'EAPM-CW:' An Ecosystem Approach Framework for Planning and Management in Environmentally Sensitive areas – with a Special Reference to Coastal Wetlands

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Abstract
Coastal Wetlands are among the most productive ecosystems in the world (Ruffolo, 2002; Larson, 2009; Ramsar convention 1990). Also, they can be considered the kidney of the earth, for their role of filtering wastes and pollutants, as well as "nature's supermarket" for their ability to provide sources of food and materials (Mitsch and Gosselink, 2000). Moreover, they can be considered the first defence line against some effects of climate change such as sea level rise. On the other hand; Coastal Wetlands are facing serious increased challenges from both sea and land sides; the global warming and the accelerated sea level rise and erosion rates are among the most natural causes of coastal wetlands area loss, currently and in the future (Nicholls et al, 1999). The huge losses and deteriorations of this unique ecosystem on one hand and the rich and wide variety of development potentials on the other hand are requiring a special framework for planning and management to make the balance between objectives of preservation and development in order to reach sustainable development.

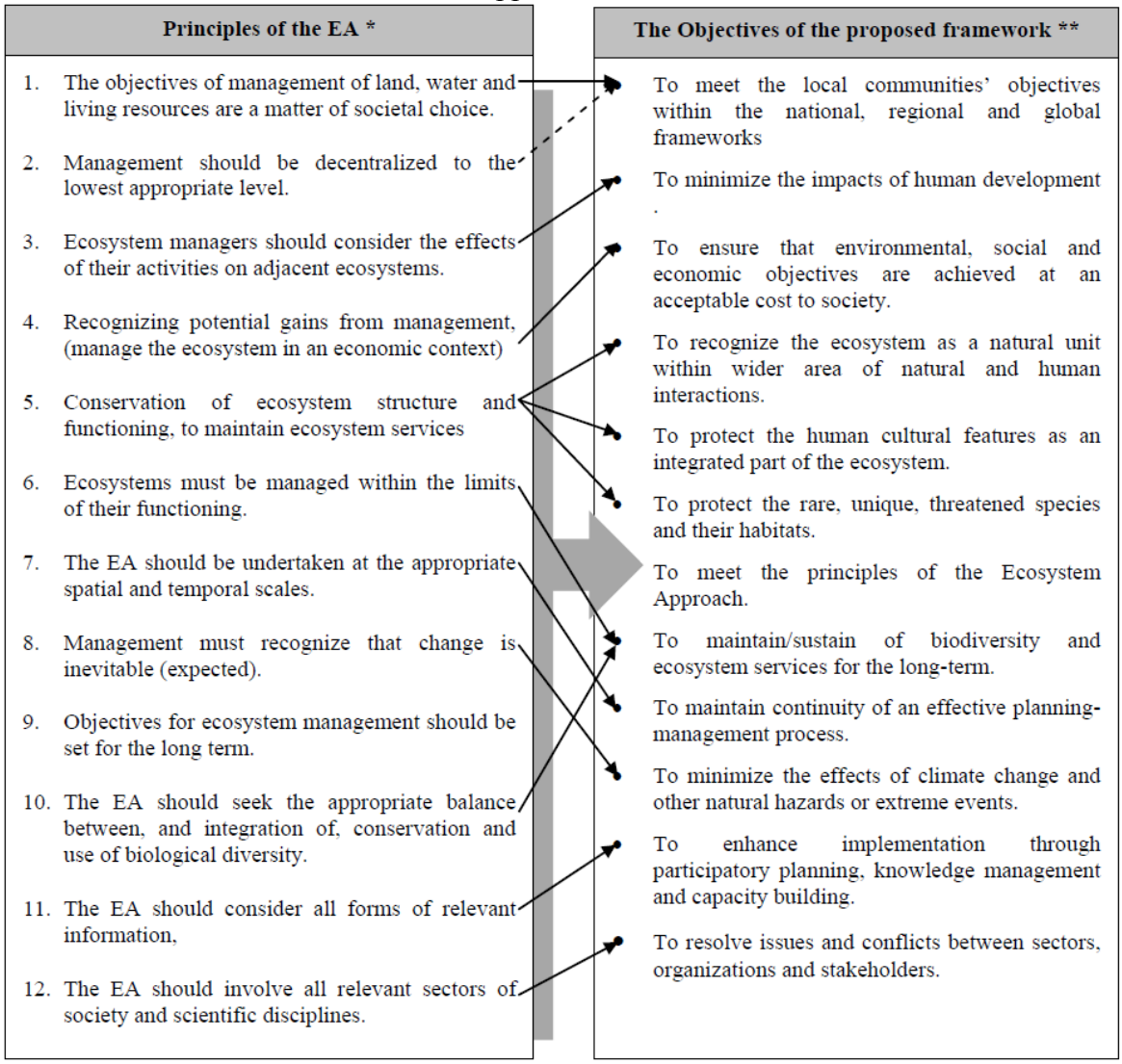
The EA "Ecosystem Approach" is the most internationally recommended to meet sustainable development especially in such sensitive ecosystems, as it has been recommended by several international organizations such as: CBD, IUCN, UNDP, UNEP, GEF, and Ramsar international convention for wetlands. However EA is still in its initial generic stage, there is a need for developing it into a methodological framework to be applied in such sensitive areas (UNFCCC, 2009; MedWetCoast, 2005). This paper introduce the EAPM-CW "*Ecosystem Approach Methodological Framework For Planning And Management In Coastal Wetlands*", which has been developed as a main part of a PhD research and tested on the Egyptian case using different techniques of scientific research, including interviews and focus groups (Author,2012). However the EAPM-CW integrated the Ecosystem Services Assessment as the main decision support tool, the GIS and Remote Sensing techniques were integrated to support more accurate results. the theoretical evaluation and practical case study test have shown high capabilities of EAPM-CW for wider applications sensitive ecosystems.

Keywords: Ecosystem Approach; Coastal wetlands; Environmentally Sensitive areas; Environmental planning

1. Introducing the EAPM-CW Methodological Framework

1.1. **The Objectives:** The objectives of the EAPM–CW have been guided by the main four related international frameworks, which concerned with environmentally sensitive areas including wetlands: the MEA[1] (CARPENTER, et al 2006; MEA, 2005) conceptual framework; the CBD[2]'s objectives (CBD, 2011a) and guidelines especially related to EA applications (SHEPHERD, 2008), RAMSAR recommendations (RAMSAR, 2010) and guidelines; and the ICZM[3] (WHITE et al. 2008; OLSEN, TOBEY & KERR 1997) as the wider and most related ecosystem. However the principles of the Ecosystem Approach are forming the base of the EAPM framework, the objectives have been down upon the spatial features of coastal wetland ecosystems, including: especial characteristics, main importance, and main challenges they are facing- see figure (1).

Figure (1) The objectives of the EAPM framework and principles of the Ecosystem Approach



[1] The Millennium Ecosystem Assessment.

[2] The United Nation Convention on Biological Diversity

[3] Integrated Coastal Zone Management

→ Direct connection ➡ Indirect connection

Source: ** Identified by this research (Author) * Identified by the CBD (CBA, 2011b)

The Main Characteristics

The main characteristics of the EAPL-CW were formed upon understanding; the main characteristics of coastal wetlands as an example of sensitive ecosystems, their importance and values, and the different challenges facing them -see Table (1).

Table (1) characteristics of the EAPM-CW framework

Characteristic	Explanation
Holistic	To facilitate good understanding of the multidimensional interactions and factors affecting the sensitive open ecosystems: internally, externally, and globally
Dynamic	To reflect the continuous changes of the natural ecosystem. (i.e. coastal wetlands)
Respecting the natural boundaries	The natural boundaries and unity of the ecosystem and flow of its natural functions should be maintained to achieve sustainability
Multi-temporal (Long & Short-term)	To achieve suitability in the long term and to respond to short term challenges and needs, the framework should include different time scales of plans and ensure that the short-term management plans are well fitting within the long-term plans.
Multi-spatial scales	Applying the MEA's conceptual framework especially coastal wetlands play vital roles on different scales; So the proposed framework should consider the development objectives and effects on these scales:(local, regional, and global).
Multi-dimensional (Ecological, Social, Economic):	However the environmental dimension should be at the core of interest to preserve highly sensitive ecosystems, the human wellbeing as an integral part of this ecosystem should be considered as the aim of sustainable development. From here, the framework should have a multi-dimensional perspective which requires integration of multi-disciplines.
Balanced (top-down & bottom-up)	Consider both human and natural aspects of the ecosystem, the local communities should be an effective partner in the planning and development process, especially to overcome most of downsides and problems of the current development.
Consider the **Ecosystem Services**	Evaluation of ecosystem services is required to support the planning and management process and enable well informed communication between science and decision making
Flexible	To respond to complexity and uncertainty associated with this very dynamic ecosystem, the proposed framework should be flexible enough. Also, flexibility is required for wider applicability of this framework within different local contexts of coastal wetlands including; social, cultural, institutional, and data characteristics

Source: Author.

1.2. The Main functions

The main functions of the framework were identified to respond to the identified objectives and characteristics, also to meet the professional requirements of the planning and management process. Table (2) shows the identified functions of the EAPM. Although the critical discussion of the concept and principles of the EA has shown that the EA is fully responding to the characteristics and objectives of the EAPM, it lacks of clear functions and methodological steps transferring it into a

practical process. Also, the literature review highlighted some limitations and areas of criticism of the EA (see Ghoneim 2012; Kidd et al. 2011; Hartje et al. 2003; SBSTTA, 2007). From here, the most commonly used approaches of environmental planning were comparatively analysed, according to these functions, in order to determine the suitable approaches to be integrated with the EA and enhance its characteristics.

Table (2) Functions of the EAPM and & what extents can the commonly used approaches of environmental planning integrated to meet them and fill the targeted gaps of the ecosystem approach?

	Other Environmental planning approaches / The required for the proposed Framework	Incremental	Advocacy	Comprehensive	Contingency	Participatory	Community Based	Adaptive	Watershed
Required functions of the proposed framework	Recognize the natural unites	-	-	-	-	×	×	-	◆
	Recognize the wider areas of interactions and flow of impacts and natural processes	-	-	◈	-	×	×	-	◆
	Identify Stakeholder and fundamental issues	×	×	×	-	◆	◆	-	◆
	Identify opportunities, objectives	-	-	◆	-	◆	◈	◈	◆
	Predict effects of climate change and natural hazards	-	-	-	◆	-	-	◆	◆
	Predict/estimate the future changes and effects	-	-	-	◆	-	-	◆	◆
	Assess/evaluate the eco-services	-	-	-	-	-	-	-	-
	evaluate the current environmental conditions	◈	◈	◆	◈	◈	◈	◈	◈
	Set priorities of protection and development	-	-	-	-	-	-	-	◈
	Assess impacts of different development alternatives	-	-	×	◆	-	-	◈	-
	Evaluate alternatives of the development plan	-	-	◆	-	-	-	-	◆
	Identify and set the management required, plan, and	◈	◈	◈	◈	◈	◈	◈	◈
	Set implementation programs	◈	◈	◈	◈	◈	◈	◈	◈
	Define monitoring requirements and programs	-	-	-	-	◈	-	◆	◆
	Build dynamic information base	-	-	-	-	-	-	◈	◆
Gaps of the EA	Compatible with EA principles	×	×	◈	◈	◆	×/◈	◆	◆
	Overcome recorded limitations of the EA	-	-	×	◈	-	◈	◆	◆
	Has clear process and steps	×	×	◈	-	◈	-	◈	◆

◆ Supportive ◈ Synergy/There is no conflicts × Conflicted - No evidence
Source: Author.

Table (2) shows the conclusion of the comparative analysis. A strong recommendation for the Watershed Approach to be integrated with the EA, while reflecting the adaptive approach's concept, in order to address the required functions. However some of the other approaches are seen to be helpful to develop particular aspects or functions of the framework, such as the participatory and contingency approaches.

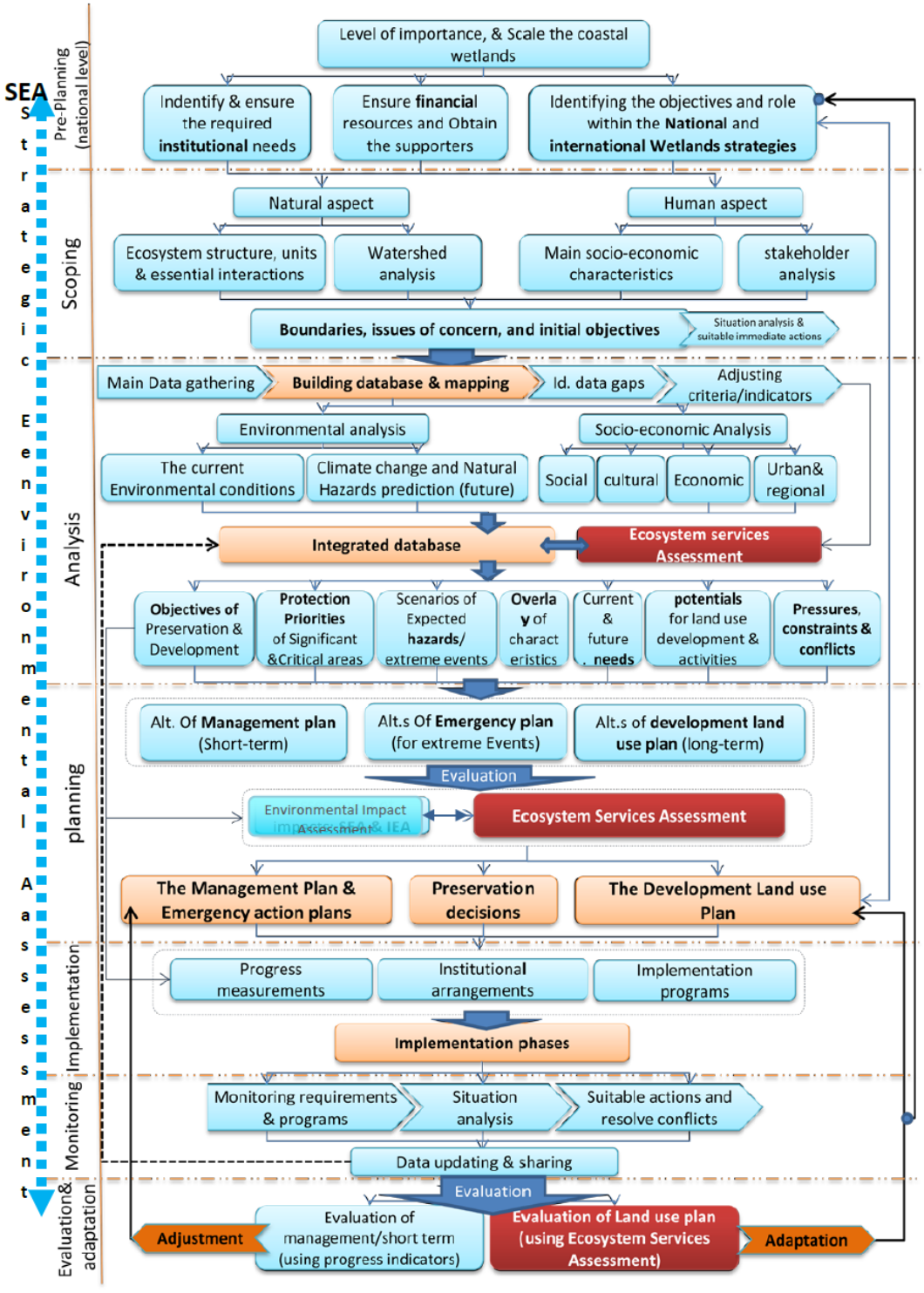
2. The EAPM-CW as a methodological framework (Ghoneim, 2012)

The EAPM-CW framework can be divided into seven stages, which reflect a continuous nonlinear process, as it contains a few feedback loops for checking, updating, learning and adapting different proposals and actions of planning and management. Figure (2) illustrates these stages and their suggested steps, as follows:

2.1. **The Pre-planning stage:** This stage aims to determine the scale of the planning and management regime, and its essential requirements. It starts with looking at the coastal wetland area from global and national perspectives to obtain

strategic reflections of these levels on the planning and management of this area. This stage includes the following steps:
Identifying the class, level and scale of the natural ecosystem (i.e. coastal wetland), Also, the sub-class (e.g. coral reefs, mangroves) should be determined to assess its biodiversity, rarity, and wider role.

Figure (2) The EAPM-CW as a methodological framework for planning and management (full process)



Source: Author

Source: Ghoneim (2012, p. 109)

The level of importance and significance should be determined whether it is a globally (e.g. RAMSAR site), nationally (e.g. a national park, preservation area), or a locally significant area. The scale of the coastal wetland or its relative size can help in determining its level of importance especially within the local context. All these factors together can help determine the preservation and direct the next steps of planning;
b. Identifying the external development objectives and role within international, national, and regional strategies to integrating the objectives and efforts of different planning levels.
c. Financial resources: funding is essential for any planning and management regime and an idea of the resources that may be available is important in informing the scope of activity. So, local, national and international sources of financial support should be sought depending on the role and importance of the case.
d. Identifying and preparing the institutional requirements: This will depend on the results of the previous steps. However, more institutions and sources of financial support may be invited through the next stages according to the issues and objectives that will be precisely determined as the planning and management process develops.

2.2. **The Scoping stage:** This stage aims to draw the direct and indirect boundaries of the planning and management regime. It is a multilevel stage which attempts to create a balance between the natural and the human aspects not only in the definition of spatial boundaries but also in the identification of the main issues of concern, goals, and the primary objectives. So, the following steps are set out:

- Understanding the ecosystem (structure, units, main functions and interactions): although this may be done generally as an introduction to the ecosystem, it should be guided by ecological specialists to meet one of the main objectives of the framework related to respecting natural units and flow of interactions.

- A watershed analysis: aims to draw the direct and indirect spatial boundaries of regime. This is a fairly complex analysis, it is recommended to be done early in the process, to understand the hydrological character of the coastal wetland as a fundamental base for dealing with the ecosystem. The complexity and detail of this step will depend on the scale and importance of the area as determined in the previous stage.

- Understanding the human aspect: to balance with the natural scoping, the human dimension should be understood, through a conceptual characterization of the 'socio-economic structure' and its main interactions with the natural ecosystem. It may be helpful at this stage to identify the different social groups, especially those who directly depend on the natural ecosystem to satisfy their essential needs, or get their income, such as fishermen, farmers and landlords. Directly or indirectly, in some cases, understanding the role and effect of other power groups such as businessmen can help to gain support or overcome conflicts within the planning and management process.

- Stakeholder analysis: This step aims to promote: meeting the social choice of the EA principles, sustaining the development process, achieving the human well-being objectives and the balance between the global and local benefits of planning and

management. The stakeholders should definitely include representatives of the different socio-economic groups within the local community but should not be limited to them, because coastal wetlands as open ecosystems always have much wider interactions and provide ecosystem services to an extensive range of stakeholders. Identification of the main and secondary stakeholders in this step is not final and more can be invited according to the results of the other stages.

By the end of this stage the main issues, preliminary goals, and the direct and indirect boundaries of the project should be determined. Besides this, the main structure, relations and interactions of both aspects of the ecosystem should be understood and conceptualized.

2.3. **The Analysis stage**: It aims to combine the different current and future characteristics of the coastal wetland, and to draw integrated pictures, which will form the basis of decision making in the planning and management stage. The steps of this stage are as follows:

2.3.1. **Mapping & Building Database:** drawing together the information gathered in the scoping stage to build a dynamic database is in the core of the framework, as it is essential to control and ensure the efficiency of all the next steps of the process. The understanding of the natural and human aspects developed in the last stage, will help in designing suitable variables of the database within the determined boundaries. However, more adaptation of the database design and adjustment of the analyses criteria (i.e. indicators of the ESA[4]) will result from the following activities

2.3.2. Analysing the environmental aspects, including:

a. Analysing the current environmental conditions covering physical, ecological and hydrological conditions with special concern for biodiversity, and threatened species. Also change detection and trend analysis would be helpful to determine rates and directions of change and to make projections about the future.

b. Analysing the effects of climate change and natural hazards should consider local and global interactions, in order to predict and build different scenarios for these effects (i.e. natural hazards, extreme events such as tsunamis). These scenarios will be the base for developing alternative plans in the next stage.

2.3.3. **Analysing the human aspect**: this includes identifying the current and future needs of the local communities; analysis of socio-cultural and economic characteristics to develop deeper understanding of many factors that are responsible for loss and deterioration of coastal wetlands. A special focus on urban and regional development is important to inform planning and management decisions. Rates and directions of urban growth, change of land use, effects of current land uses and their interactions with the wider environment should be carefully analysed to understand these dynamics and orient them to maximize the long-term benefits of their interactions with the environment and minimize their impacts on it.

2.3.4. **Developing the database** by integrating variables and results of the previous stages and steps: starting from this step, the analysis will move from single-discipline focused analysis to integrate multi-disciplinary analysis in order to synthesise the results of the huge number of specialized studies and their related layers into a few combined layers. These layers should be easy to read and use by planners, managers,

[4] Ecosystem Services Assessment

decision makers, and non-specialist stakeholders. Also, they should be where possible spatially referenced and mapped. Although the database is growing as the process moves from one step to another, it is important at this point to check and ensure its integrity, to be ready for the following steps.

2.3.5. **Ecosystem Services Assessment:** the ESA is put forward as a main step and integrated as a powerful tool supporting decisions of several stages, including: assessment of the current status of the whole ecosystem; classifying it into sub-units or homogenous areas to produce one of the main integrated multidimensional pictures of the coastal wetland under the study; and to facilitate the planning stage. This picture will be used again later as a comparative reference for evaluation in the next stages of the process.

Results of the stage: Depending on all the previous steps and stages, this stage would significantly expand the database and conclude with the following planning and decision support layers:

a. Protection Priorities: The results of the existing conditions analysis related to the natural and human aspects should include identification of the significant and critical areas and features, such as habitats of rare species and traditional historical features and classification of their importance. So, a ranking of their priorities for protection can be assessed.

b. Scenarios of expected hazardous areas and extreme events: The results of natural hazards and effects of climate change analyses would identify the areas expected to face serious changes. The level of certainty about these scenarios will determine to what extent they will be considered subsequent planning and management stages.

c. Current and future community needs: results of analysing the human dimensions should identify current and future needs and well-being aspirations.

d. Development potentials: potentials for different development activities and land uses can be identified according to environmental and urban characteristics of sub areas, such as areas with high potential for tourism, recreation or scientific study.

e. Challenges: pressures, constraints and conflicts: by the end of the analysis stage, present and expected pressures, constraints and conflicts can be identified and mapped.

f. Setting the detailed objectives of environmental planning and management: at this point of the process most of the resulting final objectives for planning and management should be integrated from different specialized scientific perspectives and interested socio-economic groups. A revision and wider discussion of these objectives should be conducted in participation with all stakeholders, community representatives, specialists, planners, managers and decision makers. Agreement and integration with both national and international strategies on a wider scale should be taken into account, and representatives of central institutions and related governmental bodies should be involved, as well. This would minimize future conflicts, and support and maximize the efficiency,

applicability and sustainability of the development plans that meet these agreed objectives.

2.4. **The Planning stage:** The aim of this stage is to develop effective and efficient land-use plans, management plans, and emergency plans, in order to achieve the agreed objectives, using the results of all previous steps. A summary of the main steps of this stage is as follows:

2.4.1. **Building alternatives plans**: Three types of alternatives should be developed here for different types of plan which reflect different time spans:

Alternatives of Land-Use Development plans (long term): alternatives here should explore different long-term objectives, addressing transformations which may occur over a long time period and relatively large-scale and high-cost desired spatial changes, mostly related to land use and land cover. Decisions related to preservation can be taken first as a separate task or be a part of the development of alternatives according to the institutional structure and local context.

Alternatives of Management Plans (short term): by definition, alternative management plans are more likely to focus on current and short-term actions, while these actions should be integrated with the long-term plans and objectives. So, it is recommended for management alternatives to be developed with, or justified within the context of development plans. However, management actions should not be stopped or postponed until all the required information has been obtained or all the previous analysis finished, because the whole process is time consuming. So, it could be recommended to set and take primary management actions directly after the scoping stage.

Alternatives of Emergency Plans (immediate actions): Coastal wetlands are located in the most dynamic coastal zone areas, and are more likely to face natural hazards, climate change effects and extreme events than many other areas. So, alternative emergency plans should be ready with suitable immediate actions to minimize these impacts. Alternative Emergency Plans should reflect scenarios of expected natural hazards and the available resources.

2.4.2. **Evaluation of alternatives:** To select the most acceptable and sustainable alternative plans. However the Ecosystem Service assessment has a main role several stages in this framework, so it can be used integrated with the EIA or separately especially in the more sensitive environments such as coral reefs. Moreover it is recommended for as monitoring and evaluation tool in the next stage by comparing the change of the ESA values with their initial values at the beginning of the process (i.e. based on the existing environmental conditions) in a regular base time.
By the end of this stage, four main products should be developed and checked with the higher levels of strategies: the land-use development plan, the management plan, alternative emergency action plans, and (in some cases this may include) decisions on protected areas.

2.5. **The Implementation stage:** To ensure efficiency of implementation, a time frame and measurements of progress should be set within each of the plans. Then the institutional arrangements, and other required resources should be prepared because

implementation phases and programmes are very case specific, so they are not discussed in details here.

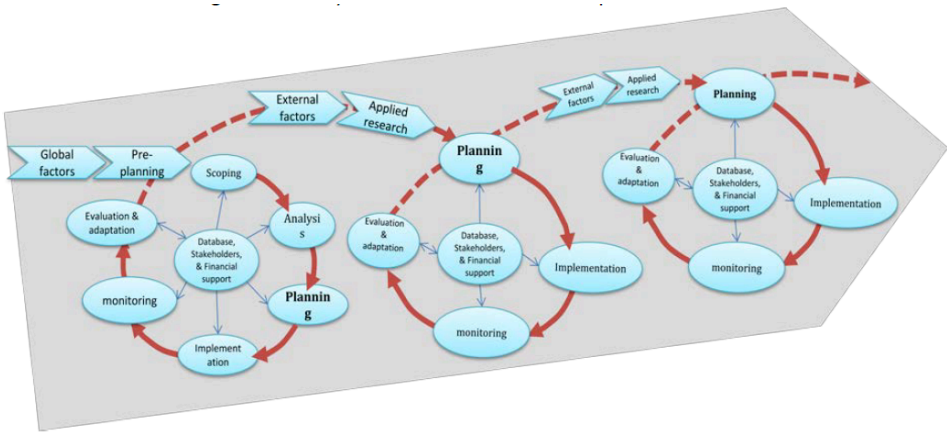
2.6. **The Monitoring (not limited to this stage)**: Details of monitoring programmes and activities are also case specific, but generally regular monitoring programmes should be established and the required human and technical resources should be ensured from the beginning. Situation analysis, taking suitable actions, and resolving conflicts is a continuous set of steps which should run throughout the whole framework and not just be limited to the end of the plan-making cycle to meet the dynamic and sensitive nature of coastal wetlands. Responding to this dynamic nature, the database should be regularly updated with a simple kind of trend analysis, and a conclusion of the situation should be shared with partners and stakeholders. It should be mentioned here that a suitable action at this stage could be applying one of the emergency plans, whenever its related scenario happens.

2.7. **The Evaluation and Adaptation stage:** Evaluation and adaptation again is a multi-temporal process, which differs in details, techniques used and outputs, from one time frame to another. Three levels of evaluation and adaptation can be distinguished as follows:

2.7.1. **- Short-term (adaptation of the management plan):** this aims to evaluate the management actions and monitoring programs to respond to the ongoing and short-term changes. The reference for evaluation and adaptation here is the pre-determined progress measurements.

2.7.2. **- Medium- or Long-term (adaptation of the land-use development plan):** this aims to adapt the suggested land-use development plan to solve the kinds of conflict or disturbance that require changes in land uses. This may happen in the medium time frame and go back directly to the suggested land-use plan after a limited ESA of the changes needed and checks with the agreed objectives have been undertaken. However, long-term evaluation and adaptation may partly go back to the first stage then go through the rest of the stages (see figure 3).

Figure (3) the dynamic adaptive nature of the EAPM



Source: Author

3. Evaluation

3.1. Does the EAPM-CW respond to the previously identified objectives?

3.1.1. *S***ustain biodiversity and ecosystem services for the long term***:* An understanding of the ecosystem units, structure and interaction has been drawn in the scoping stage. The analysis stage gives special consideration to this objective through detailed analysis of the environmental conditions, followed by intensive assessment of the current ecosystem services which help to classify the ecosystem into sub areas, with a detailed diagnosis of their functionality and different values, importance, biodiversity, etc. The same stage should analyse and identify the areas which are expected to face natural hazards or serious changes, and identify the objectives of preservation and development. This early prediction and careful determination of objectives would guide most decisions in the planning stage such as priorities for preservation and alternatives for development plans, while these alternatives will be evaluated depending on their ability to maximize the ecosystem services for the long term and minimize the impacts as well (using SEA, EIA and ESA).

3.1.2. **Protect the rare, threatened species and their habitats***:* The same steps that were integrated to reach the first objective also support this objective, as the rare, unique, threatened species and their habitats present the most important and sensitive features of areas of biodiversity and the productive ecosystem.

3.1.3. **Protect the human cultural features as an integrated part:** The EAPM has put the human dimension in parallel with the natural dimension. Cultural characteristics and features are effectively involved in most stages, and especially feature in the analysis stage as part of the Ecosystem Services Assessment, and in different steps of planning and preservation decisions.

3.1.4. **Meet the local communities' objectives within the global national, and regional frameworks:** All stages of the framework have included direct and strong support for this objective in different ways, such as involving community representatives and stakeholders in the identification of objectives and selection and adaptation of the suggested plans, and setting identification of the local communities' needs as a special step.

3.1.5. - **Minimize impacts of human development:** there are several steps directly feeding this objective, such as using EIA and SEA assessments in the evaluation of the planning and management alternatives.

3.1.6. - **Minimize effects of global warming and natural hazards:** the EAPM gives particular importance to analysing and predicting these impacts, and taking suitable decisions and actions to minimize them. This can be seen clearly in the analysis, planning, implementation and monitoring stages. It has responded to the current and predicted impacts in the different plans produced (i.e. development, management, and emergency), according to their level of expectation.

3.1.7. **Respect the natural units:** It is fundamental in the EAPM. So, the scope and boundaries of analysis and development were determined basically upon understanding the ecosystem structure (i.e. watershed in case of wetlands).

3.1.8. **Ensure that environmental, social, and economic objectives are achieved at an acceptable cost:** Inviting partners from the wider levels aims not only to create a balance between preservation and development objectives but also to share the responsibility and costs of sustainability objectives across these scales, and ensure

different means of support, including financial resources. Also, involving community representatives and stakeholders, aims to ensure the support, satisfaction and acceptance of local society.

3.1.9. **Enhance implementation through participatory planning, knowledge management:** Participatory planning is emphasized in critical steps of EAPM, such as identifying the objectives and evaluating the plans. The scoping stage sets the basis for building and exchanging knowledge and awareness with stakeholders and community representatives, while the actual building of the information base/database is mainly at the beginning of the analysis stage and is significantly increased by the results of different analyses to feed the planning and implementation stages.

3.1.10. **Resolve conflicts between sectors, organizations and stakeholders:** The EAPM uses participation, institutional integration and data sharing to increase the responsibility of the different parties and to develop a common understanding of the situation and objectives. On the other hand, the framework builds strong scientific evidence of different analyses and assessments to support decision making.

3.1.11. **Maintain continuity of effective planning–management process:** The framework tends to ensure feasibility by obtaining resources and capacity building in the pre-planning stage; efficiency in the analysis and planning stages; equity and responsibility by participation in decision making in different stages; and continuity of monitoring, evaluation, adaptation, updating and learning in the last three stages.

3.2. How has the EAPM applied principles of Ecosystem Approach&filled gaps?

Table (3) summarizes how steps of the EAPM are directly and indirectly integrated to meet and apply the 12 principles of the Ecosystem Approach, as follows:

(P.1): The EAPM emphasizes the importance of social choice and involvement of stakeholders, from the early stages of the process, and in the most important steps of decision making, such as identification of primary objective and issues, current and future needs identification.

(P.2) The special nature of coastal wetlands which has high importance, interactions and interests on different levels requires integration and participation of some or all of these levels according to their importance and effects, which may differ from one case to another. However, in all cases, the local level is essential and should be well linked with the national wetland strategy at least. It is recommended that the local level plays a main participatory role in several steps throughout the other stages.

(P.3): The EAPM widens the scope of planning and management process to include areas of interaction with adjacent ecosystems, which is clearly shown in the scoping stage, especially in the watershed analysis and the identification of boundaries.

(P.4) the EAPM considers potential economic gains of planning and management to achieve sustainability in several ways, such as putting the human aspect (i.e. mainly socio-economic dimensions) in parallel with the environmental aspect throughout the process, involving the stakeholders in the main decisions, moreover identification of development potentials and compatibilities based on scientific analysis and social participation.

(P.5) *t*o maintain and sustain the ecosystem services, the framework has developed ESA as a main technique for analysis of current conditions, evaluation of planning and management alternatives, and evaluation of results of planning and management.

(P.6) The EAPM is based on understanding of the ecosystem characteristics and functionality from its early stages. However, enhancement of this understanding is further developed through the developed continuous adaptive process of analysis, planning, implementation, monitoring, evaluation and adaptation. Moreover, the evaluation of the plan depends mainly on the ESA which reflects the health and functionality of the ecosystem.

(P.7) the EAPM suggests that the appropriate spatial scale of planning and management be determined in the scoping stage. However, there is more than one time frame for planning and management adaptation, which should differ from one case to another according to the importance of the case and the related issues.

(P.8) the multi-temporal is represented by different feedback loops in the framework (Figure 2) and discussed in the previous section as short-term adaptation, medium-term, and long-term adaptation.

(P.9) Recognition of the dynamic nature of sensitive ecosystems and predictions of the changes and natural hazards or extreme events are clearly emphasized in most stages of the EAPM. While the analysis stage has the main role of analysing and predicting serious changes, the monitoring, evaluation and adaptation stages are more concentrated on how to respond to these changes and conduct the needed adjustments in both the management actions and planning parameters and decisions.

(P.10) The EAPM has emphasized the balance throughout planning and management process, by considering the environmental aspects in parallel with the human aspects. Also, special importance is given in the identification of the primary objectives and issues, identification of the preservation and development objectives, current and future needs, and formation, evaluation and adaptation of the development plan.

(P.11) Building, developing and updating an integrated dynamic database is a continuous task in the developed, as it is clearly appears in figure (2).
(P.12) the pre-planning and scoping stages of the EAPM are focused on building a suitable partnership based and widen the dimensions of this base by inviting and encouraging cooperation: (i) between sectors, (ii) at various levels of government (e.g. national, provincial, local), and (iii) among governments, civil society and private sector stakeholders.

Table (3) The EAPM responses to principles of the Ecosystem Approach

Stages and steps of the developed framework \ Principles of the EA		1	2	3	4	5	6	7	8	9	10	11	12
Pre-planning	Id scale, type, level of importance of the case												
	Id. the required institutional needs												
	Obtain support& financial resources												
	Guides of National & International strategies												
Scoping	Ecosystem Structure, Units & Interactions												
	Watershed analysis												
	Main Socio-economic characteristics												
	Stakeholder analysis												
	Id. Boundaries & Pre: issues - goals												
	Start needed emergency actions												
Analysis	Mapping & Building database												
	The current Environmental conditions												
	Climate change & N. Hazards prediction												
	Analysis of Social dim.												
	Analysis of Cultural dim.												
	Analysis of Economic dim.												
	Analysis of Urban& regional dim.												
	Eco- services Assessment												
	Id. objectives of Preservation & Development												
	Id. Significant &Critical areas												
	Id. Expected hazards areas/ extreme events												
	Id. Current & future needs												
	Id. Potentials & compatibilities												
	Id. Pressures, constraints & conflicts												
	Overlay and extending the integrated Db.												
Planning	Id. Priorities of preservation												
	Alt. of Management plan												
	Alt.s of emergency action plans												
	Alternatives of development land use plan												
	Alter. evaluation : SEA & IEA& Eco-services												
	Management Plan & emergency actions												
	Preservation decisions												
	Development Land use Plan												
Implementation	Progress measurements												
	Implementation programs												
	Institutional arrangements												
Monitoring	Monitoring requirements & programs												
	Situation analysis												
	Suitable actions and resolve conflicts												
	Data updating & sharing												
Evaluation adaptation	Evaluation of management Short term												
	Evaluation of Long term plan												
	Adaptation of management plan												
	Adaptation of development plan												
	Feed back to national & international level												

Strong direct response Strong indirect res. Indirect res. Generally no conflicts

Source: Author

Filling the critical gaps of the EA: three main areas of criticism/gaps, moreover developing the stages and the detailed steps of the framework, could be targeted throughout the developed EAPM, as follows:

a. **Uncertainty:** To minimize the uncertainty characterizing the changes in natural ecosystems the EAPM depends on: an intensive dynamic database, integrating environmental analysis techniques (e.g. SEA, EIA, and ESA), building alternative scenarios of natural hazards and extreme events, developing different alternatives for development management, and following a continuous process of evaluation, adaptation and learning from experience.

b. **Institutional issues:** Issues such as institutional mismatch with natural units, lack of integration among sectors, and inter-institutional conflicts: are reflected in the suggested framework from the pre-planning stage, as it suggests identifying and establishing suitable institutional arrangements that meet the nature, type, scale and importance of the coastal wetland under consideration.

c. **Creation of incentives/motivations:** Because the costs of ecosystem preservation accrue locally, while the benefits are predominantly national or international; the EAPM maximizes involvement of local communities. Stakeholder participation in the main stages, including identification of objectives, needs, development potentials, and alternative plans, is supposed to create more local benefits. Also, it is recommended that national and international interested bodies and organizations be encouraged to share the costs of preservation, especially in coastal wetlands with high global importance.

Conclusion

The EAPM attempts to transfer the concepts & principles of the Ecosystem Approach into a clear methodological framework for planning and management in coastal wetlands, as an example of sensitive ecosystems, in order to achieve sustainability. However it is felt that the framework is potentially applicable for other contexts, especially those wider overlapping ecosystems, such as other wetland types or coastal areas more generally. Also, it is potentially applicable in any other ecosystem, by following the various processes and stages set at. However for wider use the special characteristics, challenges and importance of the ecosystem under application should be reflected in the detail of each step of the process.

References

CARPENTER, R. S. R., DEFRIES, R., DIETZ, T., MOONEY, H. A., POLASKY, S., REID, W. V. & SCHOLES, R. J. 2006. Millennium Ecosystem Assessment: Research Needs. *Science,* 314**,** 257–258

CBD. 2011a. *2011-2020: About the Convention* [Online]. Norway: Convention on Biological Diversity (CBD). Available: http://www.cbd.int/2011-2020/ [Accessed Jul. 2014].

CBD. 2011b. *Ecosystem Approach Sourcebook* [Online]. Norway: Convention on Biological Diversity (CBD). Available: http://www.cbd.int/ecosystem/sourcebook/ [Accessed Jul. 2011].

DAY, J. W., CHRISTIAN, R. R., BOESCH, D. M., YANEZ-ARANCIBIA, A., MORRIS, J., TWILLEY, R. R., NAYLOR, L., SCHAFFNER, L., STEVENSON, C. & 2008. Consequences of climate change on the eco-geomorphology of coastal wetlands. *Estuaries And Coasts,* 31**,** 477-491.

DE-GROOT, R., FINLAYSON, M. R., VERSCHUUREN, B., YPMA, O. & ZYLSTRA, M. 2008. Integrated assessment of wetland services and values as a tool to analyse policy trade-offs and management options, A case study in the Daly and Mary River catchments, northern Australia, Supervising Scientist.

FISCHER, THOMAS B. 2007. *Theory And Practice Of Strategic Environmental Assessment — Towards A More Systematic Approach*. Earthscan, London.

Ghoneim, Safaa A. 2012. An Ecosystem Approach Framework and an Ecosystem Services Assessment Technique for Planning and Management of Coastal Wetlands, PhD, University of Liverpool.

HARTJE, V., KLAPHAKE, A. & SCHLIEP, R. 2003. The International Debate on the Ecosystem Approach- Critical Review. Germany: Federal Agency for Nature conservation.

JOHN G. LYON & LYON, A. L. K. 2011. *Practical Handbook for Wetland Identification and Delineation,* US, Taylor & Francis.

KAY, J. J., BOYLE, M., REGIER, H. A. & GEORGE, F. 1999. An Ecosystem Approach for Sustainability: Addressing the Challenge of Complexity. *Futures,* 31**,** 721-742.

KIDD, S., MALTBY, E., ROBINSON, L., BARKER, A. & LUMB, C. (eds.) 2011. *The Ecosystem Approach to marine planning and management,* London: Earthscan.

KOTZE, D. 2010. WET-Sustainable Use A System for Assessing the Sustainability of Wetland Use. *In:* MALAN, W. H. (ed.) *Wetland Health and Importance Research Programme.*

KOTZE, D., MARNEWECK, G. G., BATCHELOR, A. L., LINDLEY, D. S. & COLLINS, N. B. 2009. WET Eco-Services: A technique for rapidly assessing ecosystem services supplied by wetlands. Pretoria, South Africa. : Water Research Commission.

LARSON, J. 2009. Introduction- methodologies for wetland assessment. *In:* MALTBY, E. & BARKER, T. (eds.) "*The Wetlands Handbook",* London, Blackwell Publishing Ltd.

MICHENER, W. K., ELIZABETH, B., KEITH, B., MARK, B. & LEONARD, G. 1997. Climate Change, Hurricanes and Tropical Storms, and Rising Sea Level in Coastal Wetlands. *Ecological Applications,* 7**,** 770-801.

MCGLADE, J. & WEBER, J. L. 2009. Ecosystem accounting: climate change and governance of ecosystem services in Mediterranean coastal wetlands. *In:* AGENCY,

E. E. (ed.) *Conf. Series: Earth and Environmental Science.* Copenhagen, Denmark: European Environment Agency.
MEA 2003a. Ecosystems and human well-being. *In:* ASSESSMENT, M. E. (ed.). Washington, DC: World Resources Institute.
MEA 2003b. Ecosystems and Human Well-Being: a framework for assessment. *In:* ASSESSMENT, M. E. (ed.). Washington: World Resources Institute.
MEA 2005. ECOSYSTEMS AND HUMAN WELL-BEING: WETLANDS AND WATER. *In:* ASSESSMENT, M. E. (ed.) *Washington.* DC.: World Resources Institute.
MEDWETCOAST 2005. The Fifth Regional Advisory Committee Meeting. *FINAL Report.* Cairo: MedWetCoast Regional Coordination Unit-Cairo.
MITSCH, W. J. & GOSSELINK, J. G. 2000. *Wetlands,* New York, John Wiley & Sons.
OLSEN, S., TOBEY, J. & KERR, M. 1997. A common framework for learning from ICM experience. *Ocean and Coastal Management,* 37**,** 155-174.
NICHOLLS, R. J., HOOZEMANS, F. M. & MARCHAND, M. 1999. Increasing flood risk and wetland losses due to global sea-level rise: regional and global analyses. *Global Environmental Change,* 9**,** 69–87.
RAMSAR 2010. (Ed.) Wise use of wetlands: Concepts and approaches for the wise use of wetlands, Gland, Switzerland, Ramsar Convention Secretariat.
RAMSAR. 2014. *Ramsar Convention on Wetlands* [Online]. WWW: RAMSAR. Available: www.Ramsar.org [Accessed June 2014]
RUFFOLO, J. 2002. The US supreme court limits federal regulation of wetlands. California California Research Bureau.
SBSTTA 2007. in-depth review of the application of the ecosystem approach. *In:* UNESCO (ed.) *Twelfth meeting UNESCO.* Paris: SBSTTA (the Subsidiary Body on Scientific, Technical and Technological Advice).
SELLAMUTTU, S. S., SILVA, S. D., KHOA, S. N. & KOON, J. S. 2008. Good Practices and Lessons Learned in Integrating Ecosystem Conservation and Poverty Reduction Objectives in Wetlands. *wetland international technical reports.* Netherlands international water management institute (IWMI) and Wetlands International (WI).
SHEPHERD, G. (ed.) 2008. *The Ecosystem Approach: learning from experience,* Gland, Switzerland and Cambridge, UK: IUCN.
US-EPA 2008. Handbook for Developing Watershed Plans to Restore and Protect Our Waters, Nonpoint Source Control Branch, Washington, DC.
UNFCCC 2009. Ecosystem-based Adaptation. Bangkok: United Nations Framework Convention on Climate Change 'UNFCCC'.
WHITE, A. T., CHRISTIE, P., D'AGNES, H., LOWRY, K. & MILNE, N. 2005. Designing ICM projects for sustainability: Lessons from the Philippines and Indonesia. *Ocean and Coastal Management,* 48**,** 271-296.
WHITE, P. C. L., GODBOLD, J. A., SOLAN, M., WIEGAND, J. & HOLT, A. R. (eds.) 2010. Ecosystem Services And Policy: A Review Of Coastal Wetland Ecosystem Services And An Efficiency-Based Framework For Implementing The Ecosystem Approach: the Royal Society of Chemistry.

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