ZONING, SITE-PLANNING & DESIGN

MODULE 8

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FIELD TRIP

Acknowledgements

The majority of the following material is excerpted or modified from:

Christ, Costas, Oliver Hillel, Seleni Matus, and Jamie Sweeting. 2003. *Tourism and Biodiversity, Mapping Tourism's Global Footprint.* Conservation International and UNEP, Washington, DC, USA.

Drumm, Andy, Alan Moore, Andrew Sales, Carol Patterson, and John E. Terborgh. 2004. Ecotourism Development: A Manual for Conservation Planners and Managers. Volume II. The Business of Ecotourism Development and Management. The Nature Conservancy, Arlington, Virginia, USA.

Hüttche, Carsten M., Alan T. White, and Ma. Monina M. Flores. 2002. *Sustainable Coastal Tourism Handbook for the Philippines*. Coastal Resource Management Project of the Department of Environment and Natural Resources and the Department of Tourism, Cebu City, Philippines.

Department of Environment and Natural Resources, Bureau of Fisheries and Aquatic Resources of the Department of Agriculture, and Department of the Interior and Local Government. 2001. *Philippine Coastal Management Guidebook No. 7: Managing Impacts of Development in the Coastal Zone*. Coastal Resource Management Project of the Department of Environment and Natural Resources, Cebu City, Philippines, 108 p.

Tanzania Ministry of Natural Resources & Tourism. 2003. *Guidelines for Coastal Tourism Development in Tanzania.* Tanzania Coastal Management Partnership.

Salm, Rodney V., John R. Clark, and Erkki Siirila. 2000. *Marine and Coastal Protected Areas: A guide for Planners and Managers.* Third edition. IUCN, Gland, Switzerland.

OVERVIEW

A good zoning plan and careful siting decisions can separate user conflicts and minimize environmental disturbances of tourism. Joining a certification program can support and advertise sustainable management practices in MPAs, as well as other tourist facilities such as hotels, dive boat operations & cruise ships.

A carefully planned zoning system for tourism in a protected area is a powerful tool for ensuring that visitation occurs in places and in ways that are within the capacity of an area's management, and that will minimize environmental disturbance. A zoning system can ensure that tourism activities take place at a sustainable level that maximizes benefits and limits negative impacts. In addition, zones can be used to separate different incompatible uses and to minimize user conflicts, such as with local fisher people. Site planning and design in zones that allow construction should be carefully assessed to minimize environmental disturbances such as shoreline erosion.

LEARNING OBJECTIVES

- ✓ Understand how zoning can be used to concentrate environmental impacts in small areas, spare "sanctuaries" from environmental disturbance, and separate user conflicts
- ✓ Understand the importance of integrating the zoning plan into the GMP
- ✓ Learn the importance of site planning for coastal construction
- ✓ Understand how construction can cause beach erosion, and methods to avoid it
- ✓ Develop a zoning plan and siting plan for your own MPA

LESSON PLAN

8.1 ZONING FOR TOURISM

Management objectives & assigning of zones

The appropriate zoning of a marine protected area is fundamental to all other management strategies. Zoning is a mechanism for assigning overall management objectives and priorities to different areas (zones) within the site or protected area. By assigning objectives and priorities to these zones, planners are also defining what uses will and will not be allowed. These parameters are usually based upon the characteristics of the natural and cultural resource base, the protected area objectives and political considerations. The decision to guide public use using sustainable tourism principles is a type of policy decision that affects zoning. Managers guide their day-to-day decisions about the area's operations based in part upon the zoning structure.

The initial zoning for an MPA is usually determined in a General Management Plan (GMP). However, although sustainable tourism may be identified in the GMP as the desired public use, current information may be insufficient to define where public use zones should be located. For example, a well-visited reef in an area may be an obvious choice for a public use zone in the GMP process, but it may not be until after a full evaluation takes place that more worthy attractions outside of pre-established public use zones are identified. Community members and tour operators might help identify important but previously unexploited attractions, such as a seamount that attracts pelagic species and divers.

Consequently, it may be necessary to modify the initial zoning of a marine protected area. Of course, it may be that some potential ecotourism attractions should not be made accessible to visitation because of their vulnerability to erosion, water quality impacts or destruction. In this way, zoning for sustainable tourism should be totally integrated into the overall zoning scheme for an area and should be compatible with the site's management objectives as applied to those zones.

The zoning system will determine the natural conditions for which the different sectors of an area will be managed. Some zones may be managed to maintain a very fragile ecosystem where even highly managed, low volume visitation may not be an option. However, well-managed sustainable tourism activities provide managers with more options, and thus sustainable tourism might be permitted in some zones where conventional tourism would not be.

The importance of diversity in zoning

Providing opportunities for a range of visitor experiences is an important part of planning for most MPAs. One might ask, "why should a MPA provide opportunities for more than one type of experience?" Visitors come to marine reserves for very different and sometimes conflicting reasons. By providing a diversity of settings, visitors can theoretically select which experience(s) most closely match the reason that they came to the park. Also, planning for a diversity of experiences helps to avoid the conflicts that often occur among visitors who want different things from their visits.

MPAs normally provide opportunities for a diversity of experiences by providing a variety of settings or environments for visitors. For example, many MPAs have coral reefs and also open-

water environments, and may also have terrestrial habitats such as beaches, sand dunes, mangrove forests or seabird/marine-mammal colonies. These different settings provide a wide range of potential visitor experiences.

In the past, MPA managers and planners did not try to define the types of visitor experience opportunities that different areas in an MPA could best provide. It also was not recognized that changes in the levels of visitor use and in behavior, as well as visitor impacts and management reactions to those impacts, affect the diversity of visitor experiences in the MPA. Most visitors went to areas in the parks with special attractions (e.g., coral reefs for snorkelling) and/or to easily accessible areas. MPA managers and planners largely responded to increasing visitor use levels with what were believed to be appropriate infrastructure and management policies. For instance, sites often were altered to accommodate more visitor use. But, the increased levels of use and reactive management action frequently changed the characteristics of the settings and the visitor experience.

Zoning allows MPA managers to take a different approach from what was done in the past. Zoning can be prescriptive and proactive about

- what visitor experience opportunities are provided in a MPA
- what the essential elements of those experiences are
- how much area should be allocated to various visitor experience opportunities
- where in the MPA should the opportunities be provided.

A zoning framework also is intended to ensure that a *diversity* of experiences is available in a park. It is not intended to ensure that a diversity of experiences will be available at every attraction in the park, nor is it intended to protect all experiences in all zones. It may not be possible to provide opportunities for a diversity of experiences at unique attractions, such as at a sea turtle nesting beach.

Defining the Zoning Scheme

The first step to defining a zoning scheme is to evaluate the current situation:

- Does the management plan establish a zoning scheme? Is it adequate?
- Can existing or potential negative visitor impacts be eliminated via good zoning?
- Can existing or potential visitor use conflicts be eliminated via good zoning?

If the preexisting zoning scheme does not adequately meet the needs for sustainable tourism development, then changes in the zoning scheme will be needed.

If a marine protected area's conservation management objectives can continue to be met following the establishment of a proposed visitor site, or if the visitor site's negative impact is outweighed by the benefits it will generate, then it will generally be feasible to overlay preexisting zones with a visitor or public use zone. If conservation management objectives are threatened by establishing a visitor use zone (e.g., if the nesting or feeding area of a rare bird species would be disrupted), then some potentially attractive sites should not be established.

Handout 8.1 – Pointers on Developing Zones for MPAs

Basic Types of Zones for MPAs

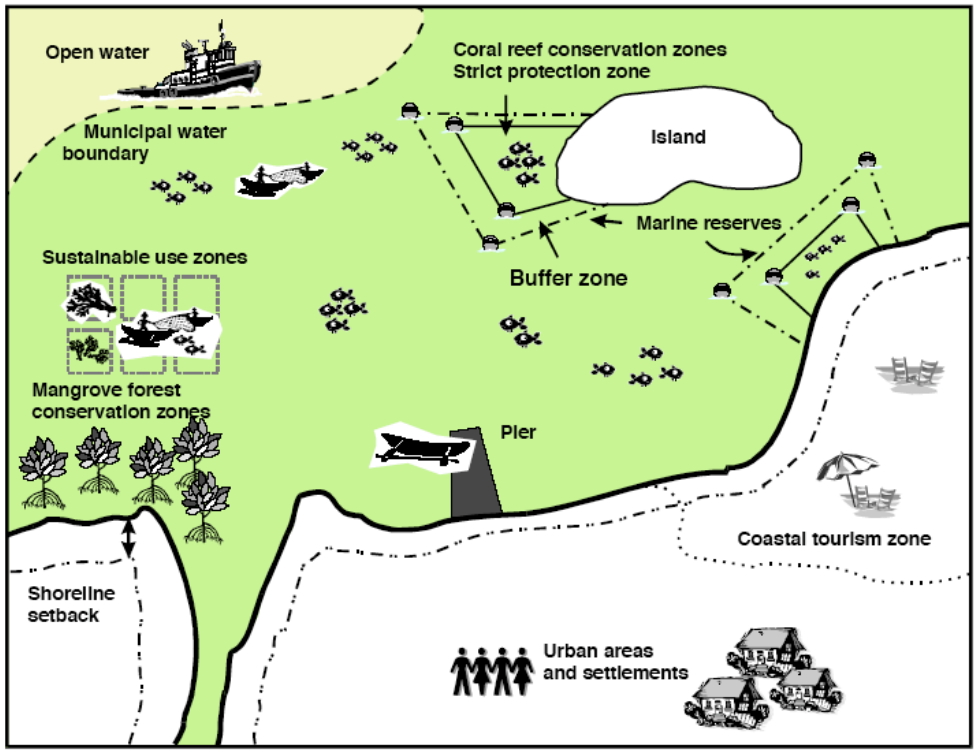


Figure 11: Illustrative zoning and resource use plan for the coastal area and municipal waters (not to scale)

Source: Carsten et al. 2002

If a new zoning system needs to be designed, the first step is to delineate the **core zones**, or **sanctuaries**, that can tolerate only a minimum of human use. These are habitats that have high conservation value and are vulnerable to disturbances. No disturbing uses should be allowed. Core zones should be large; they should include as large a variety of habitats as possible, and be large enough to sustain a breeding population of the key species. Small areas of habitat will have fewer species than larger ones, and thus, a large core zone may be necessary to protect the majority of species. For example, a 300-hectare coral reef of the Chagos Archipelago in the Indian Ocean contained 95% of all the coral genera found in the archipelago, but smaller reefs, or smaller sections of reef, had lower coral diversity. The number of coral genera decreased as reef size decreased. Also, certain genera were found only on reefs larger than a certain minimum area.

Around the core zones can be **buffer zones** or **extensive use zones** where more liberal, but still controlled, uses may be allowed - for example, trails and hiking on land, or, in water, local fisher people using traditional, non-intensive fishing gear. Finally, high-impact visitor uses should be concentrated into **intensive use zones**, such as visitor centers, restaurants, snorkeling areas, waterskiing, sport fishing, etc.

Intensive Use Zones are usually quite small in area, representing less than one percent of a protected area's territory. Extensive Use Zones are generally larger but still represent only a

minor part of the site's overall territory. Other zones may permit some ecotourism activities on a highly limited and controlled basis, frequently requiring a permit.

Separating user conflicts

MPAs often border on inhabited coasts whose residents are heavily dependent on fish, shellfish and other marine resources for food and livelihood, but who damage coastal habitats or deplete resources in their pursuits. In MPAs, an especially common issue is conflict over local fisher people's rights who have traditionally fished in the reserve. *Simply denying such residents access to the MPA is seldom a viable or desired option, often leading to resentment of the MPA and lack of compliance with MPA borders or regulations.* A better approach is a form of management that enables both continued local use and the safeguarding of ecologically valuable elements. A common solution is to award local fisher people *exclusive* fishing rights to a designated area (i.e., non-local fisher people are not allowed to fish there), to compensate them for any loss of fishing rights elsewhere. Some other solutions are to offer management responsibility in compensation for fishing rights, or to offer some other compensation such as low-cost loans for improvements in gear or boats.

When people's traditional rights may be taken away, it is best to offer appropriate compensation, and to include them in the decision-making process.

Zoning can be also used to separate tourism uses. Within the tourism areas, zoning can be used to separate incompatible recreational activities - bird watching vs. hunting, waterskiing vs. snorkeling - to increase the enjoyment and safety of different pursuits. For example, in Holetown, Barbados, the underwater park has four different zones: a central Recreational Zone (containing a snorkeling trail), bordered by a Northern Water Sports Zone and a Southern Water Sports Zone where waterskiing, jet skis, etc. are allowed. Farthest to the north, and furthest separated from the recreational zone, is a Scientific Zone that functions as a core sanctuary area that can be studied by researchers.

Due to these potential user conflicts, it is essential to include local fisher people, marine recreational tour operators, and other stakeholders in the process of developing a zoning plan. Often, local fisher people and tour operators already have informally subdivided coastal areas for different uses; these pre-existing arrangements may be useful in the process of developing a zoning scheme.

Case Study: Florida Keys, U.S.

If possible, inspect the zoning information and maps for the Florida Keys National Marine Sanctuary (U.S.) at:
http://floridakeys.noaa.gov/regs/zoning.html
(Click on "Visitor Information" to see an interactive zoning map.)

Handout 8.2 – Florida Keys Zoning Map

High-impact and low-impact tourists

Tourism encompasses a large number of potential activities ranging from ecologies to trekking. While planning for an tourism site, you should decide toward what part of the tourism market you wish to orient the site's activities. The wide spectrum of potential tourists includes some who will

arrive with full understanding of what it means to be ecologically sensitive, while others will need to be educated on site.

"High-end" visitors will expect fairly comfortable facilities, while more adventurous or lower spending visitors will seek or settle for more basic facilities. The type of visitor you wish to have at your site can determine the types of tourism activities you plan for as well as the degree to which they are developed. Traditionally, most protected area administrators have opted to manage for a wide variety of visitors, although the facilities they provide generally are geared towards the more basic visitor demands, e.g., campgrounds, trails, small-scale food service. High-end visitors usually find lodging and food service outside the protected area. As a general rule, ***high-end visitors spend more money but also require more and better quality facilities that have the potential for causing more environmental impact***. The lower-end visitor spends less money but requires only basic services and infrastructure. The more adventurous and lower-end visitor is more likely to utilize sections of the protected area that are distant and relatively undeveloped.

If sustainable tourism is to be fully implemented, protected area managers must ensure that tourism activities are low-impact and extremely well managed. If these conditions are met, then tourism significantly widens the scope and locations for public-use activities. High-end visitor infrastructure may need to be located in a separate zone to avoid possible conflicting uses. Planners and managers must balance the need to generate income with the potential negative impacts and positive economic and educational impacts that can occur with tourism.

Remember that a zoning system is not a permanent fixture. Like any plan, it should be modified as conditions change.

Zoning Attributes

When determining zones, one should take into consideration their unique biophysical, social and administrative/management factors.

Biophysical Attributes
The natural resources of a zone should be described in terms of their sensitivity and ecological importance:

- The abundance and density of unique, endangered, endemic or charismatic species that may be important for the zone should be noted.
- How natural or intact is the zone, and what evidence of human impact is there?
- How much scenic beauty is in this zone?
- What distance from human habitation or difficulty of access is involved? What sorts of human mobility will be allowed?

Social Attributes

- Given the biophysical limitations, what type of experience do you wish to offer visitors or other users in the zone?
- What user density do you wish to provide? What would be the mix of different types of visitors (e.g., national visitors, international visitors, local people, scientists, etc.)?
- What kinds of norms do you expect to govern group movement (e.g., distance, length of stay in visitor sites, waiting time before going to a site, etc.)?
- What do you expect to be the group sizes, number of groups per day, types of use and equipment that would be permitted in the zone?
- What skill levels would be required before a visitor would be allowed to enter the zone? What are the risks associated with entering the zone?

In zones where local residences are near visitor areas:

- What are the rules for tourists?
- Are they allowed to enter the areas where local residents live (i.e., do communities want visitors in their homes and fields)?
- Do local residents prefer that their photographs not be taken in these areas (or that a fee be collected for photographing)?
- Do local teachers prefer that tourists not visit nearby schools during class time?

In general, what activities are appropriate for the zone? Such zoning can give local residents the ability to control tourist activity so that there is the desired balance of privacy versus interaction.

Administrative Attributes

In order to distinguish between the experiences offered and the permitted uses in the different zones, you must describe the necessary levels of protection and management in each zone and the rules and management actions needed to effectively control the types of activities you wish to have take place there.

- What degree of autonomy will visitors have in the zone?
- Will they need permits? Reservations?
- Can they leave the trails?
- Do they need a guide?
- Can they stay as long as they want? Can they stay overnight?
- How much patrolling will there need to be in the zone?
- What kinds of infrastructure are permitted in the zone? (trash disposal, signs, trails, campsites, campfires, etc.)

Zoning Format

After considering the various attributes the zoning scheme should have, the zones should be defined on a map of the area and described. Normally, a zoning scheme includes zones with a range of visitor-use levels. The following format has proven to be a useful one.

Name of the zone: The name should appropriately describe the type of activity that is permitted in the zone, e.g., intensive use, extensive use, primitive use, wilderness, moderate use, etc.

General objective: What are you trying to accomplish with this zone? With regard to sustainable tourism, what general sort of visitor experience are you trying to provide? How does the zone reflect the site's general management objectives?

Zone description: The description should include a synopsis of the various attributes that will characterize the zone: biophysical, social and administrative.

Zone boundaries: This section should describe the location(s) of the particular zone, if possible giving precise boundaries.

Management rules, regulations and policies: Indicate what specific rules, regulations and policies are needed to govern visitor use of the zone, e.g., use of guides, skill levels, permits, camping, use of soap, campfires, group size, etc.

All of the above must be communicated effectively to visitors so that they understand the "ground rules." A proposal for the Galapagos National Park (see handout) represents two basic concepts for sustainable tourism zoning.

1. Zoning location should be such that zones of intense human use should be buffered by other zones of gradually decreasing use, i.e., primitive or wilderness areas should normally not be adjacent to zones of intensive public use.

2. Zoning for sustainable tourism should, when advisable, provide for a wide spectrum of visitor activities, from intensive use where visitor encounters will be high, to low use where visitor encounters will be very infrequent. This allows visitors with differing expectations and needs to find satisfactory experiences in the sustainable tourism site.

Handout 8.3 – Zoning Format Matrix

Exercise: Zoning for different visitor experiences

Working in small groups, identify the range of potential different visitor experiences in your MPA. Then, using the accompanying zoning matrix handout, create a series of different potential management zones. How do these compare to actual zones in the MPA? Are different types of experiences clustered or spread across all zones? Are there any potentially valuable experiences/uses that do not have a "home"? How do visitor experiences relate to existing or potential resident use of the same areas?

Case Studies

Handout 8.4 - Zoning in Galapagos & El Salvador

Handout 8.5 - Turtle Islands

Case study 3: Kenya

In Kenya, the four Marine National parks are adjacent to or surrounded by Marine National Reserves. Tourism activities (glass-bottom boats, snorkeling, diving) are permitted in the Parks, but all extractive activities are prohibited. The Reserves are open to fishing by traditional fishers using approved methods. The Parks function as no-take zones for replenishment of fishing grounds in the adjacent Reserves and beyond. By way of additional compensation for their loss of access to fishing grounds now in the Parks, local fishers have exclusive rights to fish in the Reserves - recreational, tourist, and non-resident fishing is prohibited in the Reserves and enforced by the management authority.

Handout 8.6 - Bunaken, North Sulawesi

Handout 8.7 - Establishing a tourism zoning system

Discussion: Zoning in your MPA

In small groups for each MPA, review the information on zoning from previous modules, the current zoning system used in your area (if any), the maps of attractions & infrastructure that you created in the assessment module, and the potential zones you created in the preceding exercise.

Looking over all of your information, do you have ideas for improvements in your zoning system for sustainable tourism use? If possible, consult with tourism industry participants (hoteliers, tour operators, etc.) who will likely have useful ideas about areas for lodging, small tour groups, large tour groups, etc.

Create two new acetate overlays for your MPA: the current zoning system (if any) and your desired zoning system. Present to the large group (5 minutes per MPA).

Consult the handout for a helpful process in establishing a tourism zoning system. You may not have access right now to all the types of information listed in the handout, but develop a preliminary plan with the information that you have.

8.2 SITE PLANNING & DESIGN

Introduction to site planning & design

Once a new zoning scheme has been established, a process of new construction within or near the intensive-use zones will likely begin. Typically, construction will be clustered in a few small areas where most infrastructure is to be located. Generally referred to as **visitor sites**, where most visitor use occurs, they are also where some very serious impacts may occur, which is why they must be planned carefully.

Initial Visitor Site Planning Considerations

Handout 8.8 – Site Development Process

Usually visitor site planning takes place within the context of the preparation of a sustainable tourism plan and after a zoning scheme for an area has been established. Site plans are prepared as part of the sustainable tourism plan or as a subsequent step when more time and funding are available. Visitor site designation is the result of the planning process, which analyzes natural and cultural resources and attractions of the protected area, makes a determination about the area's ecotourism potential and then selects certain strategic sites for ecotourism concentration based on their:

- inclusion of current and potential sustainable tourism attractions;
- accessibility;
- potential to concentrate visitor use with a minimum of impact; and/or
- history of previous use.

In most cases, it is advisable to use sites that have already received some human intervention in order to avoid impacting intact sites.

The sustainable tourism plan may have already made recommendations about the type(s) of infrastructure (e.g., trails, campgrounds, ecolodge, etc.) for the site, without being specific about exact locations. The site planning process will now determine the exact locations of infrastructure, taking into account the site's ecological sensitivity and positioning the infrastructure from a visitor management perspective (e.g., location of trails in relation to a campground or attraction). A

financial feasibility study can help determine whether there is or will be sufficient demand for a business-focused infrastructure (e.g., an ecolodge) and an environmental feasibility study will assess its environmental viability.

The visitor site planning process is best carried out by a team made up of a landscape architect, a biologist or ecologist, and an environmental engineer, who should all have some training in environmental impact evaluation and tourism infrastructure; and also a local resident who is familiar with the site and/or environmental conditions in the area.

The first step in preparing a visitor site plan is to survey and analyze the proposed location for the recommended infrastructure. It may be necessary to look at a fairly large area and then reduce the effective site's area depending upon results of the analysis.

At this point, the following questions should be asked and answered in at least a provisional manner:

1. Is the site appropriate for developing tourism activities according to the General Management Plan?
2. Can development impacts on the site be minimized?
3. What inputs (energy, materials, labor, products) are necessary and available?
4. Can waste outputs (solid waste, sewage effluent, exhaust emissions) be dealt with at acceptable environmental costs?
5. What are the potential indicators that should be considered in a future impact monitoring plan for this site?

The next step involves the actual siting of the proposed buildings and infrastructure.

Infrastructure Siting Considerations

As discussed above, high-end and low-end visitors will have quite different expectations, needs and motivations. Though low-end tourists may be quite happy with tent structures, high-end tourists would prefer, and pay for, enclosed rooms with private baths and other amenities. Facilities and infrastructure need to respond to actual and expected needs.

When determining exactly where buildings and infrastructure should be located, planners should take into consideration the following:

General Considerations:

- Environmental impacts should take precedence over development considerations.
- Do not be overly constrained by familiar, traditional patterns of landscape use. Consider using the landscape in new ways.
- Maintain both ecological integrity and economic viability.
- Emphasize simplicity, while respecting basic human needs of comfort and safety.
- Take full advantage of natural features such as wind, sun, shade, slopes, and vegetation.
- Assess feasibility of development in long-term social and environmental costs, not just short-term construction costs.
- Plan to implement development in phases, to allow for the monitoring of cumulative environmental impacts and the consequent adjustments for the next phase.

Specific Considerations:

Capacity. As difficult as it may be to determine, every site has a limit for development and human activity. A detailed site analysis should determine this limit based on the sensitivity of the site's

resources, the ability of the land to regenerate and the mitigating factors incorporated into the site's design.

Density. Siting of facilities should carefully weigh the relative merits of concentration versus dispersal of visitor use. Natural landscape values may be easier to maintain if facilities are carefully dispersed. Conversely, concentration of structures leaves more undisturbed natural areas.

Wildlife. Avoid the disruption of movement, nesting patterns, feeding and roosting sites of threatened, endangered or focal wildlife species by sensitive siting of development and by limits set on construction activity and facility operation. Allow opportunities for visitors to be aware of indigenous wildlife (observe but not disturb). Also, be aware that in some ecosystems, particularly on islands, tourism activities can lead to the introduction of invasive species.

Views. Views are critical and reinforce a visitor's experience. Site design should maximize views of natural features and minimize views of visitor and support facilities. To do so, avoid high structures. Buildings should remain below tree/horizon line and be invisible from the air and on ground arrival as much as possible. Colors used on exteriors should blend, not contrast, with the natural environment.

Natural Hazards. Development should be located with consideration of natural hazards such as precipitous slopes, dangerous animals and plants, and hazardous water areas.

Energy and Utilities. Conventional energy and utility systems are often minimal or nonexistent in potential ecotourism sites. Siting should consider possible connections to off-site utilities or, more likely, spatial needs for on-site utilities.

Ventilation - Infrastructure should be placed to take advantage of natural ventilation possibilities when consistent with esthetic and other considerations.

Organic waste - Consider environmentally appropriate technologies and facilities for the treatment of organic wastes, such as composting, septic tanks and biogas tanks.

On-site utilities - Remember to plan for any necessary facilities such as facilities for trash storage until removal from the site, solar panels or other appropriate energy sources, maintenance buildings, and sites for treatment of gray water.

Water - Water sources should be located where other activities will not impact them and in such a manner that water use will not significantly alter existing watercourses. Waterlines should be located to minimize disruption of earth and adjacent to trails wherever possible.

Visitor Circulation Systems. Infrastructure elements such as lodging and trails should be located to optimize visitor circulation: minimum distances, minimum disturbance to natural features, easily located by visitors, etc. Trails should be designed with environmental and cultural interpretation in mind, and with attractions and sensitivity the primary determining factors in placement. Wherever possible, trails should be offered for differing levels of physical ability and should form a **closed loop** to avoid visitors retracing their steps, thus improving their experience. Trails should be clearly delimited to discourage visitors from leaving them. Trails and roads should respect travel patterns and habitats of wildlife, including maintaining canopy cover unbroken. They should also conform to existing landforms. Low impact site development techniques such as boardwalks should be used whenever possible instead of paved or unpaved trails; where necessary, they should incorporate erosion controls.

If vehicular access is possible, the extent of roads and other vehicular access routes should be minimized. If a road is needed for supplying the lodge, consider using electric or hybrid vehicles to transport supplies from the main road in order to reduce noise, water and air pollution.

Conflicting Uses. If the site provides for different types of visitor use, for example ecolodge and campground, make sure these uses are sufficiently separated geographically so that they do not conflict. Safety, visual quality, noise and odor are all factors that need to be considered when siting support services and facilities. These areas need to be separated from public use and circulation areas. Under some circumstances, utilities, energy systems and waste recycling areas can be a positive, educational part of the ecotourism experience.

Siting should be compatible with traditional agricultural, fishing and hunting activities. Some forms of development that supplant traditional land uses may not be responsive to the local economy.

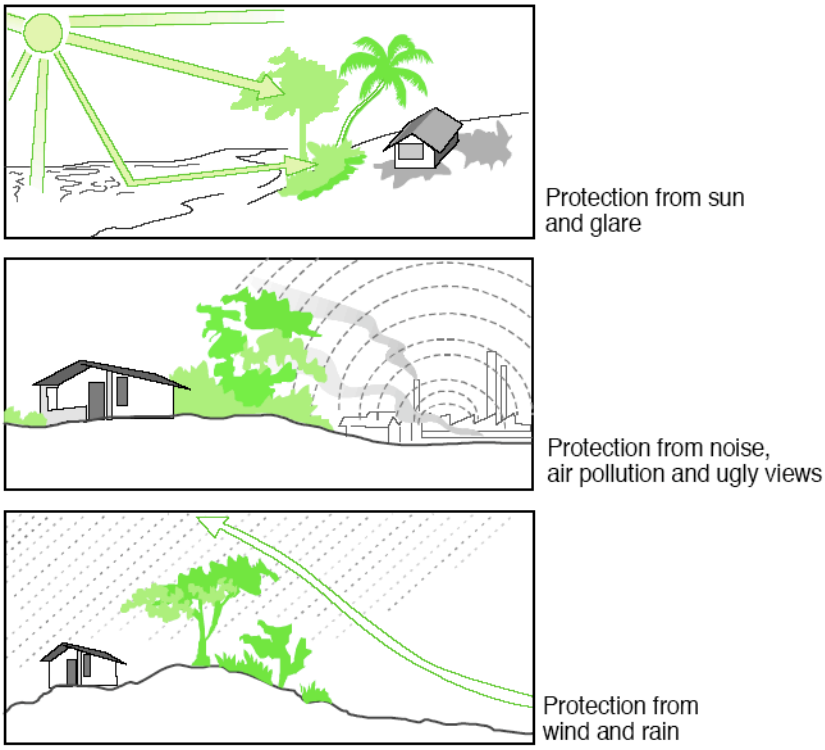
Impact Monitoring. Specific indicators and standards should be established to monitor the impact of the site's use as an ecotourism location. Refer to Chapter 5 for more information.

Aesthetics of building design. Along with regulatory considerations, design should be sensitive to the aesthetics of an area. If the development is within view of an important site or building, the tourist facility should not be taller than the site. The design of the exterior of the building should also be harmonious with the architectural style of the site. For coastal resorts, a rule of thumb is to *restrict height of buildings to the height of the surrounding vegetation.* As many coastal areas in the tropics are lined with coconut palms, the height of the coconut has been used as a common measure for good aesthetics. Building height is generally measured from the finish ground elevation to the peak or highest ridge of the building roof. Another way of sustainable siting is to step buildings to reflect changes in the site's topography.

Staggered building form to blend into landscape
Source: Sustainable Coastal Tourism Handbook for the Philippines, 2002

Landscaping design

The coastal regions of the tropics contain delicate species of vegetation that provide protection from storms, habitats for birds and mammals, shade from the sun, and a barrier to erosion forces of the ocean. The best approach is simply to leave as much of the original vegetation in place as possible. Removal of vegetation will increase erosion of valuable topsoil, cause sedimentation and pollution to local waters, and raise costs of the project. Further, large trees can take decades to grow and should therefore be considered an asset for the shade and beauty they provide to the landscape. Natural vegetation is an essential aspect of the visitor experience. Natural vegetation can also be used to diminish the visual impact of facilities. In warmer climates, it may be possible to integrate facilities with their environment through minimizing solid walls, creating outdoor activity spaces, etc. Note also that shading of facilities from large trees and shrubs will often reduce air-conditioning costs by approximately 20%.



Services provided by trees and vegetation to a coastal tourist facility
Source: Sustainable Coastal Tourism Handbook for the Philippines, 2002

If landscaping must be used to replace vegetation that was cleared during construction, plant selection will vary according to soil type, exposure to winds and saltwater, rainfall, contour of the land, and also with social aspects such as the type of tourist desired, privacy needs, and visual aesthetics. The cost of planting and of maintaining the vegetation, particularly the long-term water needs, must be considered. An overall plan should be developed with the consultation of someone who knows about vegetation and who is familiar with the physical constraints in a given area. Use native plant species. Minimize, or even eliminate, the use of lawns. Special care should be taken to preserve vegetation areas around lakes, ponds and streams, as filter strips to minimize runoff of sediment and debris.

The following suggestions can help to increase the value of the landscape as well as to protect the natural environment from negative impacts of vegetation removal.

- Protect natural environment from construction activities by fencing them off during construction or by transplanting them into on-site nurseries.
- Use indigenous species for replanting; they are already adapted to the harsh environments of salt-spray, wind, sun, sandy soil, and they are also less water consuming.
- Be realistic about the design of the landscape in relation to the ability to maintain it.
- Root-balled trees are not good alternatives to leaving trees in place. They are expensive to transplant, are subject to sudden death, and take many years to establish themselves.
- Select trees and shrubs that root vertically and deeply, rather than species that root horizontally or shallow, to avoid damage to foundations, walkways, etc.
- Use flowering and fruiting species to attract birds, mammals, butterflies, etc.
- Use hardwood species so that there is less chance of damage to property or injury to guests from falling branches.

- Use species with graceful shapes that do not lose their leaves seasonally, but throughout the year.
- When using coconut, remember that these trees grow very tall and may pose a hazard from falling fronds and nuts.
- Consider mangroves as resort landscape features or for activity areas.
- Consider using “graywater” from shower drains and kitchen sinks to irrigate plants. If graywater is used, laundry and kitchen soaps should be biodegradable and have reduced phosphate.
- Water plants after sunset to allow maximum absorption of water.

Hotel site selection

Often, the largest construction planned near the a shoreline of an MPA will be a hotel or other lodging facility. MPA managers may become involved in this process if hotels are to be sited in or near the MPA, and should also be aware of general environmental considerations if other hotels are be planned close to the MPA.

All of the above consideration for construction of visitor sites also apply to hotels, but hotels will impose a greater environmental burden than a typical visitor site, because hotels have high needs for fresh water, energy, wastewater disposal, and solid waste disposal, and will have a greater amount of visitor activity, including in the evenings.

Hotel site selection by resort developers usually involves simply finding a spot along the shoreline where guests can have quick, easy access to the beach and scenic views of the sea. However, available infrastructure, sewage treatment, water supplies, etc., may not be sufficient to support the site. Some guidelines for good site selection:

- Avoid sensitive environments such as mangroves, rain forest, or steep slopes; be particularly aware of beach erosion (we will discuss this more tomorrow).
- Seek local knowledge on the environmental, cultural & social importance of the site
- Potential user conflicts should be avoided, such as with local residents who traditionally use that area for fishing, etc.
- Concentrate hotel development in nodes, rather than a thin ribbon spread along the entire coast.
- Assess proximity to basic infrastructure, such as electricity, roads, water, solid & liquid waste disposal.
- Ensure that local residents still have easy access to and along the beach.
- Ensure appropriate use of setbacks - a prescribed distance away from the shoreline, to protect structures from wave action, protect shorelines from erosion, and ensure free access for local residents to and along the beach. (We will discuss this further below.)

Once the general site has been selected, a detailed site plan should be drawn showing the exact location of all facilities (reception areas, guest rooms, swimming pools, parking areas, etc.). This will help with planning for:

- Setbacks and buffer zones to ensure free access to beach and protect sensitive areas
- Clustering to centralize infrastructure & preserve open spaces
- Aesthetically pleasing design
- Sustainable use of local products and materials

Although some tourism developers feel setbacks decrease their establishment’s desirability tourists, there are several advantages to having setbacks in place. In a resort or tourist area, the land between development and the beach can be enhanced and provide attractions to tourists.

Many tourists come from countries where they have to spend months indoors avoiding the cold. When they travel to the tropics, they want to spend as much time as possible outside. The beach will always be an attraction, but open, landscaped spaces away from the water can be equally as appealing in providing:

- Shade from the sun and heat
- Places for artists and photographers to work
- Native vegetation which provides tourists an opportunity to study indigenous plants
- Open space to enhance the view of the coastline and ocean.

Water sources should be carefully assessed during hotel site selection. Water wells may be needed; as a general guideline, place them away from the beach to minimize salt water contamination, and away from the hotel's septic tanks. (Detailed well and septic tank placement guidelines can be found in the 2001 "Guidelines for Coastal Tourism Development in Tanzania"; see citation at beginning of this module.)

Wastewater treatment facilities are often virtually non-existent along rural coasts, and tourist developments will usually need their own septic tanks or other waste treatment systems. Septic tanks need to be sited carefully to avoid contamination of nearby water wells and to avoid sewage leakage to the ocean. (See module 7 for more information on septic systems and water wells.)

Case Study: Hotel Water Needs in Pulau Redang, Malaysia

Before development on the island of Pulau Redang, Malaysia, an environmental impact assessment predicted that major resort development would result in depletion of freshwater supplies, slope erosion and the destruction of the surrounding coral reef (marine park). Although the EIA recommended significantly limiting development and placing restrictions on building in steep areas, these recommendations were ignored and major resorts were developed, not surprisingly causing the predicted impacts. Freshwater resources on the island have been overused, resulting in saltwater intrusion and contamination and forcing the government to propose an expensive water pipeline from the mainland to meet tourists' needs. Furthermore, slope erosion has destroyed terrestrial ecosystems and choked the surrounding reef, resulting in significant species loss, the clouding of previously clear waters and a decline in the quality of the tourism product.

Source: Sustainable Coastal Tourism Handbook for the Philippines, 2002

Case Study: Maldives

Handout 8.9 – Coastal Development Criteria in Maldives

Exercise: Classification of beaches and siting of resorts / visitor centers

Using the zoning system you have developed, for each type of beach setting in or near your MPA, locate the best location for placement of a resort, lodging or visitor center. Use the maps and inventories that you have developed in earlier modules.

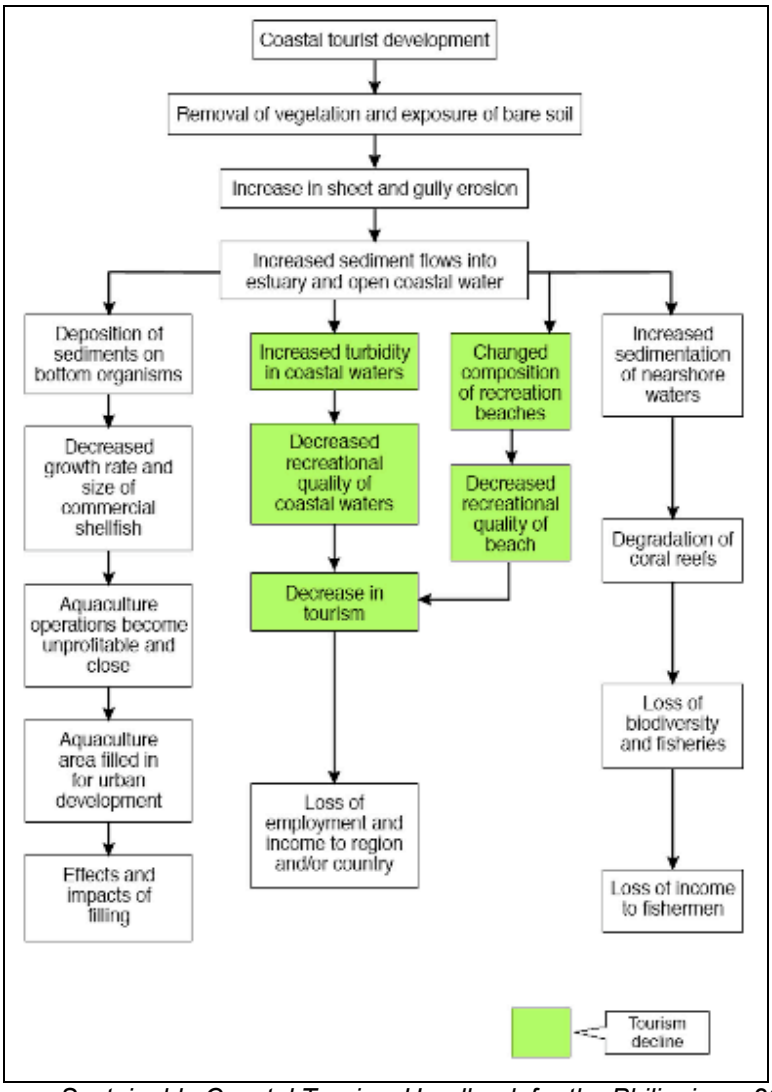
Create a new acetate overlay with proposed site for tourist-use beaches and new hotels, lodging or visitor centers.

8.3 COASTAL CONSTRUCTION AND SHORELINE EROSION

General principles for coastal construction

Coastal construction includes construction of buildings directly on beaches or shorelines, the dredging and filling of coastal waters or the erection of structures, construction of transport facilities (ports, airports, roads/bridges), or construction of structures such as navigation channels and turning basins, docks, seawalls, jetties, groins, breakwaters, replenished beaches, causeways, and roads. All of these activities can have substantial environmental impacts.

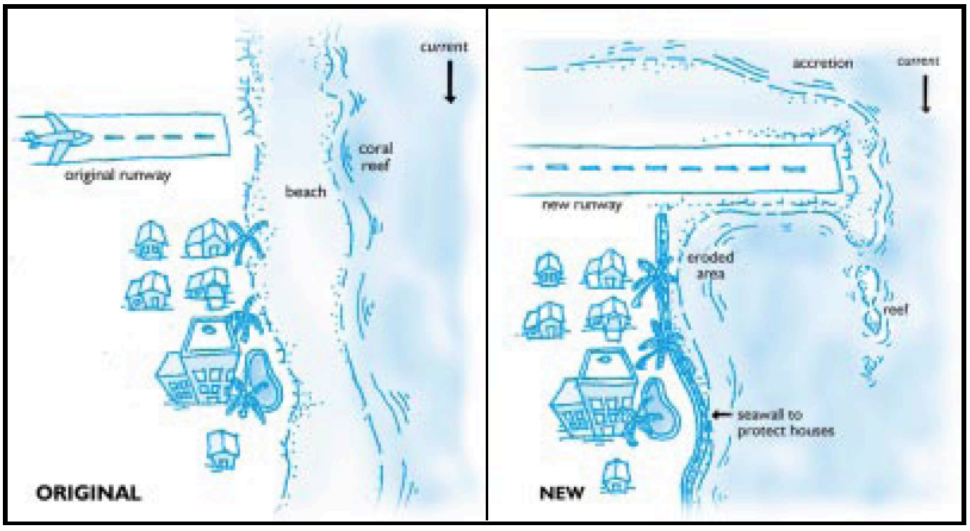
In coastal zones, the siting of development for visitor sites is especially crucial, because development can cause erosion that can actually remove or change shorelines (e.g. beach erosion), as well as causing sedimentation and turbidity that can negatively impact sensitive environments. As shown in this chart, the environmental impacts can be substantial, and can ultimately decrease tourism as well.



Source: Sustainable Coastal Tourism Handbook for the Philippines, 2002

Thus, it is imperative that any coastal development be built inland from the shoreline. Facilities for tourist resorts should be located as far away from the shore as possible. Locating these facilities directly on the shoreline pollutes nearshore waters with increased surface runoff, and greatly increases the chances of storm and wave damage and the ultimate loss of the beach.

The following figure shows the consequences of poorly planned changes in shoreline, leading to erosion and complete loss of a beach:



Source: Managing Impacts of Development in the Coastal Zone, 2001

Any construction along the coastline must be carefully assessed for its possible effects on sediments. Pay special attention to any structure that may interrupt the normal movement of sand along a beach; this will inevitably cause build-up of sand on the up-current side, and erosion of sand on the down-current side.

Any construction that modifies the shoreline will invariably change currents, wave action, tidal fluctuations, and the transport of sediments along the coast.

Beaches can erode away if development is sited inappropriately.

It goes without saying that, where possible, it is best to avoid construction that seriously impacts the coast. However, in some cases, tourist infrastructure may require major construction along a shoreline.

Bear in mind these guidelines for major construction at the shoreline:

- ***Fill or land reclamation*** cause permanent loss of marine habitat
- ***Excavation and dredging*** will permanently alter habitats and displace native ecosystems such as mangroves, sea grasses, coral reefs, and beaches.
- ***Any restriction of the circulation of coastal water*** by coastal construction, including changes in freshwater outflows, can degrade water quality and coastal ecosystems.
- ***Explosives*** used during construction can fracture nearby reefs and injure marine life.
- ***Dredging*** can release or generate large amounts of sediments that can be transported well beyond the immediate vicinity of the construction activity and bury or smother bottom

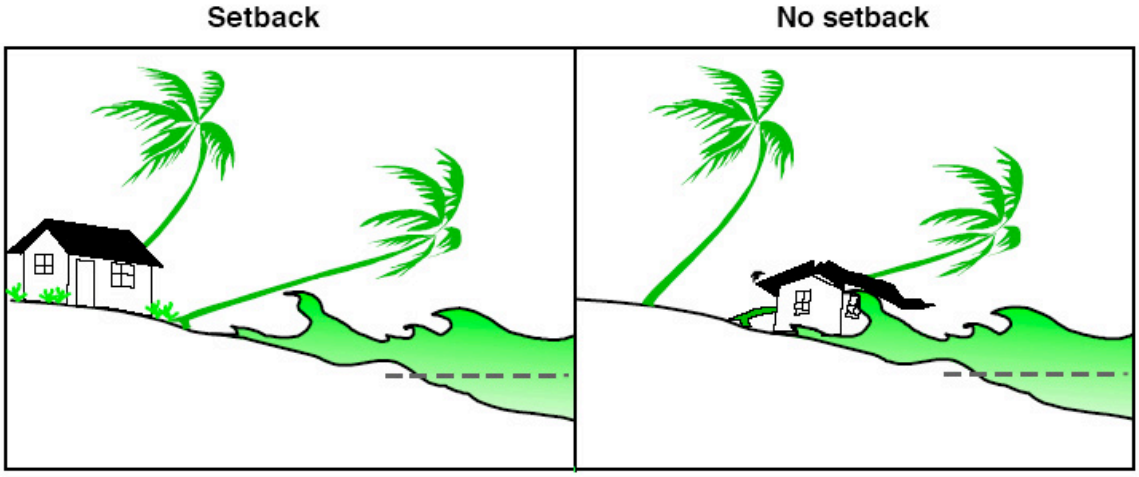
dwelling marine life and chase fish away. Dredging activities should be conducted using best management practices such as silt screens (vertically hanging screens in the water that encourage sediment to settle) and careful management of dredge spoil materials.

- ***Removal of vegetation*** from adjacent land areas can destroy wetlands and other native coastal habitats and promote soil erosion and sedimentation.

Setbacks in coastal construction

Setbacks can help preserve beaches and the infrastructure sited on them. In module 7 we briefly discussed setbacks as they apply to hotels. More generally, setbacks limit any kind of construction, and should be used in any construction planning within an MPA or along a beach. Recall that a setback is a prescribed distance away from a particular landscape feature, with no permanent development of any kind permitted within this area. Setbacks are important because they allow for natural coastal processes to occur uninterrupted and ensure both physical and visual access to the coastline. They help limit beach erosion by preserving the natural vegetation along the shoreline. The major objectives of setbacks are:

- Protecting life and property against erosion and storm surge
- Minimizing public investment in coastal protection
- Protecting and enhancing the scenic value of coastal environments
- Minimizing use conflicts among various types of activities taking place in the coastal zone
- Ensuring public access to and along the coast
- Maintaining consistency between national and local laws and plans
- Protecting vulnerable beaches and other habitats such as coral reefs and seagrass beds
- Providing buffer zones around coastal historical and traditional use areas.



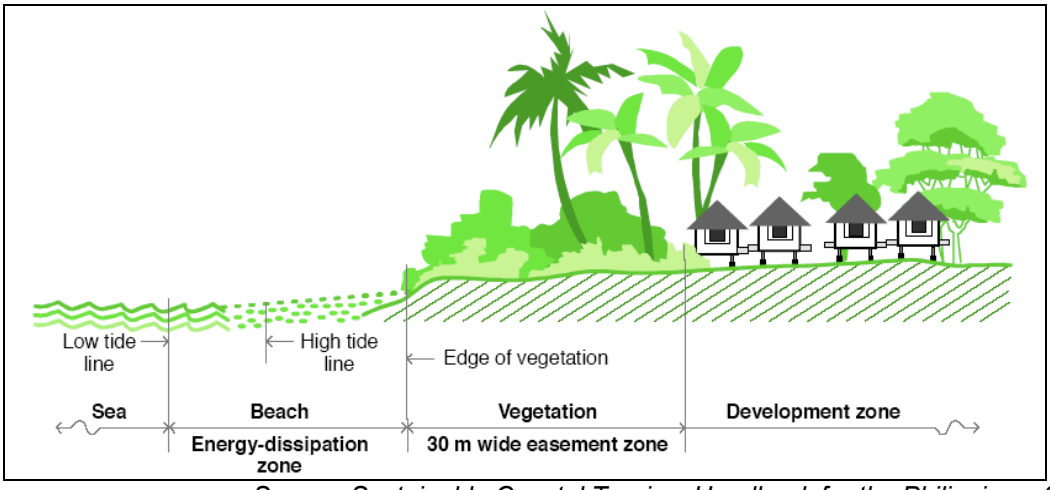
Source: Sustainable Coastal Tourism Handbook for the Philippines, 2002

It is of paramount importance that hotels & other large structures be sited with generous setbacks from the high-tide line.

If tourism structures are too close to the water's edge, they can be severely damaged or destroyed by large storm waves. For concrete or high-rise style resorts, the structures cannot be moved or removed, and resort owners are often forced to install seawalls and revetments to

prevent structural damage, or offshore breakwaters and groins to help trap new beach sand. In turn these structures invariably prevent natural replenishment of beaches during favorable weather, and cause beach erosion of down-current beaches. The net effect is an vicious cycle of beach erosion and increase in coastal fortifications, with concomitant degraded aesthetics, and increased costs for protection and artificial beach replenishment. New sources of sand then must be obtained elsewhere to place on the eroded beaches, which expands impacts to the other beaches where the new sand is taken from, well outside of the resort area. In retrospect, a good resort plan could have avoided these environmental and economic problems in the first place, by requiring all permanent structures to be set back far enough inland so as not to be threatened by wave action and subsequent beach erosion.

Setback regulations for coastal areas vary from country to country. For example, Indonesia requires a 100m shoreline setback for all buildings from the mean high water line, and Tanzania requires 60m. Some countries like Sri Lanka allow for variable setbacks that depend on the section of coast and the rates of erosion, the types of structures to be constructed and an overall appraisal of the site and its limitations. In the Philippines, setbacks from rivers, streams, lakes, and mean high tide level of seashores are 3m in urban areas, 20m in agricultural areas, and 40m in forest areas. As shown in this diagram, a setback may include a strip of beach above the high-tide line (part of the “energy-dissipation zone”), and also a band of natural vegetation above the beach (here shown as an “easement zone”). Preservation of this band of vegetation is important, as it limits erosion, and also buffers buildings from storm surges and storm winds.



Source: Sustainable Coastal Tourism Handbook for the Philippines, 2002

If you do not know the setback regulations in your local area, check with your national or regional regulatory agency or office to determine the setback and permitting requirements for coastal construction in your area.

Solutions to beach erosion

As we have seen, any construction that is directly on the shoreline has the potential to cause beach erosion. Beach erosion indicates that coastline development has been sited inappropriately. Unfortunately, once this occurs it is often difficult to correct. Methods used to reduce beach erosion include ***“hard” engineering solutions*** that are permanent features designed to reflect or dissipate incoming waves and ***“soft” engineering solutions*** that do not involve hard structures. Examples of hard engineering solutions are seawalls, bulkheads, groins and jetties. Soft engineering solutions often simply involve good planning and prevention, and

sometimes removal of structures to allow natural wave action and natural sand transport to help restore the beach. More recently, soft engineering solutions also include **"living shorelines"** that involve planting seagrass beds and other native wetland plants, installing bio-logs of coconut fiber, creating oyster reefs, etc., that naturally protect the shoreline.

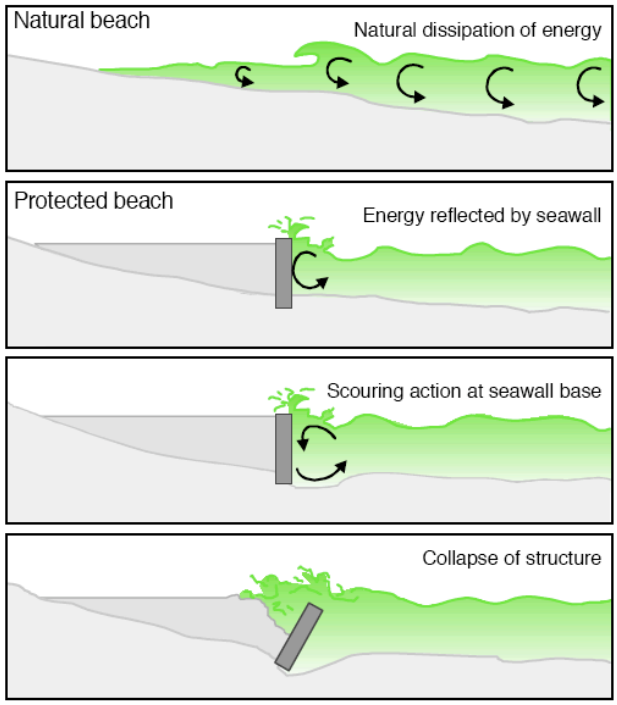
Soft engineering solutions are preferred because they retain the natural form of the shoreline and beach, and because hard structures, paradoxically, usually accelerate sand losses, especially in down-current areas. Hard structures also tend to cause wave forces that result in eventual destruction of the structures. Thus, once hard structures are in place, they are costly to maintain, and difficult to remove to correct a mistake or to adapt to new changes.

Nevertheless, hard structures are in common use, and MPA managers should be aware of the different types, and their relative advantages and disadvantages.

The best solutions will be those that are based on a thorough understanding of local wave action and tidal flux. Thus, it is important to work with coastal construction experts to determine the best shoreline stabilization method based on the local wave energy and sand transport occurring at that particular site.

Handout 8.10 - Hard engineering approaches

Seawalls, bulkheads and sheet piling are solid vertical walls constructed of concrete, masonry, or metal which all serve the same purpose. These methods are used to combat erosion because they require less material and space. However, due to their vertical nature, reflective wave energy is maximized, creating the potential for undermining and destruction of the beach or other land form being protected, as indicated in the following figure.

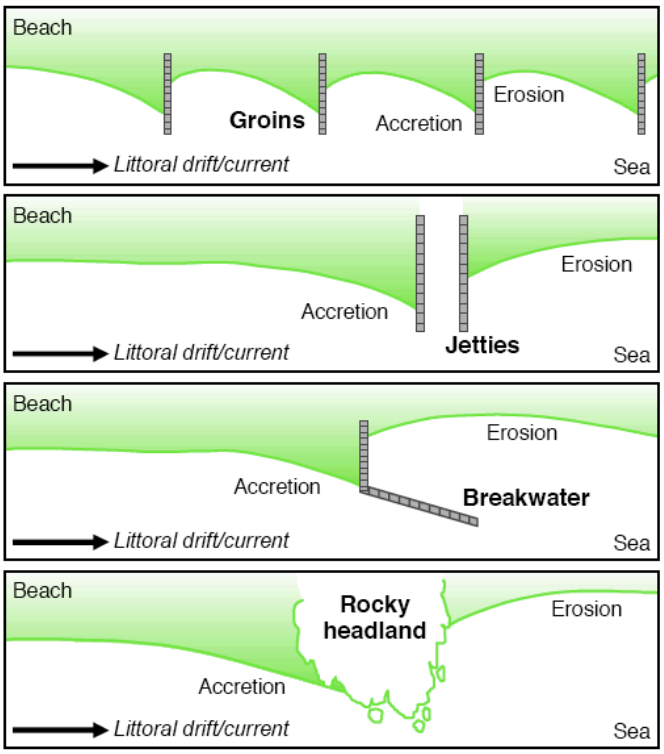


Undermining of a seawall built on a high-energy coastline.
Source: Sustainable Coastal Tourism Handbook for the Philippines, 2002

Due to the increased scouring action of waves at the base of seawalls, seawalls inevitably lead to loss of beach sand at the base of the seawall. Thus, though a seawall will temporarily protect the land behind the seawall, it is also virtually certain to accelerate loss of the beach in front of the seawall. And eventually, when the seawall falls, the land behind the seawall will be at greater risk than before, due to greater water depth due to loss of the beach.

Seawalls are a short-term solution only, and will usually accelerate loss of the beach over the long term.

Groins, breakwaters and jetties are structures predominantly built with rocks or concrete. Groins or their variations are placed perpendicular to the shoreline to trap sand on the up drift side by extending out into the water and interrupting the littoral drift, causing deposition of sand. However, after the water column loses its suspended sand load, its velocity increases, causing it to wrap around the groin and pull more sand away from the down-drift side, resulting in beach loss and erosion. (These processes occur naturally around rocky headlands.) Such structures tend to cause more problems than they solve unless they are very carefully designed and placed appropriately in relation to the shoreline features, drift and wave patterns of the water.



Source: Sustainable Coastal Tourism Handbook for the Philippines, 2002

Revetments (see handout) are sloping rock walls and similar protective structures that are used along the coast to prevent undermining and erosion of coastal lands. The slope of the wall and the spaces between the rocks act to dissipate wave energy and minimize reflective waves. They are often more affordable than more costly bulkheads, breakwaters, seawalls and groins.

Beach nourishment is another form of erosion control in which sand is brought onto an eroding beach to replace lost sand. Nourishment must be done periodically if beach erosion continues.

Nourishment is costly and since it is usually prohibited to mine sand, the source of sand may be limited or not available. An eroding beach needs to be analyzed for what is causing the erosion and the most appropriate solution sought considering nature, cost and legal restrictions.

In all options of protecting coastal areas from erosion, the science is highly imprecise and costly. Engineering studies, permits, building materials, construction, and long-term maintenance of the beach structure can be very costly, depending on the structure and the erosion forces of the area.

The only method of avoiding these costs is not to develop on beaches.

If development is to occur on these beaches, large setbacks must be used to prevent property damage and large costs.

When planning a coastal tourist establishment, the hazards of beach erosion may be avoided by following several "golden rules" for combating beach erosion:

- Understand the natural beach system before it is altered. Site-specific studies may be required.
- Develop a setback line before construction begins
- Never mine the sand from the dune, beach, or nearshore sandbars
- Where a major obstruction to longshore water transport is built, such as a harbor, use soft solutions, such as sand nourishment or diversion of channels, rather than hard solutions, such as revetments or seawalls
- Do not panic after a storm has drastically altered the beach. Wherever possible, let the normal beach cycle return the sand.

Exercise: Classification of beaches and siting of resorts.

For each type of beach setting in or near your MPA, locate the best location for placement of a resort. Use the maps and inventories that you have developed in earlier modules. Create a new map overlay with proposed site for tourist-use beaches and new hotels and resorts.

Hotels & other large buildings

As mentioned previously in module 7 (hotel siting), a very common problem is the encroachment of resorts on beaches. **It is of paramount importance that hotels be sited with generous setbacks from the high-tide line.** If resort structures are too close to the water's edge, they can be severely damaged or destroyed by large storm waves. For concrete or high-rise style resorts, the structures cannot be moved or removed, and resort owners are often forced to install seawalls and revetments to prevent structural damage, or offshore breakwaters and groins to help trap new beach sand. In turn these structures invariably prevent natural replenishment of beaches during favorable weather, and cause beach erosion of down-current beaches.

The net effect is an vicious cycle of beach erosion and increase in coastal fortifications, degraded aesthetics, increased costs for protection and artificial beach replenishment, and loss of nearshore marine life (plants, juvenile fish, crustaceans, etc.) as their habitats are slowly destroyed. New sources of sand then must be obtained elsewhere to place on the eroded beaches, which expands impacts to the other beaches where the new sand is taken from, well

outside of the resort area. In retrospect, a good resort plan could have avoided these environmental and economic problems in the first place, by requiring all permanent structures to be set back far enough inland so as not to be threatened by wave action and subsequent beach erosion.

In addition to proper setbacks, a number of other issues are important for environmentally responsible siting of large structures. Buildings should not be placed in sensitive terrestrial environments such as mangroves and rainforest, and should be grouped in nodes to allow clustering of infrastructure, and to centralize environmental impacts to a small area. Attention should be paid to siting near sources of sufficient fresh water, and near municipal infrastructure that is capable of handling, or can be upgraded to deal with, the resort's needs for water delivery, solid waste disposal, wastewater treatment, energy requirements, and transportation. (Review module 7 for further information on conservation of water, energy, etc.)

Marinas

Marinas should always be sited in areas with good water circulation, steep banks and natural wave and storm protection. To reduce potential damage to shorelines and the need for expensive and damaging dredging and bulkheads, boat slips should be placed out into the water and connected to shore with wharves. If important wetlands or other coastal features exist, developers should avoid building on or filling these areas.

Discussion: Coastal construction in or near your MPA

What scale of coastal construction has occurred in or near your MPA? Does your MPA include beaches, and if so, from what direction does the sand come? Where is the beach most vulnerable to erosion of future construction is sited inappropriately? Does this information modify your zoning plan?