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Author(s): **George Alexandrakis, Nikolaos kampanis (FORTH subcontract)**

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HERMES - A Harmonized Framework to Mitigate coastal Erosion promoting ICZM protocol implementation

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Coordinator	Ioannis Tsoukalidis	Paggaion Municipality		
WP Leaders				

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1 Abstract

This deliverable purpose is to document Best Management Practices in Erosion Mitigation. The management protocols will be based on existing management protocols from other International coastal areas. While coastal erosion issues can be seen Cyprus developed coastlines, a management plan or protocol to mitigate the impact of eroding coastlines doesn't exist so far. Such management plans have been developed in the United States, Australia, UK and other countries. Assuming the projections (IPCC 2001) for climate change, rising sea levels and variability in the frequency and intensity of storms to be correct, coastal realignment will be outside of recorded experience. Coastal economies may be faced with more erratic and severe business cycles and uncertain economic growth, especially for those economies dependent on quality beaches to sustain their existence. The level of economic activity in coastal areas can be linked to the existence and perceptions of existence (through the media) of 'a wide sandy beach'. The damage caused by major storms can be economically disastrous both in terms of the cost of rehabilitation, but also the downturn in tourist visitation. Loss of a beach can result in substantial local and non-local systemic economic effects, through lost recreational, industrial and environmental values, thus proactive planning is the key to the future. Proactive planning is required to develop measures to reduce the impacts of these highly unpredictable events. While this approach may seem unnecessary and costly, such a precautionary approach will avoid the considerable cost of reactive responses or recovery measures. Unless there is a dramatic change, Gordon (2000) considers that this "laissez faire" approach to coastal management, especially during the last twenty years has condemned future generations to an unenviable legacy of liability and loss of beaches, public reserves and private property (Gordon 2000). Beach management strategies have been implemented on the various areas, dealing with short and medium term coastal variability. Although, those are sporadic approaches and are based on the construction of coastal defences to mitigate the impact and not in the prevention of the phenomena. Longer term policies will need to be developed to deal with the potential loss of beaches and the lack of sand to replenish them. In the USA, as a response to erosion from rising sea levels, several States in the USA have legislated against the use of hard structures, opting instead for planning approaches (Zhang et al 2001). There are still major gaps in our understanding of how the natural coastline dynamics (and hence the viability of beaches) will behave under extreme events, in adapting management strategies to these changes and planning measures needed to prevent undesirable reactive processes.

2 Introduction

Cyprus is the third largest Mediterranean island, situated east of Greece. The coastline measures about 735 km of which 50% is under the control of the Republic of Cyprus and 50% under Turkish occupation. The coastline is characterised by sand, gravel and rock formations. The main climate change impact Cyprus has to deal with is persistent drought resulting in freshwater shortage. In addition, 30% of the coastline under control of the Republic of Cyprus is subject to erosion. Cyprus has not experienced any severe floods from the sea in the past. Also in the coming years, Cyprus is not expected to become very vulnerable to sea flooding. Research results (e.g. IPCC) suggest only a small SLR and the country is experiencing a land lift-up counteracting this potential effect. Nevertheless the coastal zone of Cyprus is a valuable and vulnerable area. This zone, in which most urban development and economic activity takes place, covers 23% of the total country's area, 50% of total population and 90% of the tourism industry. The most vulnerable part in this regard is the low-lying region of Larnaca located on the south coast of the island. Erosion constitutes a greater threat than flooding especially for the sandy and gravel beaches of the island. At the moment, 38% of the coastline is already subject to erosion, mostly the result of human activities such as beach mining, dam and illegal breakwater construction and urbanisation. Climate change could worsen this situation. The *Coastal Section of the Ministry of Communications and Works* is the main actor involved in coastal defence. Permission for coastal defence works needs to be obtained from different governmental departments as well as local authorities. The *Coastal Section of the Public Works Department, Ministry of Communications and Works*, is the agency responsible to plan, design and survey coastal protection and improvement works. Before any protection works can be carried out, permission needs to be obtained by the *District Officers, Ministry of the Interior*, who are the owners of the coastal zone. Such a permit is subject to an environmental impact assessment to be approved by a *Technical Environmental Committee*, subordinate to the *Environment Service of the Ministry of Agriculture, Natural Resources and Environment*. Several governmental departments are represented in this Committee as well as delegates of the ecological and environmental NGOs of Cyprus. At sub-national level, the municipalities are involved. Municipalities have their own technical department responsible for issuing town planning permits in their area. However, for coastal structures, they also need to obtain the permission of the *District Officer, Ministry of the Interior*. Financing of the coastal protection structures is shared between the government and the municipalities. The *Water Development Department, Ministry of Agriculture,*

Natural Resources and Environment, is the agency responsible for water resource management in Cyprus.

3 Background

Access to wide sandy beaches and maintaining these beach conditions are critically important to the community, beach tourism and coastal economies. Severe erosion from storm events not only endangers property and infrastructure along the coast, but more importantly, through the loss of the “beach” destroys the foundation of coastal economies. Any rise in sea levels will make such impacts even more dramatic. The coastline is a very valuable commodity to many of coastal communities because it attracts economic activity. The economic activity is in the form of tourism and supporting industries, and from local recreational, social and cultural activity. Most of Cyprus population lives within a few kilometres of the coast and any adverse or beneficial effects on the beach and dune systems of the coastline will be felt by most of the population, either directly or indirectly.

The tourism industry in the island plays a leading role to its economic growth during the last decades (Manasakis et al., 2013). Moreover, it has consistently acted as the interface for strong inter-sectoral connections with further multiplying growth effects. It has been estimated that approximately 40% of the local population is, directly or indirectly, involved in the tourism industry.

While coastal erosion issues can be seen in Cyprus developed coastlines, there has not been a management plan or protocol to mitigate the impact of eroding coastlines. Such management plans have been developed in the United States, Australia, UK and other countries. If the projections (IPCC 2001) for climate change, rising sea levels and variability in the frequency and intensity of storms are correct, coastal realignment will be outside of recorded experience. Coastal economies may be faced with more erratic and severe business cycles and uncertain economic growth, especially for those economies dependent on quality beaches to sustain their existence. The level of economic activity in coastal areas can be linked to the existence and perceptions of existence (through the media) of ‘a wide sandy beach’. The damage caused by major storms can be economically disastrous both in terms of the cost of rehabilitation, but also the downturn in tourist visitation. Loss of a beach can result in substantial local and non-local systemic economic effects, through lost recreational, industrial and environmental values, thus proactive planning is the key to the future.

Proactive planning is required to develop measures to reduce the impacts of these highly unpredictable events. While this approach may seem unnecessary and costly, such a precautionary approach will avoid the considerable cost of reactive responses or recovery measures. Unless there is a dramatic change, Gordon (2000) considers that this “laissez faire” approach to coastal management, especially during the last twenty years has condemned future generations to an unenviable legacy of liability and loss of beaches, public reserves and private property (Gordon 2000).

Beach management strategies have been implemented on the various areas of Cyprus, dealing with short and medium term coastal variability. Although, those are sporadic approaches and are based on the construction of coastal defences to mitigate the impact and not in the prevention of the phenomena. Longer term policies will need to be developed to deal with the potential loss of beaches and the lack of sand to replenish them. In the USA, as a response to erosion from rising sea levels, several States in the USA have legislated against the use of hard structures, opting instead for planning approaches (Zhang et al 2001). There are still major gaps in our understanding of how the natural coastline dynamics (and hence the viability of beaches) will behave under extreme events, in adapting management strategies to these changes and to planning processes needed to prevent undesirable reactive measures.

4 Current planning practices

4.1 International Examples

In 1971, Florida's Legislature passed a law requiring coastal construction setback lines for counties along the sand beaches fronting the Atlantic Ocean and Gulf of Mexico. This legislation was introduced because Florida has 'a serious beach erosion problem' and some development interventions, such as vertical seawalls, had magnified erosive forces (Purpura 1972). The Florida legislation prohibits construction, excavation and dune and vegetation damage seaward of setback lines, established through a rigorous statutory assessment process. Setback lines were established on the basis of technical studies, including historical data and field measurements of all relevant factors, such as dune elevations, erosion trends, storm surge, wave action, vegetation lines, coastal structures and inland development. The legislation also requires that setback lines are reviewed every five years or sooner if proven necessary (Purpura 1972). Accordingly, Canada, in New Brunswick, remapped the coast to delineate vulnerable coastal features and defined setback for new development from this limit. Other Canadian provinces have adopted setback policies based on future coastal retreat estimates (IPCC 2001).

In Australia, state governments have adopted setback criteria for beachfront development, although these vary between States. South Australian setbacks are based on the 100 year erosion trend and storm surge flood level with a projected sea level rise of 0.3 metres by 2050, and development prohibited on sand dunes and vulnerable coastal cliffs. Major developments must be based on 200 year projections (RAC 1993). The Western Australian Government prohibits development within 100 metres of the shore, with additional setbacks for erosion areas, based on the 100 year erosion trend. Beachfront setbacks are measured from the line of permanent vegetation at the base of the foredune, and estuarine setbacks are above the 100 year flood levels (RAC 1993). In Tasmania, development below 3 metres AHD (Australian height datum) must take account of erosion, storm surge and sea level rise projections. The 1988 Victorian Coastal Policy prohibits development on fragile or unstable areas (RAC 1993). The Coastal Policy requires coastal development to take account of coastal processes, particularly minimizing interference with sand movement in the beach system, prohibiting development in areas subject to marine erosion and requiring the design of major

developments to reduce potentially undesirable impacts (Victorian Government 1988). Queensland setback levels were based on a 50 year erosion trend plus allowances for cyclonic erosion events, storm surges, scarp slumping and sea level rise, multiplied by a safety factor to retain a nominal foredune should these events occur. In 2000, the State Coastal Management Plan established an integrated approach to coastal management throughout the State. The New South Wales State Government Coastline Management Manual (1990) provides guidelines for local Councils to determine setbacks, based on a suggested minimum setback of new development above the 50 year erosion trend with a preferred setback based on the 100 year erosion trend (RAC 1993).

In the Baltic areas, the responsibility for planning of coastal protection schemes usually is located at a national level. The most frequently applied policy options in the coastal zone of the Baltic area are hold the line and limited intervention. Limited intervention is applied in areas where the threat to economic values is small; the advantages of dynamic coasts for nature conservation have also been acknowledged in the Baltic. Hold the line is still applied when high economic values are threatened by erosion, historically it was mainly executed with hard measures like seawalls, revetments, slope protection, groins and more sparsely detached breakwaters. However since the 1970s a shift towards the use of soft measures, nourishments started in Germany and Denmark. The last decade this shift has taken place in all Baltic area countries and the use of nourishments has increased significantly in the entire area. Hard measures turned out to be failing after some time by storm damage or increased foreshore erosion, and furthermore caused increased erosion downstream. Nourishments, although only temporarily effective, have shown to be successful in mitigating the effects of interruption of longshore transport and not causing a disturbance of the natural equilibrium in the Baltic area. Repetition of nourishment is needed for effectiveness on the long-term. In the past, private landowners or local groups have often tried to protect their property individually in the Baltic Sea area. This individual approach often resulted in unprofessional designs and a lack of maintenance causing quick deterioration of the structures, and a lack of common approach causing the problem to be moved but not solved. Through the failures of these coastal protections, the importance of a common approach, a design by professionals and good maintenance was acknowledged in the Baltic area. However, maintenance is still relatively poor and underestimated in some parts of the Baltic. Besides, or even instead of, measures to stop or slow down erosion, measures like foredune and forest maintenance are applied to mitigate the effects of storm surges in the Baltic. This strategy has shown to be cost effective

mainly in low labour costs countries like the Baltic States. This is likely to change with entry to the EU, when labour costs probably increase. ICZM is in a very early stage in the Baltic Sea area, though some ICZM programs have started the past years (HELCOM, VASAB 2100). In some projects steps towards integral approach for the planning and financing process is seen (mainly in Denmark and Germany), furthermore the importance of other functions besides safety, like tourism and nature, has clearly been acknowledged but this has generally not yet been implemented in legislation and organization in the Baltic area.

In countries of the North Sea, the effect of sea level rise on coastal defence measures is recognized and coastal zone management plans are developed, in which the future erosion is taken into account. As a result of the economic situation, it is expected that these countries may be able to counteract the future erosion more easily. Historically the most frequently used policy option was to hold the line when safety of human lives and of economic investments are at stake. This was mainly executed with hard measures, but the last few decades the emphasis is shifting in the direction of soft measures (e.g. nourishments). Do nothing has historically been applied when no investments or human lives were threatened. Later, the option do nothing is also suggested when a coastal protection measure would cause too much negative effects at adjoining coastal stretches or when this option enhances the natural behaviour of coastlines and estuaries. In the North Sea countries in general a growing awareness of environmental issues has developed among the general public and politicians, especially during the last few decades. As a result of the economic situation and the rather high population, authorities are willing to invest in the preservation of areas that are valuable from an ecological point of view, such as salt marshes, mud flats and islands where bird colonies breed. A rehabilitation of the natural sea-land environment, new technical potentialities and political accents have made that since the seventies preference is given to "soft" measures, i.e. beach nourishment, respecting the natural dynamics of the shoreline (coast or estuary). A further advantage is the sufficient availability of sediment in the relatively shallow North Sea. On the other hand, the long-term consequences of structural deepening of the foreshore due to sand extraction are not well known. A less accepted policy option is managed realignment. Large flooding in the past with loss of life and property left a legacy in present day attitude towards coastal zone management in low-lying countries in the North Sea region. The general perception of the necessary defence against the sea makes hinder the acceptance of the managed realignment option. Despite this, at least in South-East England a major change in policy in

the direction of managed realignment is observed, which recognises the implications of coastal squeeze with its loss of intertidal land and the value of recreating habitat both for nature conservation and as a contribution to a more sustainable sea defence.

In the North Sea area, most countries have a long tradition of coastal management and of integrated strategies. Compared to other countries in Europe, these countries have therefore made most progress in establishing ICZM, although national legislation concerning ICZM is not present yet in any of the North Sea countries. It is clear that there are moves to develop ICZM – either on a statutory or non-statutory basis – in all the North Sea countries.

The Atlantic Ocean borders Western Europe along the following EU-countries: the United Kingdom, Ireland, France, Spain and Portugal. The policy option ‘hold the line’ is often applied when seaside resorts or other recreational facilities are at risk. Especially in the southern countries France, Spain and Portugal but also often in the southern part of the United Kingdom and Ireland tourism plays a leading role at the protected sites. Furthermore, high population densities and economic investments are protected applying the policy option hold the line, like in the United Kingdom, Ireland and Portugal. ‘Do nothing’ and ‘managed realignment’ are possible at some of the seaside resorts and recreational facilities if the capital at risk is relatively low and the recreation facility or houses can be moved landward without too many problems. ‘Do nothing’ is usually applied at cliff coasts where no flooding risks are present and therefore the capital at risk is relatively low. In a flooding area, a new defence line is usually defined (thus “managed realignment”). At many sites along the Atlantic coast, a mix between hard and soft engineering solutions is adopted when dealing with erosion issues. Various types of hard solutions were applied in the cases considered. Although applied in nearly all cases, beach nourishments are executed on a much smaller scale (in terms of m³) than in the North Sea and the Baltic Sea regions. Whereas in the North Sea regions soft measures are often taken to combat erosion, along the Atlantic Ocean coasts the soft solutions are often combined with hard measures, probably due to the high energy conditions of the coast. Integrated Coastal Zone Management is still in an orienting phase in the Atlantic region. About half of the regions have developed some kind of progress in ICZM. Although national ICZM policies are not yet present in any of the Atlantic Sea countries, on a local scale it is implemented by means of for instance interregional cooperation (e.g. Normandy and Picardy, France). The ICZM-projects (OSPAR) mainly concern environmental issues and they are executed mainly on a local scale. Some of the TERRA and LIFE projects focus on coastal erosion issues.

4.2 Mediterranean Sea

Coastal management, since about 1960, resulted in some heavily engineered coastlines in the Mediterranean Sea at places where human interests had to be protected. By building hard constructions erosion was tried to stop. Although in many cases the works did not have the desired result, many seawalls and groins continued to be constructed and shifted the problems to the future or neighbouring areas. As the pressure on the coastal zone due to human-induced activities and relative sea level rise keeps expanding, the need for sustainable solutions that do justice to the environmental values is growing. Over the last decades a trend is visible towards more flexible solutions. Soft measures (nourishments) are being applied more often. A disadvantage of nourishment is a necessary repetition and possible (irreversible) damage to sea grass communities (*Posidonia Oceanica*). Integrated Coastal Zone Management principles are not commonly used in the Mediterranean. Some of the cases illustrate management curtailed to the specific area.

Black Sea respect tourism is the most important factor for most sites on the Black Sea. The applied policies to deal with coastal erosion vary, from limited interventions; hold the line, to do nothing. In the Danube delta only a small percentage of the beaches are kept at their place (hold the line) and the remainder is allowed to prograde and retreat (do nothing). This follows from the role of the Danube delta as an ecologic, rather than in economic important area. The hold the line option is applied in Bulgaria and Romania, where economic factors are at risk. Technical measures on the Black Sea shores are mainly hard, experience with nourishments are limited and not very positive. The not-so-positive experience is related to the technical details of the particular nourishment, and not with technique in general. Hard measures vary from dikes and sea walls to detached breakwaters. The effectiveness of the hard measures varies strongly on their design in relation with the erosion problem. Future developments follow the trends that are observed today. Pressure on the shorelines will undoubtedly increase, when inhabitation and tourism increases as the economy in Bulgaria and Romania grows. An accelerated rise in sea level may add to the already existing problems. Integrated Coastal Zone Management is starting in Bulgaria and in Romania. Coastal zone management plans are being developed, with strategies to deal with erosion and environmental rehabilitation.

4.3 Greece

Coastal defense covers two related but distinct issues: (i) coast protection, concerned with works designed to manage or prevent erosion of the coastline; and (ii) sea defense, which relates to schemes intended to manage or prevent flooding or inundation of the coastline. Today, coast protection works are the most common type of coastal defense, mainly consisting of structures designed to resist natural processes, such as wave action and sediment movement; commonly called “hard engineering” options, they include various constructions such as vertical sea walls, groynes, breakwaters, revetments, flood embankments, placement of gabions and rock armouring. Approximately 15% of the eroding (4.20% of the total) shoreline length of Greece is artificially protected and 4% of the eroding (1.1% of the total) shoreline length continues to erode despite the protection measures.

Along the Hellenic coast, vertical seawalls (built of concrete or rock) usually accompany and protect coastal roads (e.g. the coastal road at Nea Makri (Chatzieleftheriou et al., 2007)). In many cases, especially where the beach zone is narrow, rock armorings are used to protect the toe of the seawall against undermining. The most common ‘hard’ defense currently employed to protect private property and infrastructure of low importance and economic value is designed walls and revetments constructed of boulders of a rather uniform size (rock armorings), typically many tonnes in weight. Similar structures, formed from precast concrete blocks, are commonly used for the protection against coastline retreat of reclaimed coastal lands, coastal installations of greater importance, or areas of higher aesthetic value, such as the “Peace and Friendship” Stadium and the Olympic Beach Volley Stadium at Faliron Bay (Attica). In rare cases, gabions (wire baskets filled with stone and stacked vertically or damped horizontally) have been used temporarily for shore zone stabilization, as in the case of Xilokastro. In other cases, the dumping of piles of rocks tipped over the coastal edge has been applied to prevent further erosion in areas of low conservation value. The second most popular protection method during the past decades has been the construction of groynes, generally perpendicular to the coastline, designed to intercept sand and gravel movement along the beach; these have usually been constructed of boulders with a concrete or asphalt top pavement in areas of high wave activity, e.g. Gournes beach, or of timber in beach zones that experience relatively low wave energy, such as the Dilesi beach (Poulos et al., 2002). Recently, concrete-filled geotextile tubes have been used for the construction of less obtrusive groynes in recreational beaches, with limited success

especially in beaches with significant on-offshore transport. During the last one or two decades the construction of groynes is being gradually abandoned, mainly due to their limited success in areas with low longshore sediment transport rates, their obtrusiveness and problems with downdrift erosion. In open beaches with a significant onshore component in the nearshore wave energy field, the construction of emerged shore-parallel offshore breakwaters has been quite successful.

Submerged offshore breakwaters are becoming increasingly popular during the last two decades and in some cases they have successfully replaced existing groyne systems, as in the coastal zone of Katerini. In areas with a high conservation value, “soft engineering” options are often preferred. These are designed to emulate, harness or manipulate natural processes. The most commonly used “soft” protection methods are beach nourishment or recharge, sediment recycling and stabilization of coastal dunes with vegetation. Beach nourishment (addition of sand or gravel to a beach to restore former levels or to improve current ones) has been used primarily for the maintenance or creation of beaches associated with large hotel units or coastal recreational facilities, either as a standalone measure or in conjunction with a “hard protection” measure, usually a detached submerged breakwater. In many cases, such actions were undertaken during the low-season touristic periods either without the required permissions or by public authorities without proper studies (e.g. Gournes, Crete). Sediment recycling (transport of beach sediment from the down-drift end of a beach back to its up-drift end) has been used in beaches with significant longshore sediment transport, such as the Ag. Ioannis-Gyra beach zone in Lefkada Isl.

Additionally, other semi-technical semi-managerial schemes may be considered, that incorporate coastal defenses by combining elements of hard and soft engineering and a managed back retreat (removal of coastal defenses inland to permit the natural evolution of a beach and, if the coastline is retreating farther, supply of beach sediment).

5 Coastal defence, risk reduction and adaptation plans

In Cyprus, coastal defence is concentrated on the problem of erosion. Furthermore measures are undertaken to counteract the issue of freshwater shortage. Cyprus is gradually developing MasterPlans to protect the entire coastline against erosion and fights the problem of water shortage with theimport of freshwater from Greece. Specific climate change scenarios are not taken into account in anyof these actions as related research is still lacking.At present, the Environment Service of the Ministry of Agriculture, Natural Resources andEnvironment has the intention to launch besides a vulnerability study also a tender to establish a national climate change adaptation plan. Coastal areas will be included, but further details are notavailable at this stage.

5.1 Measures taken to counteract coastal erosion

In the period 1993-1996 a coastal zone management projects was carried out with the objective to identify proper protection methods and improve the quality of beaches without causing seriousimpacts on the environment. The project budget amounted to € 1 million.The entire coastline of the Republic of Cyprus was divided in 12 'sections' or coastal areas based ontheir morphology. Master Plans as well as conceptual and detailed designs were developed for threeof the twelve coastal areas (Limassol, Larnaca and Paphos South). The 3 sections were selected basedon a multi-criteria-analysis (MCA), and a cost comparison between alternative erosion solutions wascarried out.In 1998 the Cyprus government started with the implementation of these Master Plans. Up to now, sixbreakwaters have been constructed in the region of Larnaca and fourteen in the region of Limassol. Inaddition a number of illegal groins have been removed (mainly built by private parties such as hotelowners).A coastal section monitoring system is needed to support shoreline management in Cyprus. To thisend, 200 beach profiles have been established along the coast. To assess the shoreline position and therate of erosion these profiles are measured once a year, in summer, up to a depth of -10 m or -20 m.In the period 2000-2006 a second project, dealing with three new sections (Kato Tyrgos Tillirias,Crysochou Bay and Zygi-Kiti) was carried out in cooperation with the National Technical University of Athens. The budget for this project was again € 1 million and was financed entirely by the Republicof Cyprus.

The study for the region of Kato Tyrgos Tillirias is still at a preliminary stage and the Master Plan forKhrysochou Bay, which foresees the construction of a series of breakwaters, has been submitted for

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approval by the Technical Environmental Committee. The Master Plan for Zygi-Kiti has been approved by the Technical Environmental Committee and the construction of 15 parallel breakwaters will begin early 2009. The preparation of a Master plan for a 7th section, Geroskipou, has recently started. During the coming years, the Cyprus government intends to prepare Master Plans and detailed designs for all remaining areas. Although Cyprus has always been using breakwaters and groins to face the problem of erosion, difficulties are to be expected with the use of these structures in the future. The natural resources are being exhausted and environmental lobby groups (e.g. AKTH), fighting against the use of hard coastal defences, have gained increased attention in Cyprus.

5.2 Past, present and future adaptation expenditure

For Cyprus, the adaptation expenditure has been split between the protection against flooding and erosion on the one hand, and actions to counteract freshwater shortage on the other hand. Between 1998 and 2008, Cyprus spent € 0.45 million annually on the implementation of the Master Plans to combat coastal erosion. Furthermore, the annual expenditure for monitoring the coast amounts to € 0.35 million, which can be categorised as yearly 'fixed' maintenance cost. Therefore, in 2008, the amount spent to protect the coastal zones of Cyprus against flooding and erosion amounted to € 0.8 million. Over the entire period considered (1998-2015) about € 15.4 million will be spent to protect Cyprus against flooding and erosion. It must however be noted that none of the studies and Master Plans have taken any kind of climate scenario into account.

6 Management practices

6.1 Integrated Coastal Area Management Strategic Framework

Coastal areas are under pressure from building, infrastructure development and population growth. At present there is lack of a common definition of the “coastal area” either in legislation or in the spatial planning system. The various authorities adopt different definitions while the management and planning of coastal areas is segmented into individual spatial plans which, although they take into account local criteria and circumstances, are not guided by a comprehensive strategy for coastal management. Policy formulation and implementation actions are disparate and responses to emerging needs are pursued outside an overall coastal resource management strategy. To move towards sustainable coastal management policies, actions and programmes should be guided by an Integrated Coastal Area Strategic Framework to ensure, in the first instance, effective protection of coastal resources and ultimately to integrate all sectoral policies within a long term perspective on environmental and development. Sustainable use of coastal resources should be a primary issue in all sectoral plans and policies.

An *Integrated Coastal Area Strategic Framework* set out below defines the main guiding goals and objectives pertaining to an integrated approach to coastal areas cutting across the various sectors centered around four overriding axes:

- protection, preservation and management of coastal areas through sustainable use of resources;
- promotion of economic development through synergies between environmental quality and economic activities that rely on environmental quality;
- restoration of balanced coastal and hinterland development;
- Improvement of governance at the local, district and national level.

For the protection, preservation and management of coastal areas through sustainable use of resources, an holistic Spatial Planning is needed. The planning has to involve ICZM Protocol guidelines on foreshore protection, incorporate biodiversity strategy in the Development Plans (including marine, coastal and terrestrial biodiversity), protection coastal agricultural land and heritage sites from the

expansion of designated development zones, and observe Carrying Capacity and Strategic Environmental Assessments and also Resource Valuation assessment and Economic Instruments in Plan preparation and implementation.

Planning decisions and zoning changes that create “betterment” of property values and increased development rights should be taxed to “internalize” development costs, encourage resource conservation and raise revenues for coastal and other environmental expenditure for protection and monitoring

Related to Tourism the growth of accommodation facilities has to be restrained and encourage diversity through development of sport, cultural, recreational facilities and nature destinations. Protection and promotion of open coastal areas as a complementary element of tourism attraction and a tourism strategy defining development areas should take into account Carrying Capacity constraints and impeding Strategic Environmental impacts, particularly the need for the protection of coastal ecology and the integrity of coastal and marine biodiversity.

Additionally, protection of the marine environment and the land/sea interface shore area from interventions and constructions that cause erosion with regulatory directives. Moreover, it is need to avoid interventions that alter beach morphology and beach quality and restore area suffering from erosion areas with actions that secure pedestrian accessibility and recreation. Prevent vehicular road construction within a distance of at least 100 m from the shore and other road and accesses to the beach that may fragment coastal landscapes.

In Cyprus, development Plans and particularly in those for Larnaca area, and coastal developments (such as energy projects, marinas, etc.) should be guided and planned as part of an overall strategy (vision) for coastal management.

Development Plans should balance short term and long term consequences on coastal resources, biodiversity, landscape and natural / cultural heritage, which ensure economic and social development opportunities for the future. Diversification of tourism development with respect to the type and location of tourism development (harmonizing hotel accommodation with recreation facilities) will provide a reduce pressure in the coastal zone.

Coastal resource management should become an integral part in economic development strategy given that coastal areas are the spatial focus of the Cyprus economy. Coastal areas should be given a designated status in economic and spatial planning policy. Strengthen effective public participation in

coastal management to ensure a more equitable distribution of benefits from coastal development /conservation

For the restoration of balanced coastal and hinterland development, it's important to avoid further expansion of coastal development, by consolidating existing development areas; reducing the pressures on open coastal areas; and create development centres in rural areas through an integrated rural development strategy, for job creation and population increase.

7 Framework for Coastal Area Management

A Framework for Coastal Area Management needs an adaptive process of resource management for environmentally sustainable development in coastal area. It is not a substitute for sectoral planning but focuses on the linkages between sectoral activities to achieve more comprehensive goals and objectives (UNEP, 1995). According to the definition of the European Commission Council Recommendation, ICZM is a dynamic, multi-disciplinary and integrated process to promote sustainable development of coastal areas, seeking to balance the objectives of development and resource conservation. Such a framework is the vehicle for overcoming the present fragmented, sector-based coastal development control system, and move towards an integrated coastal development approach. Three fundamental elements of Coastal Area Management consist its capacity to bring about and support sustainable coastal management. First, to improve cross-sectoral and multi-level cooperation; second, to preserve and protect the productivity and biodiversity of coastal ecosystems by preventing habitat destruction, pollution and overexploitation; and third, to promote rational development and sustainable utilization of coastal resources.

Such a framework may assume different degrees of integration, depending on the relative emphasis given to development, environment or to integrated development / environmental approach. The emphasis determines the framework's meaningful content as a tool for sustainable coastal development. Three alternative Coastal Area Management approaches are possible with different scope for promoting sustainable coastal management objectives.

7.1 Development-Driven Approach

Cyprus has, by default, a development-driven coastal management framework, where development objectives are overriding environmental conservation objectives. This is a legacy from the past where Cyprus was a poor rural economy and efforts for development were pursued actively, and successfully from that point of view. Under this prevailing "coastal development philosophy", opportunities for coastal development are viewed with greater interest as investment actions with environmental conservation considered as an afterthought or an obstacle to be overcome.

The Goals are defined sectorally, inadequately shared and reflected across sectors. To the extent that general goals are common across sectors, they lack focus and are interpreted more in terms of sectoral priorities than in cross sectoral implications. Cyprus coastal management goals are development-driven, creating a bias towards development actions.

Moreover, Policies are sectoral, usually defining short term development priorities independently of environmental considerations and longer term requirements. Resource and infrastructure capacity limits arising from development commitments are not considered in most cases. Additionally, there is limited use of environmental information in development policy making and also inadequate valuation of coastal and natural resources.

The institutional and implementation Issues include the fact that public sector comprehensive development strategy is either missing, weak or overtaken by market forces, overlooking the need for coordination with environmental management. Additionally, decision-making bodies act with reference to separate programmes supporting development needs and investment plans. Furthermore, environmental resources are protected by relatively weak legislation and enforcement capacities often isolated as anti-development.

Although the plus in Cyprus Coastal area management policies include the reduced need for policy reforms and change and the maximization of short-term economic growth. On the other hand, the cons are the high risk of overdevelopment and resource degradation, the accumulated threats to environmental quality and the increasing “cost of environmental degradation”, undermining future options and productivity of activities that depend of environmental quality (tourism, agriculture, etc.).

7.2 Conservation-Driven Approach

A possible reaction to the present development dominated approach may be the conservation-driven approach. This approach may attract the support of environmental groups, and possibly by the environmentally aware and sensitive sections of the public, but will probably have very little appeal in policy making lest it compromises development needs. The “conservation-driven” approach operates in terms of the main characteristics. The conservation becomes a sector-driven goal underlying a view of development as a source of conflict and essentially harmful to the coastal environment. It aims to apply a conservation policy without taking into account development needs and opportunities.

Additionally, its goals are not shared by the already well established stakeholders and development groups.

Policies that are involved in this approach, are mainly sectoral policies tackling specific terrestrial, coastal and marine resources, with little or no reference to economic factors. Also, it presents a weak link with economic instruments necessary for sustainable conservation and environmental investment.

The institutional and implementation issues of this approach can be identified mainly to its implementation. This is due to the fact that implementation relies on restriction and regulation enforced in local spatial contexts, whose effectiveness will fluctuate according to the quality and scope of the land use plans and the licensing process. Also, to the presence of a good legal framework for resource conservation, implementation will remain dependent on enforcement and monitoring requiring good governance and sound environmental awareness which takes many years to build up.

The conservation driven approach merit can be identified as the increase in environmental awareness. And to the limitation to resource degradation. On the other hand the demerits include the failure to achieve synergies between development and environment, necessary for sustainable resource management and also the failure to integrated environmental concerns in overall policy framework.

8 Conclusions

Currently, in Cyprus, neither the development-driven nor the conservation-driven approach can ensure, or even contribute to sustainable coastal management. Both approaches lack the capacity to integrate development and conservation objectives and promote opportunities for synergies between them. Spatial planning is a major policy area for integrating development and conservation objectives. However, at present, development plans fall short of enclosing all the policies and actions to ensure sustainable management of coastal development. Also, development plans lack an overall development vision harmonizing development and conservation objectives, and are insufficiently aligned with the wider field of economic and social policies. Moreover, development plans are prepared and implemented as sectoral land use policies poorly coordinated with other sectoral policies with activities influencing or determining the use of coastal resources (tourism, water development, infrastructure development, heritage preservation, landscape conservation, etc). But most importantly, the current development plans lack guidance and support from a higher-tier strategy combining a comprehensive territorial and policy perspective.

The achievement of sustainable coastal management requires an integrated strategy comprising mainly a horizontal integration of policy goals across all sectors affecting coastal development (land use, infrastructure, tourism, water management, waste management, cultural and heritage conservation, rural development, etc.). Also a vertical integration of sectoral actions, spatial integration of development priorities according to development/conservation and the full integration of ICAM with the above elements in the national, regional and local policy framework.

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