infrastructure, and utilities that are deemed critical? Has an assessment of the vulnerability of the critical facilities, infrastructure, and utilities is conducted?

Resilience in Action: Comprehensive Risk Assessments in the Maldives

The Maldives, through efforts funded by the United Nations Development Programme, completed a risk assessment to develop a disaster risk profile for the entire country. The risk assessment addressed exposures of physical, environmental, and social aspects separately. The hazard and risk information generated by the study was comprehensive and at a scale appropriate to guide national policy and planning. National government agencies in the Maldives are currently utilizing the risk assessment information to guide the location, planning, and design of "safe islands", proactive measures to lessen the impacts of future disasters (UNDP 2005).

Table 6-19. Risk Knowledge Benchmark on Social and Cultural Capacity

E3. Community participates in the hazard risk assessment process.	
Benchmark Description	**Potential Assessment Questions**
Risk information is one of the keys to building a resilient community. However, to build resilience, risk information must be accessible and understood by all members of the community. It is critical that all risk information be shared among all those who make decisions related to community development, coastal resources, and disaster management. The sharing of risk knowledge helps resilient coastal communities make wiser decisions, thereby helping to reduce risk.	Was the community involved when hazards risks were assessed? Is risk information made accessible to the community? Is risk information shared and used among institutions to better inform policy and action? Do formal or informal education programs exist to promote risk knowledge?

Resilience in Action: Community Mapping in Ranong, Thailand

Following the devastating impacts of the December 2004 tsunami, five communities in the Ranong Province in Thailand utilized a community mapping process to help define hazard risks in the communities. The community mapping process was facilitated by community members and involved members from all sectors of the community, including community leaders, fishermen, business leaders, the elderly, housewives, and children.

Table 6-20. Risk Knowledge Benchmark on Technical and Financial Capacity

E4. Information from risk assessment is accessible and utilized by the community and government.	
Benchmark Description	***Potential Assessment Questions***
For a community to be resilient, all long-term development plans must be developed through processes that include assessing potential impacts from hazards. Hazard risk knowledge should be utilized to guide all community planning efforts, both short term and long term. The utilization of risk knowledge helps to ensure that the plans are sustainable and the goals are attainable. Risk knowledge should also be utilized to identify mechanisms to lessen the risk through mitigation measures. Over time, risk can change due to numerous factors, such as population growth, climate change, deforestation, etc. Resilient communities periodically reassess their risks to account for these changes.	Do community development goals and the plans to achieve them take into account hazard risk? Are hazard risks considered by institutions when making planning and development decisions? Are hazard risks considered when making coastal management decisions? Are risks utilized to prioritize and guide planning and mitigation actions consistent with community development goals? Is risk periodically assessed to address changes in physical, social, cultural, environmental, and climate conditions?

Resilience in Action: Sri Lanka Disaster Risk Information System

As part of its "road map" toward building a safer country, Sri Lanka identified the need for a GIS-based Disaster Risk Management Information System at the national Disaster Management Center, to be made available for the benefit of all involved stakeholders. The information system will house risk and vulnerability information for multiple hazards and help ensure that all government agencies, donors, and NGOs working with communities to enhance resilience have easy access to hazard risk information.

Warning and Evacuation

The desired outcome of this element of resilience is a community that is capable of receiving notifications and alerts of coastal hazards, warning at-risk populations, and acting on an alert.

What Is Warning and Evacuation?

Warning and evacuation consists of three essential parts: an early warning system, evacuation plans, and a well informed public. Resilient coastal communities possess early warning systems that provide the best available information on potential hazards in a timely manner, implement effective evacuation plans, and have a population that responds appropriately to the information they are given.

An effective early warning system consistently detects potential hazards and communicates the threat in a manner that ensures ample warning is received by the community. Warning messages inform individuals on what is happening, what this means to an individual, and how the individual should take action. Warning messages are delivered in clear, simple language, with enough lead time for recipients to respond. Resilient coastal communities have local early warning systems that are operational at all times and are linked to international or national hazard detection and warning systems. These linkages and other components of the warning system also require backup mechanisms that ensure fail-safe operation during hazard events. This redundancy ensures that if one component of the system is not functioning, then the warning message is still delivered.

Resilient coastal communities also have well publicized evacuation plans in place well in advance of receiving any hazard warning. The development of effective evacuation plans requires expert and local knowledge of the hazard risk, including information on the location of hazard areas and vulnerable populations such as the elderly. Effective evacuation plans also require a high degree of coordination and planning for the development of proper evacuation routes and signs. Regular evacuation drills are needed to ensure that all sectors of society are knowledgeable of the warning and evacuation procedures. Resilient coastal communities also conduct assessments of evacuation drills and post-event warning and evacuation procedures. These assessments provide information to disaster managers and community leaders on how to improve and adapt systems and plans to further reduce or avoid risks from coastal hazards.

A warning system cannot be effective without education and outreach. No matter how expensive or sophisticated the system, if individuals are not able to understand the warning information or do not know how to respond, there is increased risk that lives may be lost. Comprehensive public awareness campaigns should provide constant reminders about hazards risks, warning procedures, and evacuation plans within coastal communities.

Why Is Warning and Evacuation an Essential Element of CCR?

Warning systems and evacuation procedures provide communities an opportunity to significantly reduce risk by taking quick action to mitigate impacts of hazard events. An effective response to an impending hazard event can greatly reduce hazard impacts by removing people from dangerous areas. Warning and evacuation benchmarks of resilience are described in Tables 6-21 to 6-24.

Reduce Risk

Warning systems and evacuation plans reduce risk by empowering communities and individuals to take action to limit hazard impacts.

Accelerate Recovery

Recovery needs are reduced when individuals respond appropriately to warning information.

Learn from Experience

Drills, exercises, and monitoring programs provide opportunities for improvements to warning systems and evacuation plans.

Enhancing Resilience in Hilo, Hawaii: Good Warning and Evacuation Practices

The era of tsunami warnings began in the United States when the founder of the Hawaiian Volcano Observatory, Thomas Jaggar, attempted to warn the Hilo harbormaster of the possibility of a tsunami generated by the 1923 Aleutian Islands earthquake. His warning was not taken seriously, and at least one fisherman was killed.

In response to the 1946 tsunami generated in the Aleutian Islands, official tsunami warning capability in the United States began in 1949. The U.S. federal government established the Tsunami Warning Center in Ewa Beach on the island of Oahu in Hawaii.

In 1960, the Chilean earthquake and tsunami devastated Chile, killed dozens in Hawaii, and perhaps as many as 200 people in Japan. In the aftermath, the nations of the Pacific decided to coordinate their efforts to prevent the recurrence of such loss of life in the Pacific Basin due to destructive ocean-crossing tsunamis. Under the auspices of the United Nations, the Intergovernmental Oceanographic Commission (IOC) established the Intergovernmental Coordination Group for the Pacific Tsunami Warning System in 1968. The United States offered the Ewa Beach center as the operational headquarters for the Pacific Tsunami Warning System, and the facility was renamed the Pacific Tsunami Warning Center (PTWC).

In the aftermath of the 2004 Indian Ocean tsunami, PTWC has taken on additional areas of responsibility, including the Indian Ocean, South China Sea, Caribbean Sea, and Puerto Rico and the U.S. Virgin Islands.

Local officials in the Town of Hilo receive warning notifications directly from PTWC and subsequently utilize an Emergency Alert System (EAS) to notify the community. The EAS includes the use of sirens and warning messages that are broadcast on television and radio networks. Additionally, tsunami signage is utilized to identify tsunami hazard zones and evacuation routes throughout the Town of Hilo.

Warning and Evacuation: Good Practices to Enhance Resilience

Redundant human and technical warning system components

Clearly defined roles and responsibilities for regional, national, and local authorities and media for disseminating warning information

Clear and well publicized standard operating procedures for warning at-risk populations

Appropriate technology to facilitate rapid communication of warning information

Periodic testing and evaluation of all aspects of warning systems and evacuation procedures

Use of clear, simple language in warning messages

Identification and preparation of at-risk segments of the population

How Does Warning and Evacuation Relate to the Other Elements of CCR?

- **Risk Knowledge:** Warning systems and evacuation plans must be based on information about the frequency, magnitude, and location of potential hazard risks. Furthermore, knowledge of the location of critical infrastructure and vulnerable populations ensures evacuation procedures meet the needs of the community as a whole and of individuals.

- **Society and Economy:** Evacuation procedures should be developed with involvement from the local business community to ensure employees are safe, and damage to facilities and loss of supplies are minimized. In addition, evacuation procedures should involve community members in the development of evacuation routes to ensure they are socially acceptable.

- **Governance:** Governance provides the enabling conditions for institutions and organizations to establish clear roles and responsibilities for warning and evacuation, from the national to the local level. Institutional leadership and support can ensure systems and plans are maintained, tested, and improved to enhance community resilience.

Warning and Evacuation: Challenges and Lessons Learned in Enhancing Resilience

- Access to and use of information technology and communication technology is limited in many locations

- Lack of redundancy exists in many warning systems

- Organizational and institutional relationships, arrangements, and protocols for warning systems are generally not well documented

- Warning system standard operating procedures are generally not standardized, may not be well understood by key agencies and organizations, and in some cases do not exist

- Use of information from risk and vulnerability assessments is limited

- Translation of forecast information into warning information is difficult

- Many existing warning systems are hazard specific, and coverage is limited

- Many existing institutional mechanisms for disaster management are largely response driven

- Maintenance of early warning systems is difficult

- Drills and exercises for both warning systems and evacuation plans require political support

Benchmarks for Resilience in Warning and Evacuation

Table 6-21. Warning and Evacuation Benchmark on Policy and Planning Capacity

F1. Community warning and evacuation systems, policies, plans, and procedures are in place and capable of alerting vulnerable populations in a timely manner.	
Benchmark Description	*Potential Assessment Questions*
Resilient coastal communities possess adequate mechanisms for receiving emergency information from external sources and are able to disseminate messages to the farthest reaches of the community in an appropriate amount of time. Resilient coastal communities also have evacuation plans in place well in advance of receiving any hazard warning. These plans incorporate knowledge of vulnerable populations and input from the community in identifying evacuation routes and developing procedures. Lastly, resilient coastal communities practice responding to hazard events through training exercises and drills. These activities are evaluated for their effectiveness, and mechanisms exist to modify procedures and plans for improvement.	Does the community have a way to receive emergency information from national and/or regional systems? Does the community have a way to disseminate emergency information? Does the community have an evacuation plan in place that is comprehensive and addresses individuals with special needs? Do evacuation procedures address transient populations (tourists or migrants) and local businesses? Is there redundancy in both human and technical components of the warning and evacuation system? Are warning system and evacuation procedures tested regularly and evaluated after exercises or hazard events to improve effectiveness?

Resilience in Action: Plans and Procedures for an Alert System in Southern Thailand

The National Disaster Warning Center (NDWC) of Thailand, working with the southern Provincial governments and selected local tambon governments, has developed a Tsunami Alert Rapid Notification System (TARNS). The policies and plans necessary to implement and support the TARNS have been developed through a series of national and local workshops that provided a venue for all levels of government and community to voice their opinion about what such a system would include and how it would operate. The alert system was tested in 2006 and 2007 and is becoming a regular function of both local and provincial governments in coordination with the NDWC, which provides the overall guidance and coordination for the alert system.

Table 6-22. Warning and Evacuation Benchmark on Physical and Natural Resource Capacity

F2. Community warning and evacuation infrastructure is in place and maintained.	
Benchmark Description	*Potential Assessment Questions*
Resilient coastal communities maintain the infrastructure that is used to warn and evacuate vulnerable populations. This infrastructure may include warning sirens, warning flags, warning towers, evacuation route signs, tsunami zone signs, tsunami shelters, and safe areas. In addition, resilient coastal communities maintain their information technology and communications hardware and ensure critical system components have backups and alternative power supplies.	Are warning system components in place and maintained? Are hazard zones, evacuation routes, shelters, and safe areas clearly marked throughout the community with signs and/or maps? Is there redundancy in the technical and human components required for effective warning and evacuation?

Resilience in Action: Community-Based Evacuation Plan Development in Padang, Indonesia

Following the December 2004 tsunami, several citizens in Padang, Indonesia, formed Kogami, an NGO focused on ensuring that their city is ready for the next tsunami. Since its inception Kogami has worked on behalf of the community with other NGO and government officials to coordinate the development of evacuation zones, develop an evacuation plan, and print tsunami evacuation maps and signs.

Table 6-23. Warning and Evacuation Benchmark on Social and Cultural Capacity

F3. Community is prepared to respond to hazard warnings with appropriate actions.	
Benchmark Description	*Potential Assessment Questions*
Resilient coastal communities actively educate all sectors of the community about coastal hazard risks and warnings. Resilient communities prepare individuals and institutions to respond appropriately to warning information through awareness campaigns and outreach activities. When emergency information is provided, individuals and institutions act accordingly. Resilient communities also take responsibility for visitors in their community and educate them about hazard risks and emergency procedures.	Have outreach programs been established to ensure that community members are aware of hazard risks, warning procedures, and evacuation plans? Do outreach efforts reach transient populations such as tourists and migrants? Do schools teach students about hazard risks, emergency preparedness, hazard warnings, and evacuation plans? Are there trained community volunteers and/or organizations that provide awareness information? Do popular culture and news media outlets participate in raising community awareness?

Resilience in Action: Tsunami Evacuation Drills in Padang, Indonesia

Kogami is an NGO focused on ensuring that Padang, Indonesia is ready for the next tsunami. To accomplish this mission, the organization has coordinated with national and local government officials to conduct tsunami evacuation drills in Padang to ensure the community is aware of evacuation routes and is prepared to act. Tsunami evacuation drills have taken place in many other coastal communities in the Indian Ocean region and have proved to be effective at informing the public about actions they can take to save lives.

Table 6-24. Warning and Evacuation Benchmark on Technical and Financial Capacity

F4. Technical and financial resources are available to maintain and improve warning and evacuation systems.	
Benchmark Description	***Potential Assessment Questions***
Resilient coastal communities identify and allocate the technical and financial resources to maintain and improve warning systems and evacuation plans and procedures. Resilient coastal communities seek out the weakest link in warning systems and evacuation procedures and actively work to address them through fundraising, partnerships, and agreements.	Are warning systems and evacuation procedures supported by government programs? Does the community have the appropriate amount of resources to maintain warning systems? Are evacuation procedures routinely updated to incorporate changes in the community? Has the community established partnerships or agreements with external governments or organizations for funding or technical assistance?

Resilience in Action: Collaborative State Partnership Program in Indonesia

Indonesia and the State of Hawaii have entered a state partnership program to build tsunami preparedness in Indonesia and Hawaii. The partnership involves sharing expertise in preparedness, early warning, and first response to emergencies. The goal of the effort is to learn how civil defense resources and responsibilities in Hawaii and Indonesia are shared between different levels of government and the critical role of the civilian sector. The partnership is expected to result in improvements to local preparedness, warning, and response in Hawaii and Indonesia and create opportunities for collaboration on disaster and response planning, economic partnerships, and other sister-state relationships.

Emergency Response

The desired outcome of this element of resilience is that mechanisms and networks are established and maintained to respond quickly to coastal disasters and address emergency needs at the community level.

What Is Emergency Response?

The emergency response function incorporates a wide range of measures to manage risks to communities and the environment. Emergency response addresses the potential occurrence of major emergency situations requiring a complete government approach to natural and human-induced hazards (e.g. the consequences of acts of terrorism or the release of hazardous materials, etc). All emergencies and crisis events are by definition chaotic and highly dynamic, creating physical, emotional, and social disorder. The establishment of an emergency response system, including all of the institutions that are maintained to respond quickly to disasters, is essential for addressing emergency needs at the community level. Since the first few hours of a disaster are the most crucial, it is important to recognize that the community provides the first response. Thus, community involvement is critical during the development of emergency response plans. Normally, a central entity, such as an Emergency Operations Center, manages the emergency response effort. It should be the central operational, tactical, or strategic point for the lead agency and supporting staff to manage the emergency. Properly developed and implemented emergency response plans help to ensure the availability of shelter, food, transportation, medical services, and search and rescue operations during disaster events.

Why Is Emergency Response an Essential Element of CCR?

Effective emergency response enables a resilient coastal community to better absorb the shock associated with disaster events. Emergency response plans and mechanisms also provide the basis for the community to bounce back quickly from the impacts of disasters. In the event of a disaster, effective emergency response procedures can reduce the loss of life and help to lessen the time and investment needed for a community to recover. Emergency response benchmarks of resilience are described in Tables 6-25 to 6-28.

Reduce Risk

Effective emergency response helps to save lives and property.

Accelerate Recovery

By limiting the loss of life and property, emergency response helps to lessen the recovery efforts.

Learn from Experience

For emergency response to be effective, lessons learned from drills and actual response activities need to be utilized as feedback for improving emergency response plans.

Enhancing Resilience in Hilo, Hawaii: Good Emergency Response Practices

The Hawaii County Civil Defense Agency has worked with various local, county, state, and national agencies and NGOs to develop an effective emergency response plan for Hilo, Hawaii. The emergency response plan for Hilo details how the various agencies and NGOs will work together under the leadership of the County Civil Defense Director. The plan includes details for training and maintaining Community Emergency Response Teams (CERT). Participants of CERT Training learn about emergency response procedures and understand their roles and functions in the event of a major emergency or natural disaster that affects their community. This knowledge is important because a neighborhood may be on its own during the early stages of a major emergency or disaster. Also, after an emergency, citizens will volunteer to help, and without proper training, these people can expose themselves to potential injury or even death. Experience has shown that basic training in emergency response and rescue skills improves the ability of citizens to survive until responders or other assistance arrives.

A trained CERT will provide services that will:
- Increase the community's disaster readiness
- Assess damage after a disaster
- Extinguish small fires and teach fire safety
- Perform basic rescue operations and provide first aid
- Organize procurement of supplies

Emergency Response: Good Practices to Enhance Resilience

Risk knowledge is used to guide the development of emergency response plans.

The Incident Command System (ICS), a proven emergency response system used by many countries in the world (e.g. Australia, Canada, New Zealand, United States, India, etc.) is used to provide a means for multiple government agencies to effectively manage any emergency response.

Materials and supplies for emergency response have been identified and routinely maintained to ensure availability during disaster events.

A command system is established from the outset of incident operations, thereby ensuring a unified command and the efficient coordination of multiagency and multijurisdictional efforts for emergency response.

Redundant back up systems (e.g., generators, communications systems, etc.) are in place and operational to ensure success of response activities.

The command system is structured to integrate any type of resource including police, military, technical experts, international resources, and NGOs, and can be used to manage sudden-onset disasters, long-term relief efforts, or nonemergency events.

Mutual-aid agreements have been established with adjacent communities before events to ensure the availability of resources during a disaster event.

Training, education, and drills are ongoing to exercise, test, and institutionalize the emergency response system.

Capacity-building programs have been established for emergency response to ensure that personnel have the key skills to perform their tasks in an emergency. The training program includes search and rescue, first aid, temporary shelter construction, food distribution, and evacuation management.

Volunteers, a vital resource for effective emergency response, are identified and trained properly prior to disaster events.

Emergency response plans are periodically updated to address changes in physical, social, environmental, and climate conditions.

How Does Emergency Response Relate to Other Elements of CCR?

- **Governance:** Governmental institutions, strong political will, and effective leadership provide the framework for multiple agencies, NGOs, and community groups to work together to respond to emergencies.

- **Risk Knowledge:** Risk knowledge provides the information required to ensure that emergency response plans address all of the potential issues and needs that may arise in a community during a disaster. Risk knowledge also helps first responders quickly identify the most heavily impacted areas, enabling targeted search and rescue efforts to help save lives and property.

- **Warning and Evacuation:** Effective warning systems combined with properly executed evacuations can help to reduce the negative impacts of hazard events. This can help to lessen the need for emergency response activities.

- **Disaster Recovery:** An effective emergency response plan and efficient implementation of the plan in a timely manner can help to save lives and property. Thus, it can also help to reduce the efforts and investments needed for the community to recover from disaster events.

Emergency Response: Challenges and Lessons Learned in Enhancing Resilience

- How to effectively engage the community in emergency response activities.

- In many countries, there is no national center to coordinate the national response and provide situational awareness and a common operating picture for the entire national or provincial government.

- In many situations, there is a lack of communication between national and community response efforts.

- Good management is imperative. There is no denying that emergencies cause a great deal of panic, stress, and chaos. Response must be well coordinated and controlled, and good leadership must command and direct activities and operations.

- Emergency response should first be sought within the national borders of the affected areas.

- The existence of different emergency response organizational structures between various levels of government can be challenging.

- Reliable incident information during disasters is often lacking.

- Inadequate and incompatible communications systems sometimes exist among agencies.

- There must be a mechanism for coordinated planning between agencies, including clear lines of authority.

Benchmarks for Resilience in Emergency Response

Table 6-25. Emergency Response Benchmark on Policy and Planning Capacity

G1. Predefined roles and responsibilities are established for immediate action at all levels.	
Benchmark Description	***Potential Assessment Questions***
Emergency response to disaster events usually requires the involvement of multiple institutions. For the response activities to be effective, there must be a clearly defined system for leading and coordinating the activities of all of the institutions involved. For a community to be resilient, it should have an emergency response plan that includes information detailing how numerous institutions and various levels of government will interact and coordinate during disasters. In addition, resilient communities take steps to ensure that vital response supplies and resources are identified, stored in safe locations, and can be mobilized in a timely manner.	Have disaster-specific emergency response plans been developed? Do emergency response plans clearly define leadership roles and coordination mechanisms (e.g. incident command system)? Have response teams (e.g., damage assessment teams, search and rescue, etc.) or other relevant committees been formed and trained for action? Does the Emergency Operations Center have the capacity to mobilize and implement the emergency response plan? Have protocols and linkages between all response institutions been established for coordination? Have materials and supplies for short-term disaster management and emergency response been identified? Are materials and supplies for short-term disaster management and emergency response stored in locations outside of high risk areas?

Resilience in Action: Tsunami Response in Nagapattinam, Tamil Nadu, India

India established and adopted an Incident Command System (ICS) in 2002. The Ministry of Home Affairs is the focal point, and the Indian Administrative Service Training Institution provides training on ICS. During the December 2004 Indian Ocean Tsunami, the Tamil Nadu Government utilized the ICS to implement its successful emergency response. In the initial response on December 26 and 27, 2004, the local district first responders, police and fire service members, medical staff, and ambulances rushed from neighboring districts to form the ICS team. The ICS team was utilized to oversee the establishment of relief centers, distribution of food, round-the-clock search and rescue, and other immediate response activities. On the third day, a full-scale team was established, including the appointment of the Secretary of Rural Development as Incident Commander. The ICS team oversaw the emergency response activities of 73 affected habitations, divided into 7 contiguous ICS Divisions.

Source: Rajiv Ranjan Mishra, IAS Deputy Director (Sr.) & Coordinator, Centre for Disaster Management, LBS National Academy of Administration, Mussoorie, India.

Table 6-26. Emergency Response Benchmark on Physical and Natural Resource Capacity

G2. Basic emergency and relief services are available.	
Benchmark Description	***Potential Assessment Questions***
During emergency response, some of the most immediate needs relate to the well-being of the community members. Disasters can be very traumatic, and emergency response measures are needed to help save lives, reduce losses, and attend to those in need of assistance. Resilient communities take measures to ensure that community members have access to medical care, food, water, and temporary shelter in the immediate aftermath of disaster events.	Have facilities vital to emergency response activities been identified?
	Have assessments been done to determine if these vital facilities will withstand the impacts of disasters?
	Have measures been taken to ensure that these vital facilities will be functional during a disaster?
	Have measures been taken to ensure that emergency healthcare and life support systems for the community will be functional during a disaster?
	Are essential emergency food supply systems accessible during disaster events?
	Have plans been implemented to ensure that psychological and social support is incorporated into healthcare and life support systems during disaster events?

Resilience in Action: Community-Based Disaster Preparedness, Indonesia

Throughout Indonesia, the Indonesian Red Cross has been working with communities to enhance their emergency response capabilities through its Community Based Disaster Preparedness Programme. An essential part of the program involves forming a Community Based Action Team (CBAT) to facilitate a community mapping exercise to identify vital emergency response facilities and resources, as well as hazard risk areas. The CBAT then works with community leaders to develop plans to ensure that these facilities and resources will be available during an event. Subsequently, the CBAT works with the community to develop comprehensive emergency response plans that encompass the following elements: identification and training of volunteers; establishment of early warning systems that are agreed to and understood by the community; procedures to ensure that medical teams are always on standby to assist; protocols for establishing field hospitals; procedures to ensure the community's willingness to work with other agencies and organizations; and procedures to ensure the provision of water and sanitation facilities.

Table 6-27. Emergency Response Benchmark Social and Cultural Capacity

G3. Preparedness activities (drills and simulations) are ongoing to train and educate responders.	
Benchmark Description	***Potential Assessment Questions***
Some communities are forced to deal with hazard events on a routine basis. Others only experience hazard events on rare occasions. In either type of community, it is important to periodically train members of emergency response institutions to ensure that they are ready when their services are needed. It is just as important to ensure that community members are aware of the types of emergency response services available and how to utilize them. This requires an effective education and awareness program. In addition, it is important to conduct drills and exercises on a periodic basis to ensure that the community is ready to respond, they can also help to identify gaps and deficiencies in the response plan. Resilient communities ensure that response institutions and community members are ready to respond to hazard events through training, education, and drills.	Does the community conduct regular training programs for institutions responsible for emergency response activities? Do public awareness and education programs exist to inform all sectors of the community of the emergency response plans? Have volunteers been identified and trained properly prior to disaster events? Does the community conduct periodic "end-to-end" emergency response drills and exercises? Are the results of emergency response drills and exercises utilized to identify gaps or deficiencies in existing response plans? Are emergency response plans updated based on assessments of response drills and exercises?

Resilience in Action: Practicing Preparedness in the Andaman Islands

Sustainable Environment and Ecological Development Society (SEEDS) is a nonprofit voluntary organization working in India to make vulnerable communities resilient to disasters. Through its Tsunami Response Programme, SEEDS has provided emergency response training to communities that were affected by the December 6, 2004, tsunami in the Andaman Islands. SEEDS delivers hands-on training to community task forces that have specific responsibilities following a hazard event. These and other community-based disaster management activities carried out by SEEDS help community members to understand their role during an emergency and identify actions they can take to reduce risk and respond with appropriate actions in the case of emergencies.

Table 6-28. Emergency Response Benchmark on Technical and Financial Capacity

G4. Organizations and volunteers are in place with technical and financial resources to support emergency response activities.	
Benchmark Description	***Potential Assessment Questions***
During the immediate response phase of hazard events, communities often must respond with limited or no resources from outside of the community. For response to be effective at limiting the loss of life and property, a community must have a pre-established network in place to utilize community organizations, volunteers, and resources in a well thought-out manner. These organizations and volunteers will need to be trained periodically to ensure that they are ready to respond when necessary. In addition, mechanisms must be in place to ensure that all resources identified for use during an emergency are readily available and properly maintained.	Have community resources been identified that can be utilized during emergency response activity? Have community volunteers willing to assist during emergencies been identified? Have community organizations willing to assist during emergencies been identified? Have community organizations and volunteers been trained on emergency response activities? Have agreements been established to utilize community resources during emergency response? Are there mechanisms in place to ensure proper maintenance of community resources identified for use during emergency response?

Resilience in Action: Community-Level Management in Hat Yai, Thailand

In the Hat Yai municipality in Songkhla Province, Thailand, the locally based Sammakhi Foundation specializes in emergency response. It trains local volunteers in first aid and search-and-rescue and issues emergency warnings via radio. It is generally first on the scene and works closely with local government in emergency response. Its good track record of emergency response management has gained it trust within the Hat Yai community to take the lead role during disaster events. The Sammakhi Foundation's emergency response leadership role was evident in the successful response to a November 2001 flood that inundated Hat Yai.

Source: Asian Disaster Preparedness Center, 2005

Disaster Recovery

The desired outcome of this element of resilience is that plans are in place prior to hazard events that accelerate disaster recovery, engage communities in the recovery process, and minimize negative environmental, social, and economic impacts.

What Is Disaster Recovery?

Disaster recovery is the process of restoring and improving basic services, natural resources, and livelihoods in a community affected by a hazard event. Resilient coastal communities accept that hazard events will happen in their community and develop plans and procedures before they happen to guide the recovery process. Furthermore, resilient communities seek out and take advantage of opportunities to reduce exposure to potential future hazards and further reduce risk through restoration and reconstruction activities.

Disaster recovery is a comprehensive process that can be broken down into different stages, with each stage having complementary goals.

Early Recovery Process: Damage and Needs Assessment. The damage and needs assessment is the starting point for decision making during the recovery process. In general, a damage and needs assessment will provide detailed information about the affected population and estimates of the damage and losses. Information sharing and coordination among agencies and organizations during this stage is critical to avoid duplication of effort and identify gaps. As this is the first stage of recovery, it is critical that communities be directly involved during the damage assessment process. This early participation sets the scene for community involvement throughout the entire recovery process. Other activities that occur during this stage include providing psychosocial care, debris removal, restoring critical facilities such as hospitals and schools, and construction of transitional shelters.

Medium-Term Recovery Process: Restoring and Promoting Livelihoods. As relief efforts continue, there is the need to revive livelihoods and get the local economy back to normal. Restoring livelihoods in affected communities can also help those coping with loss and recovery to their predisaster condition. Livelihood support is typically provided in the form of asset replacements, provision of new tools, income-generating activities, cash for work, cash grants, and other financial mechanisms. This stage also presents opportunities to reduce risk by diversifying livelihoods. Effective diversification of livelihood activities requires commitment from individuals, significant amounts of technical assistance from supporting organizations, and a long-term commitment to sustainability.

Long-Term Recovery Process: Natural Resource Restoration. Coastal resources are significant sources of economic and social health in many coastal communities. Healthy coastal ecosystems, such as coral reefs and mangroves, may mitigate impacts of coastal hazards and provide critical habitat for fish stocks to recover. During many disasters, these resources become damaged, and excess pressure on strained resources often leads to overuse. The loss of these and other ecosystem services can hamper the recovery process and exacerbate the suffering of people dependent on these resources. However, if short-term solutions can be identified to provide alternative livelihoods and/or food sources, long-term damage may be avoided.

Why Is Disaster Recovery an Essential Element of CCR?

Disaster recovery is an essential element of CCR because it provides an invaluable window of opportunity for communities to learn from the disaster experience and take actions to reduce risk. The period immediately following a disaster provides many opportunities for implementing strategies to mitigate the impacts of potential future disasters, especially while the political will remains strong. If the disaster recovery process is to be successful in building community resilience, it must take a holistic approach by incorporating good practices from the other essential elements of CCR and fully integrate the domains of disaster management, community development, and coastal resource management. Otherwise, if the process is narrowly focused and recovery activities are not coordinated across these three domains, the disaster recovery process can result in a community that is more vulnerable and less resilient than before. Disaster recovery benchmarks of resilience are described in Tables 6-29 to 6-32.

Reduce Risk

Actions taken during the recovery process can reduce risk from future hazard events (i.e., land use change, livelihood diversification, etc.).

Accelerate Recovery

Pre-established disaster recovery plans developed with the community can support rapid recovery.

Learn from Experience

The recovery process provides many opportunities for communities to translate their experience into enhancing resilience.

Enhancing Resilience in Hilo, Hawaii: Good Disaster Recovery Practices

The recovery process in Hilo following the tsunami in 1960 was driven by the goal of creating a tsunami resilient community. This goal was developed through a community participatory process led by strong community leaders. Since Hilo had been impacted by two significant tsunamis in a 14 year timeframe, the community decided to take actions during the recovery process to enhance its resilience to future tsunamis. To guide the recovery process, the Town of Hilo developed the Downtown Development Plan. The plan, which used tsunami risk information as its basis, outlined major changes in the recovery of the area. The plan determined safe areas in which to build based on both the 1946 and 1960 tsunamis that affected the downtown area. It also required all new buildings to conform to urban design and building design standards. In addition, the plan also outlined measures to protect coastal resources.

Disaster Recovery: Good Practices to Enhance Resilience

Community participation is central to disaster recovery and must be ensured at all stages.

Strong coordination of external donors and service organizations supports recovery.

Recovery provides opportunities for diversification of livelihoods.

Risk reduction measures can be easily taken through relocation and reconstruction.

Recovery process can be supported by government through clear policies and strategies.

Transparency and accountability of government programs and officials promotes recovery.

Coordination mechanisms set up prior to the event can accelerate the recovery process.

How Does Disaster Recovery Relate to Other Elements of CCR?

- Governance: Governmental institutions, strong political will, and effective leadership provide the enabling conditions for disaster recovery.

- Society and Economy: The disaster recovery process provides opportunities for diversification of livelihoods and development of new markets.

- Coastal Resource Management: Restoration and protection of coastal resources during the recovery process ensures resources are available in the future for both their social and economic value.

- Emergency Response: Effective emergency response minimizes the severity of hazard impacts and reduces the need for recovery actions.

- Risk Knowledge and Land Use and Structural Design: Risk knowledge and land use management and structures provide the foundation for community-level decisions regarding redevelopment and reconstruction. The disaster recovery process provides tremendous opportunity for communities to reduce their exposure to future coastal hazards through changes in land use, siting of facilities and infrastructure, and building design and construction. By considering risk knowledge in land use and reconstruction decisions during the recovery process, a community can become more resilient.

Disaster Recovery: Challenges and Lessons Learned in Enhancing Resilience

- The disaster recovery process is dependent upon external support from government and humanitarian agencies.

- Coordination is incredibly difficult following a hazard event.

- Immediate needs, such as alleviating homelessness after a disaster, can result in the loss of opportunities to reduce impacts of future disasters.

- Political will to support actions aimed at enhancing resilience can fade quickly.

Benchmarks for Resilience in Disaster Recovery

Table 6-29. Disaster Recovery Benchmark on Policy and Planning Capacity

H1. Disaster recovery plan is pre-established that addresses economic, environmental, and social concerns of the community.	
Benchmark Description	*Potential Assessment Questions*
Resilient coastal communities accept that disasters will impact the community and develop plans and procedures for recovery before they occur. These plans address short-and long-term recovery needs and conform to community values and development goals. They include guidance for reconstruction and outline procedures for a community-driven decision-making process. Resilient communities take advantage of opportunities during the recovery process to implement long-term strategies for advancing prosperity, sustaining natural resources, and reducing future risks.	Does the community have pre-established disaster recovery plans? Do existing plans address short-term needs, such as debris removal and sanitation? Do existing plans address long-term community development goals and values? Do existing plans address restoration, protection, and sustainable use of natural resources? Do policies and procedures exist for guiding reconstruction and redevelopment away from hazard areas and sensitive natural resources? Are multiple hazard scenarios used to consider the range of potential impacts?

Resilience in Action: Establishing a Recovery Process in Ban Nam Khem, Thailand

The fishing village of Ban Nam Khem in southern Thailand was devastated by the December 26, 2004, tsunami. As was the case in many locations, conflicts quickly arose as a result of the influx of donor funds and services. The community quickly recognized the need to build social capital to prevent conflicts and drive the recovery process themselves. The community organized itself into groups while living in relief camps to address issues together regarding sanitation, security, managing donors, coordinating with government agencies, and transportation. This development of social capital carried over into economic development programs. Group savings accounts were created, a revolving fund was established, and micro-credit loans were made available so that people who had nothing to do or no means of earning could start to generate income. Today, many occupation groups are established in Ban Nam Khem, including handicraft production and batik, food vending and coffee shops, boat-building, fishing net-weaving, and motorcycle and taxi services.

Table 6-30. Disaster Recovery Benchmark on Physical and Natural Resource Capacity

H2. Disaster recovery process is monitored, evaluated, and improved at periodic intervals.	
Benchmark Description	***Potential Assessment Questions***
Resilient coastal communities are adaptive and evaluate their actions for effectiveness. In terms of disaster recovery, this entails monitoring and evaluation of the entire recovery process. In addition, resilient coastal communities establish mechanisms to report on progress of the recovery process to the public, receive input from the community, and adapt recovery actions and plans accordingly.	Are there processes established to monitor and report on the progress of recovery efforts? Are there opportunities to revise recovery plans based on assessments, community input, and monitoring? Are post-disaster review and analysis of the recovery process conducted to revise protocols for the future?

Resilience in Action: Monitoring and Evaluating the Recovery Process in Indonesia

Disaster recovery efforts must be monitored and periodically adapted as the conditions of disaster stricken communities change. After the 2004 tsunami, the Government of Indonesia established a new ministerial agency, the Rehabilitation and Reconstruction Agency (BRR) to coordinate, monitor, and evaluate the reconstruction process in Aceh and Nias. The BRR was needed to manage the large volume of work to accelerate disaster recovery. UN ISDR (2007)

Table 6-31. Disaster Recovery Benchmark on Social and Cultural Capacity

H3. Coordination mechanisms at international, national, and local levels are pre-established for disaster recovery.	
Benchmark Description	*Potential Assessment Questions*
Resilient coastal communities have pre-established mechanisms in place for coordinating assistance from external organizations such as donor and service organizations. These mechanisms ensure donors understand and support existing community and government priorities. Resilient coastal communities are able to receive and coordinate the delivery of goods and services in such a way that they do not negatively impact the community.	Have stakeholder coordination mechanisms been pre-established with organizations and agencies responsible for recovery efforts? Have mechanisms been pre-established to coordinate donor and service organization efforts in the community? Are communication mechanisms in place to obtain and share information with the community on the recovery process? Do external organizations understand the process for delivering goods and services?

Resilience in Action: Coordination for Disaster Recovery in Sri Lanka

Coordination between government agencies and donor agencies for disaster recovery was one of the greatest challenges after the December 2004 tsunami disaster. Multi-agency disaster management coordination bodies, such as those established by Sri Lanka, are critical to guiding effective and sustainable disaster recovery, harmonizing the recovery efforts of donor agencies, and minimizing confusion and redundancy. The Sri Lankan coordination body consisted of key government agencies such as the Disaster Management Center, the Coast Conservation Department, the Urban Development Authority and others, together with the development agencies such as UNDP, USAID, AusAid, CIDA, IFRC among others, who all played active roles in post disaster relief and recovery. This same body has continued to serve as a means of coordinating longer-term plans for building coastal community resilience, among other functions.

Table 6-32. Disaster Recovery Benchmark on Technical and Financial Capacity

H4. Technical and financial resources are available to support the recovery process.	
Benchmark Description	*Potential Assessment Questions*
Resilient coastal communities have the technical and financial resources needed to recover. Such resources are tailored to the local needs and are appropriate for the scale and capacity of the community and do not overwhelm the implementing mechanisms. Technical information regarding future hazard risks and related risk reduction strategies provides a foundation for decision making in planning recovery. Resilient coastal communities seek out funds, leverage investments, and establish partnerships to make effective use of all available financial resources for enhancing resilience.	Is technical assistance available to communities after a hazard event? Are there recovery programs or incentives that offer funds for recovery? Are mechanisms in place for communities to solicit and accept external funds? Is assistance available to manage the recovery resources to a useful end? Is the level of support and its means of implementation appropriate for the community and its context?

Resilience in Action: Recovery Support in Southern Thailand

The Government of Thailand mobilized substantial support in the wake of the 2004 tsunami through its national disaster management agency and the provincial governments, working together with the private sector. It also received some external assistance but was careful to channel this assistance to areas most in need and to coordinate such support with existing government organizations so that confusion and corruption were minimized. The national government focused on repairing infrastructure, while the private sector, working with local governments, tended to focus on the immediate needs of people in the initial stages of recovery. Longer-term recovery efforts are being addressed through the local government system together with strategically placed development projects. Models for recovery are seen in Phuket, Ranong, and Phannga Provinces in southern Thailand.