IOI - BSOC Leadership Seminar "Using Today's Scientific Knowledge for the Black Sea Area's Development Tomorrow", A.S. Bologa & R.H.Charlier (Eds), Proceedings, 2000, 109-131

SUSTAINABLE MULTIPLE-USE AND MANAGEMENT OF THE COASTAL ZONE

R. H. CHARLIER[1], C. C. P. CHARLIER[2]

[1] Free University of Brussels (VUB), Belgium

[2] Weber State University, Utah, USA, now University of Arizona, Tucson AZ,USA

ABSTRACT

This paper will consider both the nearshore and the onshore sector of the coastal zone but stops short of the immediate hinterland. As the 21st century dawns, pressures on the littoral fringe intensify at an accelerating pace. Demands for its use are complex and numerous, with conflict steadily increasing. They encompass expanding human occupance, industry's search for water, implantation of transformation-facilities, processing, manufacture- and manutention plants, alternative energy installations, road-, rail- and air transportation centres, harbour space, terminals, maintenance and expansion of existing fisheries facilities, accomodation of various pipe- and slurry lines, siting of artificial islands of divergent purposes, preservation of touristic attractiveness, development of recreational installations, and - in some sites -exploitation of beaches and inner-shelf mineral deposits. Besides harmonising this vast array of exigencies, and rationally allocating space, managing must cope with environmental impact of multiple-use and the threatening aspects of sea-level rise posing the recurrent problems of coastal defence, beach restoration, and shoreline retreat.

KEY WORDS : multiple-use, users' conflicts, system conservation, implementation, communication, wetlands

INTRODUCTION

Global changes, global warming, greenhouse effect, sea level rise, many terms that have joined the already lengthy list of pollution, environmental impact, ozone layer, population explosion. Had the word "catastrophism" not yet been tapped to designate an orogenic theory, it could qualify as a catchword for today's problems. There is more: travel the central spine of Spain, let us say from Saragossa on, then veer towards Valencia, and one rapidly gets the feeling of being alone. Populations have left. The phenomenon is not unique: everywhere, but more so in already industrialised regions, man is migrating towards cities, in quest of a supposedly higher standard of living, and especially towards shore areas, in search of space, cleaner air, and water.

In the United States, for instance, predictions forecast an occupancy rate of the coastal fringe that could reach 70 to 80% within the next decade or so.[1] Are there already 50% of populations settled in the coastal zone ? Doubts have been expressed whether these estimates are correct and that as many people will live within 50 miles (90 km) from the coastline by the year 2000 and 2010 (MITCHELL, 1982; SORENSEN & BRANDANI, 1982; BRANDANI & SCHNACK, 1986; Anonymous, 1989; VAN HERWERDEN & BALLY, 1989). But 54% is believed to be realistic, while a 27% increase has occurred in a 20 years span. As a consequence, the coastal zone is under stress, a situation compounded by keen competition among existing and potential users. Concern for the future of the coastal zone has sprouted a great number of management plans, ranging from the US Coastal Zone Management Act (CZMA) to legislation and scenarios covering countries in South America, Australia and Asia. While individual countries have put forth some management schemes, Europe lacks a coordinated policy (KOEKKEBAKKER & PEET, 1987; VIGNEAUX, 1987; CHARLIER, 1987,1989). Present shifts in population and the search for littoral space by a broad array of users, constitute a strong motivation for working out plans for future management.

The coastal zone concept

The concept of coastal zone is not defined with geographical precision; in fact, it even varies with geographical location, and also with the discipline to which the specialists belong. On one thing, though, they all agree: its crucial importance for humankind.

Taking into consideration the physical reality, and the human activities, a coastal zone encompasses expanses on both sides of the "land-sea boundary", the inner part of the coastal shelf, and a hinterland. Its dynamics, in a delicate equilibrium,

[1] EDWARDS S.F., quoted in CHARLIER, 1989

are easily affected by natural processes and anthropic activities. Their impact can be felt at considerable distance in time and space: among man-induced processes are deforestation, river damming, pollution - both domestic and industrial - and marine mining.

Pressures in the zone

The coastal zone is subjected to several pressures, natural - such as erosion, sea-level rise-hazards - and human. The latter involves both use and increased migration.

Space, water, resources, opportunities have acted as magnets to draw individuals, developers, entrepreneurs, enterprises and industries towards coastal areas. The trend has gained momentum for some time. [CENDRERO and CHARLIER (1989)]. Taking the case of the Iberian Peninsula as an example, points to the spectacular drop in population in all interior regions, except around Madrid and Saragossa, as opposed to a rapid increase along the coast. Of the four million inhabitants of Cantabria, Basque-land and the Asturias, three are settled in the 15 km wide Atlantic coastal strip.

USES OF THE COASTAL ZONE

Demand on space

Coastal zone resources encompass the "goods and services" groups in the following broad classes: mineral and energy resources; seawater, bio-resources; prime space for ports, industries, communications; tourism and recreation opportunities; ground and surface water supplies; sand, gravel or clay recovery; residential areas; waste disposal.

Agriculture, animal husbandry, fisheries and trade establishments have been squeezed out. Natural coastal systems thus offer a wide range of resources, yet only a selected few are retained and then an attempt is made at maximising "production".[2] This approach entrains in many cases the waste of opportunities for economic and social improvements, but also leads to eventual degradation, destruction, even outright loss of others - already existing or still untapped.

Space "consumption" must likewise be regulated with a view to stopping landscape deterioration, a common consequence of anarchic tourism, and uncontrolled urban- industrial development. Wetlands restoration, free sediment transport, non-interference with dune-field coastal barriers will have to be programmed, and further land-filling, draining and reclamation curtailed;

[2] MITCHELL & COSSELINCK, 1986, cited in CENDRERO & CHARLIER, 1989

mangroves, reefs, deltas may not be further disturbed. Rehabilitation plans have been urged (CHARLIER & VIGNEAUX, 1985 a, b; VALLEGA, 1998).

Coal ports' impacts are related to site, construction, ecology, human aspects (construction workforces), operation, pollution (and the human health), biological resources, socio-economic situations, transportation, and even shoreline changes. Their mitigation requires a community- conscious approach of operations, and monitoring and surveillance of fugitive dust, leakage, marine habitat, noise and community disruption.

Whither to give priority to industrialisation or tourism-related development is an universally recurrent coastal zone management's dilemma. Only rational apportionment can solve it and provide negative-impact relief. If sheer economics are to prevail, then touristic areas will loose out if also suited for a harbour, a petroleum terminal, and/or a waste processing factory on an artificial island. The social outfall will be felt deep as existing social layers will be uprooted. Are long-term better paid jobs preferable to seasonal fishing and holiday-season services employment ?

Economic aspects

The ocean waters contain exploitable dissolved quantities of magnesium, calcium, bromine, potassium, sulphur and, of course, sodium (CHARLIER, 1987). Also present are copper, lead, zinc and silver. The continental shelf has deposits of sand, gravel, aragonite, phosphorite and numerous heavy metals, as well as gold, platinum, native copper and diamonds. Consolidated material present includes coal, limestone, sulphur, tin, to which one must add hydrocarbons. However, besides the traditional extraction of salt, and in this century that of hydrocarbons, little exploitation of marine minerals has been carried out nearshore (CHARLIER & DE MEYER, 1992). The oldest modern mining activity is retrieval of cassiterite, and dredging of sand and gravel for construction purposes. Bromine, magnesium and diamonds have sporadically been exploited. The shortage of materials on land may become a strong incentive for marine mining in the decades to come.

Multiple-use environmental impact

The coastal zone environment is severely affected by most human activities and it would be unfair to single out one user as the culprit. Multiple-use of an area merely compounds some noxious outfalls (BURBRIDGE *et al.,* 1989). The waste processing plants and treatment stations are often geared towards servicing the permanent population, and ruefully inadequate for the seasonal influx of vacationers; raw sewage is discharged into the sea. Cost-conscious industries often do not provide for purification of used waters or proper disposal of tailings or wastes. Large quantities of matter are commonly dumped: they range from dredged

materials to keep navigation channels open, building material, fine noxious particles, heavy metals to even radioactive materials. All this not to mention pleasure crafts generated pollution and hydrocarbon exploitation seepage (CLARK, 1989).

Pollution, eutrophication, sea level rise, erosion

Pollution abatement has been proposed for several decades and is a pressing matter: not only have "dirty" waters deleterious effects and metal contamination is a proven danger, but nutrient enrichment has resulted in eutrophication and algal blooms. The list of pollutions endangering particularly, but not exclusively, the coastal zone, is uncomfortably long ranging from agrochemicals to metals, wastes and industrial leakage, thermal effects, acid rains, extraction, etc.

Any management scheme must provide for relief of water pollution by potentially noxious substances. These considerations play a primordial role in marine resources utilisation planning, especially when there is no precise policy. Plastic matter too poses a serious problem as it may provoke strangling or dire consequences if ingested by marine dwellers.

Gradually spreading around the world, due to increase in nutrients' discharge, eutrophication, particularly of coastal zone waters, has become a nuisance for tourism and fisheries. It is followed by biomass proliferation.

Green tides

Concentration of populations and industries in the coastal zone seems to be the principal factor that has caused an environmental trauma in coastal and estuarine waters. Eutrophication is recurrent, since decades in Norway, Sweden and Denmark. Further south, it is common in The Netherlands, Ireland, Scotland and England. It affects France, Italy, Spain and Portugal. In the United States, eight states have to cope with the problem on the Atlantic, three on the west coast and Hawaii. In Africa blooms are reported in Tunisia, Senegal, Tanzania and South Africa, elsewhere in China, Japan, India, Australia, New Zealand and Guam. Its consequences are severely affecting the economy, principally where the tourism and recreational sectors are an important source of income.

Domestic and industrial wastes discharged without treatment, or insufficiently treated, increase the amount of nutrients present in coastal waters.[3] They have favoured proliferation of certain species of algae which, in fact, reduce the phosphatic nitrogen pollution. However, the algal material strands, decays and in turn becomes pollutive, starting again an enrichment phase. These biomasses have been designated by the term "green tide". Not only native species pose problems,

[3] SEFAR (1984), quoted in CENDRERO & CHARLIER, 1989

but "foreign" species have colonised eutrophicated European water, e.g. *Sargassum myticum*.

Deposits of algae on beaches and their accumulation in nearshore waters are unsightly and cause foul smells by release of hydrogen sulphide. They deter tourists, while pleasure crafts have problems navigating.

Counter-measures, short of punitive steps against polluting industries and coercive measures against municipalities that improperly discharge their sewage, consist in cutting algal beds and picking up the strandings. In some cases only tourism is at stake (e.g. Brittany), in others survival of fisheries depends on it (e.g. Orbetello, Italy). The costs of such operations are far from negligible; but also in many locations a water pollution is transformed in a land pollution. Indeed, picked-up material is transported to land dumps and left to rot, attracting insects, generating atmospheric pollution, and eventually contaminating phreatic layers, which in turn carry more nutrients to the regions where the blooms occur.

It might be advisable, if not necessarily economically profitable, to envision utilisation of the thus harvested biomass. Possibilities include composting, use as fertiliser, extraction of food and feed constituents, generation of biogasses and methane, even electricity production. These activities entail naturally providing space in or near the coastal fringe for such industries.

The blooms are prevalent where inlets, bays, gulfs are in narrow communication with the open sea, limiting waters exchanges and renewals, though they are not necessarily absent from less enclosed areas.

The green tide's management is part of any comprehensive coastal zone management plan.

Sea level rise

Sea level rise, of still debated magnitude, could reduce the extent of today's coastal zone. In industrialised countries, coastal cities could be flooded. Subsidence, anthropogenic activities (oil, gas, sand extraction, barrage construction) contribute to a beach "retreat" further exacerbated by offshore airport runways construction, coral reef exploitation, mining and touristic depredations.

Ocean energy systems

The "energy pinch" launched a frantic search for alternate sources of supply that included tapping ocean sources of power. Of the several possibilities, a limited number could conceivably be utilised in the immediate future, or at present. Enthusiasm waned as an "oil glut" developed. A renewed interest burgeons.

Nevertheless, ocean thermal energy conversion schemes are still tested, tidal power plants have been implanted or are under construction (France, Russian Federation, China, Canada, Korea) and wave-powered electricity systems have

been placed into service. In how far such installations compete for space is uncertain. They are few, many bar an estuary rather than being on the coast and some have been developed as multipurpose schemes (roadway, tourist attraction). Their impact has been benign and they are not unaesthetic.

Artificial islands

Ocean dumping of garbage and other matter being frowned upon, though still practised, a new approach has been thought up. It has been variously presented as a solution to overpopulation, siting of nuisance industries, implanting of additional airports, noise pollution abatement, and so on.

Some proposals have been euphemistically called "environmental islands" where nuclear plants could be located or waste processing plants built (CHARLIER & DE MEYER, 1992). Whatever their proposed use or label, artificial islands are increasingly proposed as one of the solutions to reduce the competition for space in the coastal fringe.

If indeed additional "acreage" is created by building artificial islands, the view is generally unaesthetic, noise from activities carried out there may be disturbing for coastal inhabitants, climatic or at least current modifications are bound to result, and the no-pollution pledge must be taken with reservations. Land extensions by building artificial beaches (e.g. Monte Carlo, Deauville) are a somewhat different matter, though certainly not problem free. Japan is definitely forging ahead with a very ambitious artificial islands program; airports are to be constructed, while in some cases - Ocean City Communications Centre - an entire "city" is to be built at sea, far more sophisticated and extensive than Aquapolis of Okinawa International Exposition memory.

Such islands would be the site for moorings for vessels carrying dangerous cargo, for fuel terminals and pipeline endings. While indeed space would be released, onshore, for more recreational and touristic activities, it remains a debatable matter whether the holiday-goer will accept to have his view blocked either by a "floating city" or an industrial settlement.

COASTAL ZONE MANAGEMENT

Multiple-use practice

Multiple-use has been practised in a variety of geographical areas, and flourished harmoniously. However, previous arrangements are far different from what contemporary competitiveness is generating.

Economic conflicts

Often strong economic pressure destroy multi-use systems: fisheries are squeezed out along the Belgian shores, mangrove is converted in shrimp aquaculture ponds in southeast Asia. Furthermore, in many regions, an economic conflict develops between the champions of total utilisation for industry, mining and commerce, and the "shared" occupance between these activities and tourism and habitat. Economic and environmental conflicts between the various users are inevitable, often deep-seated.

"The potential that complex resource system such as estuaries and mangrove forests offer to us in meeting social and economic needs lies in the maintenance of their functional integrity and their development for sustainable, multiple-use, not in their conversion or management for single purpose uses". Management systems often fail to harness resource potential offered by the natural systems: opportunities to improve economic and welfare conditions are lost, others are degraded or destroyed (HAMILTON *et al.*, 1989).

Management of processes may be more important than management of uses, which may better be based on complementarity. The "Coastal Zone Management" concept has gained acceptance in many non-industrialised countries e.g. in South America (MITCHELL, 1982; SORENSEN & BRANDANI, 1982; BRANDANI & SCHNACK, 1986; Anonymous, 1989; VAN HERWERDEN & BALLY, 1989). To achieve significant results, the natural functions of complex coastal systems, e.g. wetlands, should be correctly assessed, goods and services appraised, and practical techniques to promote system conservation and sustainable resource use developed. All three steps should be accomplished through a multiple-use approach. Yet, nearly universally, responsible instances nurture single purpose approaches.

Sectorial agencies make usually short shrift of activities outside their well delimited resource system; they find it difficult to grasp that multiple-use concepts are a logical alternative for fulfilling competing development objectives. Furthermore, experience in the United States has shown, for instance in the case of wetlands, that unharnessed private property rights are detrimental to good management.

Multiple-use has been practised and it flourished harmoniously. Yet is was discontinued often, due to sectorial agencies' single purpose programs geared to better returns. The trend has thus been to favour opportunities for social and economic improvements. However, these have, when unwisely approached, led to degradation, destruction and losses.

Conflicting uses

Shifts in populations and demands for littoral space by a broad spectrum of users have thus placed strong pressure upon the coastal zone. This trend has steadily

gathered momentum. Incompatibility plays a role. Jockeying for the best facilities is conducive to environmental degradation, e.g. tourism in the Mediterranean areas.

Incompatibility of uses

"Traditional ... agriculture, stock raising, fishing, ports ... have been joined ... by residential developments, tourism facilities ... industries, quarries ..., sand and gravel pits ... sand and gravel offshore mining, hydrocarbon extraction, storage and processing, conventional and nuclear power plants, mariculture, ... waste disposal, various forms of ... recreation." The "elbowing" has, as expected, exacted a toll (MEITH & HELMEER, 1982).

Wetlands and estuaries

Impingement of man upon wetlands has vastly reduced this area of natural productivity. Yet, they are among the most important breeding grounds, hence play a primordial role in the chain. Estuaries likewise provide breeding grounds and are nursery areas for coastal water fish during their early development stage.

Theoretically 10% of the wetlands could produce ten million tons of food per year or the equivalent of the world's commercial fisheries potential provided, naturally, the area is not ruined by pollution, and aquaculture is pursued according to improved scientific methods. A fragile environment, it is too often sacrificed to industrial expansion.

Coastal zones often encompass estuaries. The salt and freshwater contact creates a very distinctive aquatic environment undergoing constant evolutions. Estuarine circulation contributes nutrients to surface waters and retain plankton, particles and nutrients in adjoining coastal areas.

Unfortunately, estuaries severely encroached upon, often become a recipient for domestic and industrial wastes. "Estuaries are equal to or greater in productivity than oceanic upwelling system. At the same time, they are downhill and downstream from all the things we do on land. We put more nitrogen and phosphorus per acre into most of our estuaries than we do on our agricultural fields" (Scott Nixon, director University of Rhode Island Sea Grant Program). It is therefore necessary to identify pollutants' travel paths and assess constituents flows.

In Zaire, industrial waste dumping in the Congo River, had nocive consequences for river mouth and coast. A preliminary assessment of worldwide contamination has been presented by SEGAR and his co-workers. Modifications brought to an estuary may influence the coast to considerable extent and upon great distances. Mathematical modelling has been used in several geographical locations to assess such environmental stress. Except for karstic areas, occupation of the littoral zone of Cantabria has left barely 12% of natural vegetation; intertidal areas and wetlands, filled or reclaimed for 50%, could be obliterated if the trend is not checked. And

along the Mediterranean Sea Coast and around the Canary Islands, a concrete curtain of buildings has already caused irreversible destruction of important environments.

Priorities

Allocated priorities always create another dilemma in elaborating a management plan. The problems, not uncommonly, have an international dimension. Collaborative undertakings involving the pooling of techniques and data may be envisioned as exchange on an international scale, with acquisition of information on all stages of a coast's natural evolution, prior to any well thought-out intervention.

Demise of traditional multiple-use systems as in Southeast Asia lead to unemployment, city-centred internal migration, deleterious environmental impact, and limitation of development alternatives. Limits to growth and human societal changes can be indicated. While Economic Impact Assessment examines what consequences would flow forth from a proposed specific undertaking, Economic Assessment examines the ways environmental systems can assist development, and evaluates current uses and their effects. Often "uplaned areas" exploitation is responsible for deteriorating conditions at the coast.

The case of mangroves

Southeast Asia has far more mangrove coasts than sandy beaches, approximately 4.8×10^6 ha, the largest expanse being in Indonesia (about 3.6×10^6 ha). Mangrove provides timber, firewood, charcoal, resin, tannin, medicines, local-consumption foods. It is nursery and spawning ground for fish, shellfish, a feeding area for marine and land species. A suitable ground for aquaculture, it can attract tourism and accommodate recreation (HAMILTON *et al.*, 1989).

Mangrove, however, has been destroyed at an alarming rate; in Singapore, for instance, its coastal share went down from 12 to 3%, caused by inland deforestation and agriculture, coastal land reclamation and conversion, poor fisheries practices, discharge of domestic and industrial effluents, mining activities, oil and gas production, refining, transport and pollution, creation of fishponds, operation of salterns.

But the alarm button had already been pushed in 1983. A lack of concern for mangroves and a higher land-use value, allowed further deterioration through road construction, establishment of waste dumps, short-term wood exploitation, freshwater diversions, land-fills for coastal structures, conversion to agriculture, mining and implantations of aquaculture ponds. Of Thailand's 367,900 ha of mangrove forest in 1961, 310,000 ha were left in 1983, and just under 200,000 ha in 1987. Losses due to anthropic activities may be accelerated by those resulting from a sea-level rise. Of the 169,330 km^2 of coastal regions occupied by mangroves,

approximately 69,000 were in Asia, 61,000 in the Americas, 32,500 in Africa and 6,500 in Oceania (HAMILTON *et al.*, 1989).

Accomodation of mangrove sites and the rapidly expanding brackish water aquaculture ponds are probably possible; minimal damage is caused when the pond, connected by channels to the sea, is located landward of the belt. Most ponds provide a short-term profit because pond conversion has a devastating effect upon shrimp and fish found naturally in the waters, and it also adversely affects the lower socioeconomic class (HAMILTON *et al.*, 1989).

To establish an acceptable balance between pond conversion and mangrove conservation, management practices must be revised, achievable only through education and communication dealing with alternatives (SPENCER, 1966).

In planning for multiple-use in mangrove areas, zones with priority functions should be delineated. A possible priority use assignment might consider the following: **preservation zones** where communities should be kept free of human disturbance; here non-consumptive tourism and recreation could be allowed. In sustained yield wood and non-wood products production zones, timbering with provision for regeneration could be permitted; controlled harvesting of marine products and fishing should inflict only benign damage. **Conversion zones** are those where mangrove elimination is tolerable because of high salinity, low productivity or geographic isolation. **Hold zones** are those about which information is scarce, that should be kept in reserve until a valid assessment is made. As for **restoration zones**, they are depleted areas, or those once used for aquaculture but presently abandoned, that can be recolonized or restored.

HAMILTON and his co-workers recognise "that lack of familiarity with multiple-purpose mangrove management and lack of planning skills for integrating mangrove management into broader issues of coastal zone planning" has hampered restoration, reforestation and recolonisation efforts. If "adequate management and planning are to be achieved, there must be concomitantly programs to raise the level of awareness of citizens and politicians ... about the important role mangroves fulfil as part of the coastal complex". Any coastal zone management plan addressing itself to tropical regions must take into account the fragility of the area, and the major economic and cultural importance of mangrove and reef ecosystems (CLARK, 1989).

Leisure activities

Any touristic vocation assigned a coastal area requires a site reconnaissance that includes an in-depth geological study encompassing beach study, dune evolution, shoreline variations and subsurface lithology. The seasonal population increases overtax often inadequate water purification facilities.

Seashored and ocean-related outdoor recreational activities in the U.S., are concentrated for over 66% during June through August.

This century's last decades 5 million visitors to New York City's beaches became 61 millions by the time the sixties had come around. The U.S. National Parks Service suggested ten years ago that 15% of the shoreline be set aside for public use, but less than 10% is along the East and Gulf coasts.

In Belgium where the coastline stretches over a mere 67 km, the overall population grew over a 110 year span (1860-1970) by 160%, but this increase reaches 281% for the coastal fringe, even 979% for one locality (Knokke-Heist). Built-up areas grew country-wide by 130% in a half-century (1919-1968), but by 225% along the coast. In its quest for more space, tourism development may transform the sea-front into an uninterrupted line-up of buildings stretching from the Dutch to the French border. The steady impingement on dunes and woods may endanger recreational development, even put the very survival of tourism at risk.

Even if tourism has an enormous economic potential, it transforms the human settings and deeply influences the environment. It must thus be regulated.

Similarly along the New Jersey Atlantic Seaboard, the coastal recreation vocation is under a strong strain from energy development, particularly in the counties within commuting distance of New York City. Affluent resorts are adamantly opposed to any facility implantation (e.g. Deal) but the once thriving, now decaying resorts of Asbury Park, Ocean Grove, a.o., hard put to attract residential, even commercial ventures, would welcome plants, pipelines and ports. The highly on tourism dependent barrier islands municipalities would consider commercial development but oppose energy facilities. A Coastal Tourism Response Model has attempted to assess energy development impact on environmental quality and tourism.

Waste processing and energy production have generated several proposals of artificial islands offshore the Belgian coasts (CHARLIER & DE MEYER, 1992). In July 1994, four presqu'isles schemes for a new casino in Ostend were rejected. Indeed, coastal areas can be selected for the siting of artificial islands, waste treatment, airports, power- and fresh water plants, stilt-bridges, and even floating cities (cf. the de la Rougerie-scheme).

Economic and aesthetic values of the littoral environment are often no match for other uses. In less than a hundred years the Belgian coast changed from an indolent string of fishing villages, nestled between dunes and polders, to a succession of fashionable "spas", then to an uninterrupted chain of popular resorts, now challenged by industry and harbour development. Yet, accomodations apparently can be worked out (e.g. Zeebrugge).

Planning for redress in recreational areas includes protection and preservation of the natural heritage, creation of recreation parks, resolving the sore of camping sites, creation of car parks, and careful siting of weekend "structures". Yet, ten years after these lofty schemes were proposed, progress in their implementation is less than obvious in Belgium.

The influx of tourists into Morocco increased by 27.5% between 1981 and 1987. A national policy to promote tourism has been launched to improve touristic centres, to create new ones, and to establish a network of new pleasure craft harbours. The latter are seen as a way to valorise real-estate, enhance a touristic-commercial infrastructure, and an auxiliary means to provide better facilities for fisheries. R. Charlier carried out a coastal survey and feasibility study. The Moroccan government already selected several sites. However, some concern may be voiced as regards the environmental impact; a thorough assessment was not conducted and commercial aspects were the prime consideration in plan implementation.

As an example, one may take the number of "beds" available. In the two-year span 1984-1986 their number climbed from 61,000 to 86,000 - a 40% jump - and should overtake the 100,000 mark for the country as a whole. But, over 80,000 of these beds are made available in the coastal zone. The five priority touristic equipment zones provided for in the development plan are all but one (Great South Zone) on the coast: Tangiers, Al Hoceima, Restinga and Agadir. At Tangiers and Agadir respectively, areas of 12,000 and 60,000 ha are involved. But little has been disclosed about water supplies and purification. Nor has much been said about the social-cultural impact.

While the plan is sound, it stays short from a preliminary environmental impact assessment of the type required in the United States for instance. On the positive side, it behoves us to laud the absence of concrete "towers", so prevalent along Spain's shores, and the blending of four story buildings into the greenery. Except for Restinga-Smir, the architecture is Arab-Mediterranean style inspired. At Al Hoceima, for instance, bungalows have been nestled into the cliff.

Notwithstanding remarks made earlier, site selection was made upon specific criteria, viz. economic, technical, city planning and tourism-related constraints. The latter of these embodies environment considerations; particular attention "must be paid to aesthetically fit the port in the site, so that the natural equilibrium of the area not be disturbed". And a recommendation was made that disturbances brought upon the environment, and ensuing damage to natural resources, not outweighed port generated benefits.

Boating constitutes a major pollution factor and may endanger other forms of shore recreation. Severe controls consequently are necessary for boat effluents disposal, diesel and gas storage tanks, number of crafts limitation (MAZURKIEWICZ, 1992).

Worldwide piecemeal efforts to harmonise the growing needs of coastal recreation with economic development, environmental conservation and environmental protection lack coordination, sufficient funding and, often outright sincerity. Pollution has taken a very serious toll of shore recreation facilities.

The fallacy that the negative effects of tourism are felt only in countries with well established recreational facilities where they built-up by slow inurement, has

been, we believe, dissipated. Developing countries have an opportunity to work out a balance, an option not afforded the industrialised countries nor the late-comers on the touristic scene. The sea resort has first been searched for in Western Europe and North America because distances were in general relatively short, amenities of high calibre. Barriers with Eastern Europe came eventually down, but by then West Europeans and North Americans had already been awakened to the immense, unspoiled, littoral zones of Africa. Mauritania, Senegal, the Ivory Coast, Gambia and the pre-Saharan countries rapidly drew attention.

Coastal zone tourism, which is mass-tourism, is quite different from National Parks recreation areas. The latter pose no utilisation conflict, even through they are often gnawed at by influence-wielding parties. On the contrary, coastal tourism does compete with economic development of different sorts: industrial expansion, human settlement, building materials exploitation, fisheries, portuary and storage facilities, transportation centra.

Developing countries can benefit from the experience of the industrialised countries. They can make a deliberate, and hopefully judicious choice, including the decision whether tourism within pristine natural beauty will prevail.

Concern for the touristic value of the Southern Bali beaches, and the considerable equipment investment, has reached a critical point. This situation results from conflicting uses: removal of river-brought material is at the origin of beach retreat at Gumbrih Beach, coral extraction for decorative and construction purposes has caused serious damage to the beaches of Batumadeg, Samur, Kuta and Nusa Dua, and lengthening of the Ngurah Rai airport runway has threatened maintenance of Kuta Beach. In some instances, e.g. at Syut and Lebih, beach erosion has been caused by the shifting of a river mouth, while natural erosion, viz. wave attacks is taking its toll at Uluwatu and Tanah Lot. A major study was to plan protective, and probably restorative, action.

As some recreational activities are no longer economically viable as taxes increase and more profitable industries move to the coast, unless there is recreational input into planning and management schemes, the recreational opportunities will shrink, particularly public ones.

Planning involves re-establishing an adequate balance between product and user on macro-sociological and macro-economic scales. Localised effort has mostly little effect though good results were achieved in France (Port Grimaud), Italy and Spain.

PLANNING AND MANAGEMENT FOR THE FUTURE

Survey units

Planning is facilitated by carving up the coastal zone in survey units. Identification and classification of existing activities, and of proposed or potential

new activities should be next. Then possible impact and the uses' reciprocal influence should be assessed. These studies and assessments could be complemented by economic valuation of what the actual experience or activity of being on a coastal zone represents.

Ocean mining in the coastal zone is physically and economically complex and planning requires that sources and risks, resource allocation and owner's compensation, benefits and foreseeable economic rent be placed into the balance. A tailored mineral exploitation plan will examine proposed methods, environmental location and impact, conservation aspects and guarantees of a final maximum recovery.

Complementarity and parallelism

Future planning must consider relationships: from an economic viewpoint a beach and the adjoining touristic complex have an interaction quite comparable to a mine and a related processing plant. Can the interests of economic marine environmental development be reconciled and environmental protection insured, while avoiding or dampening varied users' conflicts ? All the while the international dimension may not be overlooked and political boundaries must be set aside in regional agreements.

Complementarity or parallelism of uses could be strived for.

Beneficial multi-use strategies should be planned. Basic issues common to all countries include improved assessment of natural functions of complex coastal resources systems, e.g. wetlands, economic and environmental value assessments, and techniques development for system conservation and sustainable use norms.

Specification of sustainable use

As CLARK (1989) puts it "The basic challenge of coastal area management and planning (CAMP) is the establishment of a balance between the maximising of sustainable resource production and the conservation of development options". To BURBRIDGE and his co-workers (1989) six steps allow to determine a sustainable use of potential non-exhaustible coastal zone resource: the coastal zone delimitation in a particular area, its subdivision into survey units based for instance upon landforms or ecosystems types, classification of existing activities, ecosystems and uses condition analysis, potential impacts identification, and undeveloped multiple-use potential (CLARK, 1989).

In Europe as in Asia international cooperation provides for scientific information sharing, fish stocks management and marine pollution abatement, yet priorities assignment hampers practical results. Integration of interaction among users, though, benefit sustainable development of coastal resources.

Coping with problems

Subject to natural evolution trends and several geological hazards, the coastal zone has their effects compounded by human interference. Frequently a close relationship exists between environmental quality and some important economic activities.

Coastline retreat

Coastal erosion's cost can be very high. Remedial action requires familiarisation with the genesis and the history of the beach, examination of the current state of the system, and the natural evolution trends.

Hard structures protection is expensive and requires continuous upkeep; generally, it transferred the erosion problem further down the coast. Beach protection and restoration, can be attained and coast erosion remedied immediately - but frequently such actions dismay both residents and vacationers by numerous prohibitions, dune restoration, beach nourishment with coarse sand, abandon of buildings, setting of a construction boundary line, end of flood control projects on rivers.

With sea-level rise how long is it sensible to try to hold back the sea ? Economic realities notwithstanding the forever stand will have to be abandoned and after each storm consideration will have to be given not to rebuild some homes. How well a community ultimately adapts to sea-level rise will depend largely on the direction it takes when it reaches this crossroads.

Coastal protection management can consider stabilisation, let nature take its course, or compromise. In the latter instance land-leasing, rather than selling and the use of movable buildings seem indicated. A management plan that ignores rising sea-levels, a gnawing erosion, silting access routes is futile. Disastrous floods do not affect only Bangladesh coasts; spectacular inundations wrought havoc on the Iberian littorals. Storms can wipe out a beach in a matter of hours, geological subsidence is not uncommon, seismic and volcanic affect many a coastal area (IOC, 1983).

Economic challenge

The size of offshore hydrocarbons fields and their location in relation to existing coastal infrastructures are factors to be considered in management schemes. Offshore facilities are usually backed by onshore support facilities, construction and repair installations, product transport systems, refining and processing and processing plants, and various bases.

Such activities can provide a forceful boost to the economy of the coastal area. But exploration is only temporary, so is construction. Coastal land-use patterns

are deeply modified as a freeze results for other uses. Conflicts ensue and effects must be mitigated; existing urban areas should be fully used, buffer zones surrounded offshore industry parks can be established. Expanded employment creates internal immigration, demand for more services, and housing. Development planning is essential to avoid massive environmental and social problems (MITCHELL, 1982; CHARLIER, 1985).

Fisheries have suffered most in employment and loss of breeding grounds. Laying of pipelines, debris scattering and space demands have major impacts.

High returns activities

Biological and geological resources' exploitation must be controlled to end stock depletion. Ground-water supplies, endangered by over-consumption; intensive agriculture, whose demands are considerable, may have to be reined in, thereby also reducing nutrients and pesticide laden runoff, thus water pollution and eutrophication.

DEVELOPMENT - RESOURCES - PLANNING

Waterfront sites are wanted by industry in search of cheap water, needed by various types of conventional and alternative power generation plants, and shipping facilities, and by the exodus of inland populations in search of purer air, whether as permanent settlements or as temporary recreation areas and touristic resorts. Even countries in the industrialised process are faced by the dilemma. Competition for coastal space is not only keen, polyvalent development is very difficult as possible uses are mutually exclusive (CENDRERO & DIAZ DE TERAN, 1989).

Ocean mining of the deep sea bed has potential environmental polluting effects on the coastal and neritic zone; surface discharges in the mining area result in settling of material, subsequent diffusion towards the coastal zone and, particularly if upwelling occurs in the vicinity, plankton, benthos and fish will be affected.

Planning for littoral fringe use in developing countries should pursue three main objectives: knowledge, exploitation and preservation. The initial phase of human occupance must be a technical and scientific assessment by multi-disciplinary teams drawn from academe and industry. Permissible limits of industrial development must be determined. Tourists cause often irreversible damage (CENDRERO, 1989).

Twenty years ago, the United States Commission on Marine Science, Engineering and Resources underscored that man's actions in regards to coasts and estuaries were incompletely and poorly planned and often destructive. Hence, a rational management of the coastal fringe should preempt further anarchic and irresponsible development. One could speak of planned "seasteading" as an urgent objective.

A judicious combination of coastline evolution and trend, human occupance, and economic potential maps would not only constitute a working dossier for multi-disciplinary teams of planners, but perhaps also weigh the benefits-disadvantages balance of major undertakings. Failure to project consequences when constructing the Volta River (Ghana) barrage of Akossombo resulted in drastic reduction of sediment apport near the mouth of the river and the disappearance of the cities of Ada and Keta (Ghana), while harbour extension and construction in Benin (Cotonou) and Togo (Lomé) led to disquieting coastal erosion (AKLE, 1986).

National coastal management policies and environmental legislation vary widely. In many countries, for instance the United States, coastal zone management already severely hampered by political fragmentation, is further hamstrung by extensive private ownership.

"At present, programs to study coastal processes (...) tend to set up independent monitoring and surveillance activities that ignore the interactions and so overlook the biological processes. This is an area where greater interdisciplinary interaction is badly needed (...): there are broad zonal patterns in ecosystems that transcend ... local variations. This highlights the need for the intercomparison studies (...) so that better and clearer generalisations can be derived".[4]

In the use-conflict, each single purpose assignment may appear justified in its own right, but a management that must approach a situation piecemeal cannot be successful: dredging and dumping are damaging to fishing, offshore hydrocarbon drilling impedes easy navigation, private waterfront ownership hampers public recreational development, establishment of industries impairs water quality even if located rather far inland as land use plays an important role in coastal water quality.

Deforestation along coasts in Southeast Asia to make room for traditional crops, and careless lumbering led to erosion problems with potential damage to river mouths fisheries. Slash-and-burn agriculture has contributed to siltation while artisanal farming practices result in shoreline accretion, problems compounded by coastal waters contamination by fertilisers and pesticides carried to the coast from inland farms.

Growth for growth's sake, pursued without thorough preparatory study, constitutes a dangerous lack of foresight. Great care should be taken that the unavoidable reduction of natural heritage be kept to a minimum and that any encroachment on the coastal environment be offset.

RESEARCH EFFORTS

Literally hundreds of natural and human scientists focus their efforts on coastal zone problems and conflicts. It is not certain whether this author could compile a

[4] see note 2

comprehensive list, yet such analytical effort, particularly where GIS (Geographical Information Systems) are involved, has been undertaken, at the University of Victoria's (BC, Canada) geography department by R.R. Canessa.

The proceedings of the yearly Coastal Zone International Conference constitute a good source for an overview. The 1994 meeting, in particular, strongly focused on multiple occupancy of the coastal zone. The chosen theme, "Cooperation in the Coastal Zone", was generated by the conviction the time was propitious for a broadly-based conference, a meeting that would bring together academics, scientists, engineers, but also inhabitants, users, managers, the public and community groups, as well as representatives of governmental bodies and industry.

Land-Ocean Interactions in the Coastal Zone (LOICZ), a project of the International Geosphere-Biosphere Programme under the aegis of the ICSU (International Commission of Scientific Unions), recognises the intensity of the exploitation of many coastal areas, hence the need for the creation of long term policies for a sustainable coastal management; this, in turn, requires a predictive understanding of the impacts of changes in climate, land-use and sea-level on the global functioning of coastal systems. Worldwide data are inadequate, so new methods of simulation and prediction of coastal zone response to global change are needed.

LOICZ proposes to determine fluxes of material through the coastal zone, the transformation and storing capacity of coastal systems, and the effects of changes upon them. It plans to include impacts of changes and outfalls of coastal systems responses in its studies. The work plan encompasses the effects of change in external forcing or boundary conditions on coastal fluxes, coastal biogeomorphology and sea-level change, carbon fluxes and trace gas emissions, and economic and social impact of global change on coastal systems.

CONCLUSIONS

The coastal zone is the major attraction pole for settlement and economic development. It has also a high potential for recreative and touristic use. A keen users competition exists and will exacerbate a growing conflict.

With this intense demand for space come stress and pollution. While sometimes irreversible damage has occurred in some countries, areas under development may benefit from the experience of industrialised countries and safekeeping the natural heritage with still concomitant economic progress. To insure this balance rigorous planning, not piecemeal or anarchic steps, must be enforced; it requires a multi- and interdisciplinary effort.

It is recommended that such a concerted approach be organised to insure minimal unfavourable impact.

The attraction of resources and opportunities has led to increased occupance, stresses deterioration, conflicts between users, and between exploitation and

conservation. Planning strategies must be based on detailed area knowledge, mapping, zoning, analyses, evaluations and inventory taking. A coordinated policy of research, planning and management backed by public support will foster positive action.

A management plan must consider area single or multiple vocation and aesthetics. A search for financing sources and an assessment of benefit-cost ratios are ingredients of the economic forecast. Where a touristic determination is intended, a site reconnaissance, environmental study, exploitation strategy and presentation scenario are necessary preliminary steps (CHARLIER, 1992).

Needed actions cover preservation and protection of fragile environments through legislation, purchase and control, promotion of non-destructive uses, elimination of waste disposal operations, production of descriptive, diagnostic and prescriptive maps, delimitation of marine mining areas, pollution abatement, building regulation, biomass exploitation, minimisation of natural hazards, preservation of high quality soils, E.I.A., and development of programs of public information and - education, nurturing of general awareness of the need to protect the coastal zone and promote conservation and management cooperation.

Major coastal zone processes should be continuously monitored. Mapping can play a major part in several of these steps as, e.g. shown in Oman (SALM and DOBBING, 1989). It can help formulate policies and identify areas. Thematic maps are particularly helpful (BOLLING, 1978).

Programmes to study coastal processes associating climate, weather and fisheries frequently ignore interactions and thereby overlook essential elements of the system they try to define. The domain is in need of greater interdisciplinary intercourse. Often parochial, they concentrate on specific physical features though broad zonal patterns transcend, in ecosystems, local variations. Effective management guidelines, can only be formulated if generalisations can be derived and local observations be extrapolated.

To achieve a tolerable balance in the coastal zone, managers and researchers ought to end lip-service to interdisciplinary approach and effort, and implement them, while developing communications skills so as to enroll public support.

The casual approach to coastal zone occupation and use must bow to the imperatives of the coming decades: scientific approach and careful planning, resistance to selfish private interests, a "global" approach, synchronisation of legislation - where it exists - at least on a regional basis, and, where the law lags behind the times, well thought-out rules must be implemented. In this regard, one can rightfully deplore the still prevailing lack of common legislation in the European Community, and the frequent overlapping of many and varied jurisdictions in individual countries. A coherent, integrated policy of inventory, diagnosis, planning and management and research is needed. Research, multi- and interdisciplinary, overarching the natural-, social- and engineering aspects should deal with basic theoretical topics but especially aim to provide short and long terms solutions to planning, development and management. An inventory of the units and resources,

sites, an analysis of natural hazards with affected areas, periodicity and preventive measures design, of natural processes, of the geological picture, determination of treshholds, environmental relationships and resources, and an analysis for flow trends for populations and capital should be part of the overall picture.

L. Mermet, in a thesis presented to the University of Paris-Dauphine, stresses the idea of common action: "our common action modes are ... insufficient where community management (*gestion coommunautaire*) are concerned, this being a management wherein the actors, rather than to rely upon the « collectivity » for all common problems, make every effort to solve them, each by tailoring his/her actions according to his/her place and responsibilities, within the framework of an active process of communication and exchanges. Ideally such community management could bring each ones's intentional management to converge towards an effective management which, effectively, would translate the group intentions of the community". He then appropriately introduces the concepts of adaptive environmental assessment and management, environmental meditation and patrimonial audit. All would contribute to a global approach which could apply evenly to the coastal zone and inland areas.

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