Towards a new Integrated Beach Management System: the Ecosystem-Based Management System for beaches.

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Highlights

- **A new Integrated Beach Management System (EBMS-Beaches) that introduces the principles of ecosystem management into these social-ecological environments.**
- **Linking the Theory of Environmental Policy and the Practice of Environmental Management: application to beach management.**
- **Coupling Environmental and Risk Management Systems with the principles of Ecosystem Management**
- **A need of further innovation in beach management frameworks: the case of Spain**

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Abstract

Massive use of beaches has forced traditional management of these systems to focus on the service offer to users. Consequently, human activity and behavior prevailed over other biological and physical processes and functions. Mirroring this tendency, the use of Performance Awards (Blue Flag) and Environmental/Quality Management Systems (ISO 14001, EMAS, and Q of Quality) were popularized as standards of environmental quality. In parallel to this process, recent international coastal and marine policies have emphasized the need to develop sustainable strategies for implementing the principles of the Ecosystem Approach into management with the overarching goal to maintain ecosystem integrity while enabling the sustainable use of ecosystem goods and services in system under management. As Performance Awards and Environmental/Quality Management Systems do not follow the Ecosystem Approach, an Ecosystem-Based Management System for beaches (EBMS-Beaches) is introduced to overcome this issue. The EBMS-Beaches is intended as a formal standard framework that add new aspects not considered in a classical beach management by the introduction of the principles of the Ecosystem Approach, between them: a) a clear vision-driven process; b) a holistic approach from a geographical perspective; c) pressure analysis and institutional coordination inside clear participatory planning; d) use of risk management techniques in planning; e) the ecosystem service concept as the central piece of the system; f) use of the DPSWR as accountable framework of indicators, g) desired vision based on state indicators and using BQI partial indices; and h) timely participation by local population. The EBMS is structured along three pillars (managerial, informative and participatory pillars) working in an adaptive management way. Based on these three pillars, existing management practices can be standardized into a viable, systematic means of implementing, in an integrated way, the new international policies for beach social-ecological systems. An initial experience of EBMS implementation is a particular beach (S'Abanell beach, Girona-Catalonia, Northwestern Mediterranean) has been initiated and it is presented.

1. - Introduction

The Ecosystem Approach emerged as the dominant paradigm for managing coastal and marine ecosystems (Olsen *et al.,* 2009). New international policies emphasize the need to develop sustainable strategies for implementing the principles of ecosystem management ("*Ecosystem Approach*" -EA, "*Ecosystem-Based Approach*" -EBA, "*Ecosystem-Based Management*" -EBM three concepts considered similar according Farmer *et al*. (2012) that will be used indistinctly here). This approach offers new opportunities for sustainable use of the sea but requires better understanding of how marine social-ecological systems operate, how they generate goods and services, how well these benefits are captured and sustained, how human degradation of the systems affects human welfare and generates costs, and the complex social relations and value systems underpinning human governance of marine systems. In Europe for example, the achievement of Good Environmental Status (GEnS, following Borja *et al*., 2010, 2013) and sustainable use of marine ecosystems became primary objectives of the new Environmental Marine Policy of the Union (Marine Strategy Directive-MSFD [2008/56/EU]; Maritime Spatial Planning-MSP [2014/84/EU]). This new policy is aimed towards the achievement of a common vision and a holistic integrated approach using the Ecosystem Approach as its framework of reference. In the Mediterranean region, the "*Mediterranean Action Program*" (MAP) also has included the Ecosystem Approach as its basic marine strategic framework. While all countries belonging to the European Community supports its marine strategy, the MAP program has been ratified by 22 countries of the Mediterranean beyond their different political and social affinities (Cinnirella *et al*., 2014). All of this confirms the international support to the principles of the ecosystem approach at the level of policy and send a clear message of how it should be the future management of the coastal and marine environments.

In practice, realities are a little bit different. Different guides and manuals have been developed to facilitate the implementation of these strategies (Shepperd, 2008; Ehler and Douvere, 2009; PISCES, 2012) and several regulatory tools have been proposed (i.e. in Europe, MSFD, MSP and the Mediterranean Protocol of Integrated Coastal Zone Management-ICZM [2009/89/EC]), however, the application of the principles of the ecosystem approach into management and the use of its associated jargon is still confusing, makes its related type of management nebulous rendering it difficult to put into practice, and problems get accentuated by the complex institutional system that manage these environments, with very fragmented responsibilities and extremely reactive (Cormier *et al*., 2010;. Bainbridge *et al*., 2011; Sardá *et al*., 2014). All these issues and controversies can be seen i in present practices of beach management.

Beaches are social-ecological systems that play a key role in coastal environments. Beaches play multiple functions, being three the most important ones: to act as natural reservoirs, to offer coastal protection, and to provide human recreation. A long list of ecosystem services is provided by these three assigned functions (Sardá, 2013). In the Mediterranean region, as in many other regions of the world, beaches constitute the main asset for the maintenance of the tourism industry and a clear relation between quality, user's perception and economic valuation is found (Ariza *et al*., 2012a). Following such issues most of its public/private management has been developed around its recreational function and other functions observed in beaches have been just seen as a complement of the previous one and, in many cases, managed in a reactive way.

During recent decades, in order to bring the best recreational attributes for beach users (clean sand for lying, clean water for bathing and the best services possible), environmental quality standards and environmental management systems have been widely used in beach management. Although it is clear that those frameworks improved the way in which beaches were managed, these schemes are far to applied the principles of the Ecosystem Approach. The introduction of the Ecosystem Approach in beach management arrangements would requires the incorporation in the used framework of a set of principles to ensure the inclusion of essential components such as participation, planning and decision-making, integration, promoting accountability and quality assurance, as well as a new jargon of concepts such as social-ecological systems, ecosystem functions and services,… (CBD, 1998; Balvanera *et al*., 2001; Cognetti and Maltagliati, 2010; Sardá *et al.*, 2014). To advance into the solution of this deficit, this paper presents the development of a new formal procedure for beach management, intended to be used in practice, the Ecosystem-Based Management System for Beaches (EBMS-Beaches). The Ecosystem-Based Management System was recently developed as a formal standard management system to implement the Ecosystem Approach into the management of public goods (Sardá *et al*., 2014). It is one of the main outputs of the FP7 KnowSeas project (www.msfd.eu). The EBMS is an adaptive management system that combines the theory of environmental and risk management (Measham and Lockie, 2012) with the principles of ecosystem management (Farmer *et al*., 2012) and permit its application in a nested way at different spatial scales, whether national, regional, sub-regional or local.

This paper describes the structural and operational components of this new management model (EBMS-Beaches). In its first section, the paper describes the evolution of beach management in Spain, a country that it has always distinguished itself by introducing innovative aspects in the management of beaches. In a second section we describe what the new system incorporates into previous managerial standard systems in order to introduce the EA principles. In the third section,

the EBMS for beaches is described and the applications of several internal tools to the beach of S'Abanell (Blanes-Girona, Spain) are used as examples. Finally, we present some general conclusions that we believe can make the EBMS sufficiently attractive for its use.

2.- The development of beach management frameworks in Spain

2.1.- From the initial services in beaches to the use of Environmental Managements Systems (EMS).

In Spain, it was not until the end of the First World War when the first transformation of the pre-tourism industry was observed, from low supply activities (spa-resorts) to the initial development of new specific generic types of tourism, which would result in the "sun and sand" tourism model during the second part of the century (a good analysis of this evolution can be found in Garay and Cànoves, 2010). The pre-fordist tourist phenomenon was then initiated and beaches become part of the human landscape like other areas of the territory. At that period, the ecosystem concept was not introduced in public management and only scattered services on beaches were disposed without considering these systems as natural resources of economic interest (Figure-1).

Innovative beach management processes were initiated in Spain during the 1950s and 1960s following the long post war period after the Second World War. A new fordist stage of tourism was born and the preponderance of the "*sun and sand tourist model*" became a reality. The Spanish Coastal Act of 1969 established the so-called General Zoning Plan for beaches (PGOP) allowing to plan for services and facilities, and the first management guidelines were published for urban environments. During the 1970s Spain developed the "*Indicative Plan for the Use of Public Domain*" (PIDU) who had a great importance during the 1980s at the beginning of the Spain's democratic transition (Figure-1). The green environmental movement was born during these decades and a change in the prevailing worldview of our relation with nature recognizing the need for a sustainable use of natural resources was introduced.

The Sustainable Development concept globalized the environmental issues and the mainstreaming of environmental values within all sector and policies during the 1980s. The new Constitution of Spain (1978) promoted the development of a new Coastal Act (22/88) and its Reglament with the main focus in the protection of the coastal public domain. The management of beaches became more important but also more complex due to fragmentation of responsibilities between a bunch of local, regional, autonomic and central governments. Eco-labels emerged in mid 1980s, when the

crisis of mass tourism and the consequent pressure exerted on certain fragile resources as beaches was found. As a consequence of all these changes, concepts as sustainability, continuous quality improvements, impact assessment ... were introduced as references for beach management policies (Fraguell and Martí, 2013) and different Performance Standards such as the Blue Flag (voluntary eco-lable award found in 49 world-wide countries) and Environmental Management Systems such as the international European EMAS, the Global ISO 14001 or the Spanish Q of Quality were increasingly used in the management of beaches in Spain (Figure-1) (Ariza *et al*., 2008). Although Performance Standards and Environmental Management Systems are still widely used they are far of introducing the latest concepts of the internationally environmental policy that was initially developing at that time.

<FIGURE 1>

At the entrance into the new millennium, the World Summit on Sustainable Development of Johannesburg (2002) recommended the introduction of an Ecosystem-Based Management approach for coastal management advocating for a new social-ecological paradigm in its management processes (Figure-1). In the Mediterranean, the established legally binding mechanism of the Integrated Coastal Zone Management Protocol of the Mediterranean mirrored and reinforced the ideas of the Ecosystem Approach (Haines-Young and Poschin, 2011). Under these recommendations, beach management schemes should evolve. Beaches must be managed today as complex systems, moving into its sustainable use to guarantee socio-economic prosperity while maintaining the integrity of its natural components and its potential for the provision of ecological goods and services. Despite these ideas, during the last ten years we have not seen a substantial improvement in beach management processes, the new environmental policy is rarely applied and a deep gap is found between the theory of environmental policy and the practice of environmental management (Katsanevakis et al., 2011; Sardá et al., 2014).

2.2.- The need of an Ecosystem-Based Management System in beach management (EBMS-Beaches)

A management system is a systematic framework of policies, procedures and practices used to ensure that an organization can fulfil the tasks required to achieve its objectives. When objectives are related to environmental considerations such is the case of a natural environment like a beach, an Environmental Management System (EMS) is developed. On the other hand, the Ecosystem-Based Management (EBM) has been defined as "*an integrated approach to management that considers entire ecosystems, including humans. The goal of ecosystem-based management is to maintain an ecosystem in a healthy, productive and resilient condition so that it can provide the*

156 *services humans want and need*" (COMPASS, 2005). EMS are useful frameworks through which
157 organizations can reduce their environmental impact, improve their environmental performance and
158 provide relevant information to the public and other interested parties. EBM constitute a set of
159 principles and work as a framework for the application of the new international environmental
160 policy. Used in conjunction, a possible evolution of an EMS could be viewed as a useful tool for
161 implementing EBM. Another important aspect to be considered is the need to develop in
162 management a kind of vision to be reached when managing a particular issue. In this case,
163 management should be taken care and deal with all the associated risks that could impede and/or
164 maintain this vision. Risk management systems (RMS) are widely used in different management
165 constructs to deal with that (Cormier *et al.*, 2013). We used all these ideas to develop a new
166 intended standard tool, the Ecosystem-Based Management System-Beaches linking the EMS and
167 RMS tools with the EBM framework for beach environments.

168 To work with an EBM application, it would be necessary to incorporate into our used framework, the
169 Ecosystem approach principles presented at the UNEP/CBD/COP/4/Inf.9 Conference and referred as
170 the Malawi principles. Table-1 is listing such principles and dictating what these principles bring into
171 the need of modifying present beach management practices.

172 <TABLE 1>

173 When they are compared, EMS/RMS frameworks tend to focus more on institutional management
174 issues while EBM schemes are intended to focus more on an ecosystem management perspective.
175 When putting all together preponderance should be given to the welfare mechanisms by which
176 societies can benefit of a sustainable use of a natural resource while maintaining its integrity, both
177 structural and functional. The concept of ecosystem services acquires a preeminent role in the
178 functioning of the EBMS-Beaches. In addition, Elliott *et al*. (2006) emphasized that in order to
179 develop one of those EBM frameworks, we should have a clear integration among the components
180 of the ecosystems and resource uses and users, we must lead to a sustainable outcome, we should
181 take clear precaution in avoiding deleterious actions and have a clear vision of change by developing
182 and adaptive management approach; all of these aspects were cautiously applied in the EBMS-
183 Beaches.

184

185 **3.- <u>Towards a new integrated beach management system: the EBMS-Beaches.</u>**

3.1.- The Ecosystem-Based Management System (EBMS)

With the final aim to create a comprehensive scientific knowledge base as a practical guidance for the application of the Ecosystem Approach to the sustainable development of Europe's regional seas, the European project FP7-KnowSeas developed a suite of tools to assist policy makers and regulators with its practical application (legacy of the project can be seen in www.msfd.eu). The Ecosystem-Based Management System (EBMS) (Sardá *et al*, 2014) was one of these tools. The EBMS is based on a three pillar structure and intended to facilitate the integration of an ecosystem approach to coastal and marine policy development, regardless of the ecosystem or administrative scales.

The managerial pillar is based on classical environmental and risk management systems that incorporate environmental considerations and objectives within a continuous improvement cycle of adaptive management. The managerial pillar is thought to be supported by governance structures that provide oversight and thereby ensure that planning and implementation activities adhere to modern environmental principles. The information pillar ensures that data and scientific advice are based on current knowledge, and the participation pillar brings together institutional coordination, communication and consultation requirements as indicated by the principles of the ecosystem approach (Sardá *et al*., 2014). Figure-2 (upper left) shows how these pillars work together in a continuous improvement loop-cycle path that is intended to bring a present social-ecological system situation to its desired vision for the future.

<FIGURE 2>

The conceptual thinking underpinning the EBMS is the combined use of well-established environmental and risk management systems (EMS-RMS), ISO 14001 (ISO, 2004) and ISO 31000 (ISO 2009a; 2009b; 2009c) with a set of tools that allow to introduce in the framework all aspects needed to encompass the principles of the Ecosystem Approach (Table-1, left column). As EMS/RMS frameworks can be used by whatever organization despite size, sectors or geographical locations, the EBMS is scalable and its structure can be adopted for any program of measures, from regional scale initiatives to local ones, and adapted to the different social-ecological systems under management. The use of the EBMS in beach social-ecological systems allow us to move towards a new integrated beach management system that could fill the gap produced during the last decade regarding the management of public goods. In order to apply the EBMS into EBMS-Beaches, the principles of the Ecosystem Approach were transferred into needs for beach management (Table-2 right column).

218 3.2.- The EBMS-Beaches: application to the S'Abanell beach case study.

219 The theoretical foundation of this academic work consists of three pillars working together in an
220 adaptive management way with the final aim to reach a desired vision for the beach social-ecological
221 system under management. While the first pillar helps to get an understanding of the management
222 mechanism applied (managerial pillar), the second one provides much value added from an
223 information context (information pillar) establishing all indicators that will be used by the system.
224 The third pillar defines the ways in which participation of stakeholders is regulated in the framework
225 (participatory pillar). By looking all three of them from a theoretical pint of view, it is possible to
226 grasp certain elements that are especially important for achieving project's objectives. The
227 methodology presented is in validation at S'Abanell beach located in the bay of Blanes (NW
228 Mediterranean Catalan Coast, Spain) (Figure-3). This does not want to say that the entire EBMS
229 framework is in use now but several of the applicable tools have been proven and a good
230 relationship with the managerial institutions in charge of the beach has been obtained which
231 facilitate pilot studies and tool checking.

232 <FIGURE 3>

233 S'Abanell beach is the northern landmass emerged zone of the Tordera River delta (Figure-3). During
234 the last four decades, S'Abanell beach have been suffering significant erosive processes due to man-
235 made activities aggravated by periodic episodes of droughts that reduced drastically the sediment
236 supply from the Tordera River. Today, the occasional wetland developed at the mouth of the
237 Tordera river is nowadays put in danger by the retreat of sediment supply by the river. A description
238 of the S'Abanell beach evolution can be found in Lozoya *et al*. (2011) and Sardá *et al*. (2013).
239 Historical cartography of this region can be obtained back to the year 1611 (ICC, 2005) indicating
240 abundant information on this area. The general erosive process and retreat has contributed recently
241 to the failure of S'Abanell beach as a supplier of several ecosystem services due to the non-
242 fulfilment of its protective and recreational function. At the mouth of the River, in the southern tip
243 point of the beach, a coastal lagoon is sometimes formed allowing a wetland area which has been
244 awarded under the distinction of Natura 2000 site following European regulation.

245 3.2.1. Visioning phase (establishing the context)

246 The first task to be accomplished is the establishment of the foundation for the EBMS-Beaches.
247 Defining the social-ecological system under management (unit of analysis, in this case the beach of
248 S'Abanell) will identify the targeted geographical area. After having delimited the unit, an initial

assessment report should be drafted to develop a common understanding of the system. The assessment allows us to compile and synthesize all the relevant information for this particular unit that becomes necessary for its correct management. The assessment also let us knows about the pressuring factors on the system and the related stakeholders to be considered. The objective of the report is to comprehensively describe the major features of the unit that must be used sustainably, the human activities which must be managed within it and the major interactions among the unit features and the human activities observed there. The report is intended to provide managers with a better understanding of the social-ecological actions and relationships in the selected unit as well as to inform the public and other stakeholders about the "*status quo*" of the system and the pressures it is receiving. The visioning phase constitute the starting procedure to implement the information and participatory pillars to build interest, expand participation and create settings for actors to come are part of its work. As a final task, the visioning phase should develop the desired vision to be reached and a set of overarching goals with a potential measuring mechanism. These overarching goals must be presented as indicators of "*State*" following classical Driver-Pressure-State-Welfare-Response (DPSWR) accounting framework (Cooper, 2013).

In the case of S'Abanell beach, we have a large amount of information in form of scientific papers and grey literature (doctoral thesis, environmental impact assessment reports, nourishment technical studies…). The analysis of this information constitutes the initial assessment report obtained for the beach (a tool demanded by the EBMS, Sardá *et al*., 2014). Based on all this information and expert judgment criteria we develop our desired vision for this beach to be: a) to recover a width of, at least, 30m all over its length within a stable beach profile in order to ensure that the beach can develop its protective and recreational functions, and b) to maintain the natural integrity of the wetland found in the mouth of the River to allow the accomplishment of its preserved natural function.

3.2.2. Managerial pillar

The managerial pillar was developed with the same structure of an EMS ISO 14011-type. It followed the five main elements of the Deming cycle loop: policy baseline, planning preparedness, implementation and operation, checking and corrective actions, and management review (Deming, 1986). These elements were then adapted to work with the principles of the Ecosystem Approach following Table-1. Presently used EMS tools applied to beaches can be easily modified and adapted to the changes required by and ecosystem-based approach by modifying some of the required clauses as a consequence of having introduced the ecosystem-based management jargon, notably

clause A.3.2. (Social-ecological key aspects), A.3.4 (Risk management programs), and A.6. (Management review). Table-2 listed the different clauses observed in this pillar through the above commented steps (a much detailed explanation can be found in Sardá *et al*. (2014) and www.msfd.eu.

<TABLE 2>

The selection of the key social-ecological aspects in the planning phase will be carried out using risk management techniques (Figure-4). A Risk Management framework using the ISO 31000:2009 Risk Management Standard is used for this job. The work to be done is related with the identification of those aspects (human activities and behavior, natural hazards,) pressuring the littoral unit under management. After risk identification and environmental risk profile will be done providing the most up-to-date knowledge of the risks and its environmental effects, causes and consequences. The assessment will inform the decision-making process preparing a risk evaluation of management strategies to eliminate, reduce or mitigate risks including the costs and benefits of the implementation and evaluating options for feasibility and effectiveness. Once this is done, the risk management plan is developed (goals, targets and objectives) and it will be implemented by a series of actions that will be included in the risk management program. The further implementation and operation phase, as well as the checking and corrective measure phase will not change too much from what it is normally seen in an ISO 14001 application besides the fact that new jargon is introduced and new monitoring requirements highlighted.

<FIGURE 4>

The management of environmental issues is usually linked to chains of cause and effect. These cause and effect issues are the ones that can put us in danger of not reaching and/or not maintaining the desired state. In order to practicing these previous ideas, a proposed methodology was developed using S'Abanell beach as example (Lozoya *et al*., 2011). The methodology used the risk management framework (ISO 31000) in which coastal hazards and beach ecosystem services were jointly considered. The definition of the risk profile and the assessment of identified risks was done by building the beach Pathway of Effect, where links between coastal hazards with ecosystem services were identified following a DPSWR approach (Cooper, 2013); the second phase (risk evaluation) including risk valuation and hazard prioritization followed previous work. Figure-2 shows the scheme of this tool in the planning phase of the managerial pillar. In its application to S'Abanell beach (Lozoya *et al*., 2011) River floods and storm-induced floods were the riskiest hazards and the disturbance regulation ecosystem service the most affected one. When these events are related to

313 the present states of beach social-ecological components, beach width becomes the most acute
314 problem that should be prioritized in S'Abanell beach.

315 The DPSWR accounting framework for analysis is used (Cooper, 2013). In this accountability, aspects
316 are analytically structured along pressures, which are caused by one or multiple drivers resulting in
317 changes in the state of the social-ecological system components. These changes may lead to welfare
318 changes in the societal use of ecosystem goods and services and it require some type of response.
319 These responses are the ones that will be translated into the management program designed to
320 eliminate, mitigate or compensate pressures related to drivers of human activities, and to control
321 drivers coming from natural events and/or hazards, both of them with the purpose of avoiding
322 potential environmental negative effects.

323 The final management review is an essential part in the continual improvement of the management
324 system. As an adaptive management tool, the EBMS needs periodic reviews to analyze the distance
325 with its desired vision and to incorporate new scientifically and technical knowledge, and sometimes
326 even to re-analyze our own vision. The final review of a loop cycle will be connected with the
327 planning phase of the next cycle establishing the main context in which the next risk identification
328 and prioritization of programs should be carried out.

329 3.2.3. Information pillar

330 An essential requisite for correct environmental management is the compilation and analysis of
331 exhaustive environmental information. The information pillar must provide the managerial pillar
332 with user-friendly tools to facilitate the flow of information into the decision making process. In the
333 EBMS, the information pillar is structured into an Information Factory with two main support tools: a
334 Spatial Data Infrastructure (SDI) following standard procedures, and a platform of indicators
335 accessible to be used in the system at any time.

336 Coastal and marine SDI are no longer a novelty, they are well reported in existing literature and are
337 acknowledged to be a key element in improving the management of these areas (Drapeau, 2008;
338 Cinnirella *et al*., 2011). S'Abanell beach is the shoreline unit under management but it is being
339 influenced by processes occurring at a much wider territorial area. A cartographical representation
340 of the boundary delimitations of all this area is advisable to understand major events than can occur
341 in the zone of management (Balaguer *et al*., 2008).

342 Concerning the platform of indicators, for clarity the EBMS employs the DPSWR social-ecological
343 accounting framework to organize the information on aspects that are relevant to represent the
344 interactions between them (Cooper, 2013). This accounting framework is utilized by the risk
345 management tools used in the planning phase of the management pillar and it is also used in the
346 initial assessment and at the revision phase of each management cycle. In the case of beach
347 environments, "*State*" indicators of the different identified beach functions and sub-functions were
348 compiled to form a composite index based on function analysis called the Beach Quality Index-BQI
349 (Ariza *et al*., 2010). The BQI (Figure-5) includes thirteen partial indices divided into the three main
350 functions of the beach (recreational, natural and protective functions) that gave place to three sub-
351 indices too. Each partial index provides a quality of value of its represented state. All values (index,
352 sub-indices and partial indices) scores from 0 (worst situation) to 1 (best situation). These indicators
353 of state will also drive the implementation of the risk management program through the
354 implementation and operation and the checking and corrective measure phases.

355 <FIGURE 5>

356 State indicators are the ones that will be used to measure the distance to the desired vision. The
357 thirteen partial indices computed in the BQI can serve as a Balance Scorecard for the management
358 of the beach system. An assessment of these values was performed in S'Abanell beach during
359 summer 2005 and 2006 (Ariza *et al*., 2010). Obtained values gave a global score of 0.67; the analysis
360 of the different partial indices assessed told us that we were not having the desired vision for the
361 beach. From 2007 to 2009, three nourishment processes were carried out in S'Abanell beach
362 (180.000 m^3 in November 2007; 144.000 m^3 in May 2008; and 250.000 m^3 summer of 2009, Sardá *et*
363 *al.*, 2013). Besides these nourishment processes the geomorphological condition of the beach only
364 has improved slightly; the protective partial index that gave a value of 0,31 in summer 2006 was
365 computed as 0,33 in February 2014 (beach width at that time can be seen by transects in Figure-3).

366 3.2.4. Participatory pillar

367 The third pillar of the EBMS is aimed to facilitate societal participation, an element required in the
368 Ecosystem Approach. Participation means active involvement of the actors (people influencing and
369 affected by management actions). In order to implement a well-structured functioning of the EBMS-
370 Beaches, it is necessary to work with an effective governance structure and to identify and involve
371 its main actors. In addition, the Ecosystem Approach requires the adoption of a holistic attitude from
372 a geographic perspective, beach environments cannot be isolated from the watershed and marine
373 environment that are forming them which yield to institutional complexities and fragmented

responsibilities derived from its management. The effective governance structure will require significant cooperation amongst governments; civil society and private interests in the need of a collective action, and this participatory pillar should facilitate this work in order to overcome the barriers imposed by administrative procedures.

The participatory pillar of the EBMS accomplished three main tasks: a) facilitation of stakeholder identification, b) allowing effective participation and conflict resolution, and c) enhancing capacitation. Tools are available for the identification of stakeholders (e.g. Sanó 2009, Bainbridge *et al*. 2011), and initiatives to generate informed networks of stakeholders are beginning to emerge. The visioning phase (initial assessment) of the EBMS-beaches identifies these actors and this list should be maintained through the revision steps.

Participation should require institutional coordination of all national, regional and local authorities competent in the littoral unit managed as well as society involvement. The EBMS-Beaches implementation can be hampered by the complexity and potential conflicting jurisdictional policy objectives of the various arms and levels of government. In this case a lack of coordination can imply governance failures and can create conflicts between these different administrative institutions and between these institutions and civil society. In the case of S'Abanell beach different offices have different responsibilities and the complexity is amplified by the land-based interactions located in the Tordera catchment area and its urban environment as well as several policy objectives that may not align with the beach integrity. The Blanes municipality manage all services associated to the beach, the Regional Government (Autonomous Community of Catalonia) has two different "Consellerias" (Community Ministries) involved. The Ministry of Territory and Sustainability has the Coastal Service Unit managing licensing of beach activities and the Water Catalan Agency (a private/public institution) deals with the management of the Tordera watershed and it is responsible of managing in Catalonia the Water Framework Directive. On the other hand, the Catalan Ministry of Agriculture, Livestock, Fisheries, Food and Natural Environment have the responsibility to manage the Natura 2000 site of the mouth of the Tordera River. Finally the Central Government of Spain (Ministry of Agriculture, Food and Environment) through its Coastal General Directorate manage the Public Marine Domain regulated by the Spanish Coastal Act and it is in charge of the Marine Framework Strategy Directive. The tremendous amount of complexity involved in this structure without any supra-municipal beach office and without any clear managerial leadership is the main obstacle for a correct implementation of the EBMS-Beaches today, however, the use of the EBMS-Beaches framework could introduce a common language and a common set of procedures facilitating dialogue, coordination, and capacity building between the different offices involved.

Public engagement in coastal management was highlighted as an essential component of ICZM activities (Ernoul, 2010; Lozoya *et al*., 2011; Areizaga *et al*., 2012). Public participation is encouraged but practicing of this engagement is rare. The introduction of the Ecosystem Approach in beach management obliges to accommodate and prioritize needed public services but also to take care about the different social-ecological activities and events that are observed in the beach. At that level, the participation of users and agents with economic interest in the system need to be guarantee. To assess beach user's motivations, expectations and priorities, a survey based questionnaire is recommended to be used during the bathing season in the EBMS-Beaches. An example about this questionnaire can be found in Lozoya *et al*., 2014 for S'Abanell beach. Concerning agents with economic interest, innovative schemes for linking public and private efforts to protect social-ecological systems by ensuring the provision of ecosystem services are becoming more and more used today involving "payment for ecosystem services" schemes (Wendland *et al*., 2009; Farley and Costanza, 2010; Farley *et al*., 2010) or just raising tables for discussion.

Finally, the participatory pillar should enhance manager and societal capacitation. Raising a web portal where people can find enough information systems under management is appreciated. The EBMS standard tool has today one of this tools in operation, a visit can be done at www.msfd.eu

4.- Discussion.

Massive use of beaches has forced traditional management of these systems to focus on the service offer to users. Consequently, human activity and behavior prevailed over other biological and physical processes and functions that are normally managed in a reactive way. Mirroring this tendency, the use of Performance Awards and Environmental Management Systems (EMS) were popularized as standards of environmental quality. Although EMS has proven to be a good tool for improving beach management processes, its promotional benefits are hardly visible in the eyes of typical mass tourism and for this reason many coastal managers preferred to combine both type of certifications (performance awards and EMS) as complementary (Fraguell and Martí, 2013). However, these standard tools do not reflect the new principles of the environmental policy recognized in the international coastal and marine regulation. The change towards the requested ecosystem management approach constitutes a social challenge today; it is not seen in practice and should involve not only local managers and formal stakeholders, but also the civil society (Ariza *et al*., 2012b). The application of the EBMS for beach social-ecological systems is aimed to facilitate such integration.

439 The EBMS is aimed to be a standard adaptive management methodology to assist coastal and
440 marine environments by introducing a common set of tools and procedures and a common language
441 that can be useful for facilitating knowledge transfer and capacity building when applied to beaches.
442 The EBMS-Beaches is aimed to fill the gap between the present theory of environmental policy and
443 present beach management practices. The EBMS for beaches is scalable, can be hierarchically
444 introduced at different spatial scales and this could facilitate the institutional coordination needed
445 to solve the problem of policy fragmentation and differentiated responsibilities (Cormier *et al.*,
446 2010). The EBMS-Beaches can be considered as a quality assurance tool by itself being used in a
447 vision-driven process of continuous improvement which makes it necessary to reach a societal
448 consensus for the desired future conditions of the beach environment under management. Although
449 we are just introducing the idea, the EBMS-Beaches potentially could also work (as other standards
450 do) with the possibility to allow certification if promoting circumstances become important.

451 Although the implementation of Environmental Management Systems enhanced the achievement of
452 sustainable outcomes in the management of beaches, this enhancement was mainly focused in the
453 environmental quality for its recreational function. The use of the EBMS-Beaches will allow us to
454 manage together, in an integrated way, the different functions of the beach environment and the
455 ecosystem services they provide. The EBMS add new aspects not considered in a classical EMS
456 framework: a) beach management is part of a clear vision-driven process; b) beach management
457 adopts a holistic approach from a geographical perspective; c) it requires pressure analysis and
458 institutional coordination inside clear participatory planning; d) planning is obtained through the use
459 of risk management techniques; e) the concept of ecosystem service is a central piece of the system;
460 f) beach management use the DPSWR as its analytical accountability framework of indicators, g)
461 good final state is based on "*state*" indicators using BQI partial indices (Ariza *et al*., 2010); and h) it
462 ensures timely participation by local population. Although the EBMS-Beaches can be seen as an
463 evolvement of previous EMS systems, there are enough aspects that make this new system
464 different. The structure of the EBMS and all related jargon was uploaded into a web platform tool
465 (www.msfd.eu) to facilitate training and capacitation, something similar for beaches would be of
466 great help.

467 The use of management systems and certifications ensures that importance is given to the territorial
468 presence of beaches. It is sad to see how geographical areas as beaches what are considered
469 essential economic assets are not properly managed. By the understanding of the role of
470 stakeholders in capturing the benefits obtained from ecosystem good and services of beaches, we
471 can discuss better arguments for the recognition of possible additional governance costs of the new

adaptive management system supporting the EBMS-Beaches tool, including transaction costs, the cost of monitoring and dynamic economic effects. It is clear that beaches play a key role in the maintenance of the Tourism Industry in Spain, an essential sector for the economic welfare of the country as the present economic crisis has shown (Sardá and Fluvià, 1999; Sardá, 2001). Yepes (2004) described how the 0,001% of the Spanish surface (beaches that holds the "sun and beach" tourism model), are indirectly responsible of more than 10% of the Spanish Gross Domestic Product. Consequently, in Spain beaches should be considered to be one of the country's major assets. The recreational service of the Lloret de Mar central beach (1.3 km; 5.6 ha, located 5 km north of the S'Abanell beach) was assessed using the Travel Cost Methodology (TCM) as a valuation technique (Ariza *et al*., 2012a). We obtained an annual value of 73.8 million Euros for this beach just as its direct use. At that time, 19% of this money (13.4 million Euros) went into taxes received by the different administrations involved. The results also show the important gap between investments made by coastal managers (less than 1 million Euros for all municipal beaches of this town during the analyzed year) and users' economic valuation (73.8 million Euros year as a direct use). With all these data, the value per meter square of the central beach of Lloret de Mar was computed as 1320 Euros and its annual value per ha on 13.2 million Euros. We do not have the same values for S'Abanell beach, however, even if we assume that we can talk about half of the value per meter square (Lloret de Mar is one of the most popular beaches in Catalonia while S'Abanell is a normal one), the amount of money entering into the public finances as a consequence to have the beach is enormous when compared on the money spent on it. Ignorance of these numbers put in risk even the presence of beaches in the future in a constant tendency of accelerated erosion process, and today, no accountability is obtained by any management process.

The theoretical work done in S'Abanell about the main risks at the beach yielded the present width of the beach as the most notable state indicator to focus management activities. This is something that present management systems are not able to detect in a formalized way. The EBMS-Beaches, as it is integrated, has the potential to prioritize the most important aspects going on in the beach and it obliges coastal managers to know it and to deal with that. In this sense, it would be appreciated if Administrative offices could lead a program of advice and support to enhance the use of environmental certification of beaches for integrated management and sustainability of the coast that could be based in the new environmental policy where the EBMS-Beaches could play a major role.

5.- Conclusion.

The new European coastal and marine policy, as well as the Mediterranean Action Plan, uses the Ecosystem Approach as its framework of reference, a management concept that focuses on the relationship between human society and the ecosystems that supports it. It is necessary to bring this approach into practice and fill the gap between theory and practice. In order to bridge this gap we have described the EBMS (Sardá *et al*., 2014) as a new management standard system. This management scheme it is easily applicable for beaches. Due to the large economic importance that beaches have for the economy of different countries on its relationship with Tourism activities, we believe that we need the most rapid transition possible into this type of new management standards that can facilitate the correct management of social-ecological systems today.

5.- Acknowledgements.

This work was carried out within the framework of the MeVaPlaya-II project (CSO2009-14589) and the PLAYA+ project (CGL2013-49061) of the National Research Plan of Spain in R+D+i, as well as the KnowSeas+ project (201530E018). We thanks the Secretariat of the 3rd International Conference on ICZM for allow us to present the paper at the Conference.

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651 **Figure legends**

652

653

654 **Figure 1.-** Timeline development of the used tools in Spain for beach management issues in relation
655 to major changes in the global environmental thinking.

656

657 **Figure 2**.- General structure of the Ecosystem.-Based Management System and its managerial pillar,
658 showing the developed tool (left) used in the planning phase to deal with the beach social-ecological
659 key aspects. (Adapted from Sardá et al., 2014 and Lozoya et al., 2011).

660

661 **Figure 3.-** Location map of S'Abanell beach. The bottom-right picture is showing the width of the
662 beach (in meters) in different transects on February 7th 2014.

663

664 **Figure 4**.- The managerial pillar of the EBMS and its proposed methodology to deal with the
665 prioritizations of the key social-ecological key aspects. (Adapted from Sardá et al., 2014 and Lozoya
666 et al., 2011).

667

668 **Figure 5**.- Panel of indicators associated with the Beach Quality Index (BQI).

669

670

671

Table-1

TABLE-1.- Relationship between the Ecosystem Approach principles developed by the Convention of Biological diversity and its application for beach management frameworks.

CBD Ecosystem Approach principles	**Beach management needs**
1) The objectives of management of land, water and living resources are a matter of societal change	Use participatory planning: appropriate management schemes should adequate timely participation in a transparent decision-making process by local populations. Adopt a holistic way from a geographic perspective: beach environments cannot be isolated from the watershed and marine environment that is forming them.
2) Management should be descentralized to the lowest appropriate level	Effective governance structure should be developed to guide implementation
3) Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems	Social-ecological dynamics and functioning of the beach should take care about the interdependency between the land and the marine/freshwater parts forming a single entity. All elements relating to the hydrological, geomorphological, climatic, ecological, socio-economic and cultural systems should eb taken into account ina n integrated matter, not exceeding carrying capacity and preventing negative effects of natural disasters and development.
4) Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context	Accommodate and prioritize public services needed, but also taking care about the multiplicity of social-ecological activities/events that are observed on beaches.
5) Conservation of ecosystem structure and functioning, to maintain ecosystem services, should be a priority target of the Ecosystem Approach	The concept of ecosystem services should be central in the management of beaches following the new environmental policy
6) Ecosystems must be managed within the limits of their functioning	Beach management should work taking care of natural processes and adopting a long-term perspective Damage to the beach environment shall be prevented and, where it occurs, appropriate restoration shall be effected.
7) The Ecosystem approach should be undertaken at the appropriate spatial and temporal scales	Beach management frameworks should be taken into consideration when plans and programs for urban development or sectorial policies evolve. Development of these policies can have an effect on the beach environment and this need to be analyze.
8) Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term	Beach management should be part of a vision-driven process. The final idea is to align this management with the obtention of a sustainable development for the zone around the beach.
9) Management must recognize that change is inevitable	Adaptive management should be implemented to recognize change.
10) The Ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity	Depending of the particular case and specificities of the beach under management, natural functions of the beach should allocate the presence and use of biological diversity
11) The Ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices	An information system should be developed to guide decision-making and monitoring in the management process.
12) The Ecosystem approach should involve all relevant sectors of society and scientific disciplines	Institutional coordination of the various administrative services and regional and local authorities competent in coastal zone should be required. Appropriate effective governance structure needed.

TABLE-2.- The different phases and clauses of the mangerial pillar in the EBMS-Beaches.

A.1.- General Structure
A.2.- Vision
A.3.- Planning phase
- A.3.1.- National and International requirements.- The competent authority shall establish and maintain a procedure to identify all National and International requirements under which the area/region under management has obligations.
- A.3.2.- Social-Ecological key aspects.- The competent authority shall establish and maintain a procedure to identify aspects (human activities, events or hazards) that may have an influence on achieving the vision for the site under management.
- *A*.3.3.- Risk Management Plan.- The competent authority shall establish and maintain the documented Plan, with its objectives and targets. The Plan is the latest document based on the risk assessment approach**.**
- A.3.4.- Risk Management Programs**.-** The competent authority shall establish and maintain a series of risk management programmes and procedures intended for each management period upon which audits and reviews would be carried out.

A.4.- Implementation and Operation phase
- A.4.1.- Structure and responsibilities**.-** Roles, responsibilities and authorities shall be defined, documented and communicated in order to facilitate effective management.
- A.4.2.- Capacity building**.-** The competent authority shall identify training needs.
- A.4.3.- Communication.- A risk management communication plan should be implemented. Internal risk management communication and reporting processes as well as external communication plans must be established.
- A.4.4.- EBMS Documentation**.-** The competent authority should maintain the programmes needed to achieve its objectives and targets.
- A.4.5.- EBMS Operational Control**.-** The competent authority shall identify those operations and activities associated with the identified social-ecological key aspects in line with its policy, objectives and targets.
- A.4.6.- Vulnerable assessment and response**.-** The competent authority shall establish and maintain procedures to identify potential for and respond to accidents and emergencies, as well as for preventing and mitigating the environmental impacts that may be associated with them.

A.5.- Checking and Corrective measures phase
- A.5.1.- Monitoring.- The competent authority shall establish and maintain documented procedures to monitor and measure on a regular basis, the key social-ecological aspects that have a significant impact on the environment.
- A.5.2.- Unplanned events and conflict resolution capacity.- The competent authority shall establish an alert system to detect inappropriate functioning in the system and/or unexpected environmental hazards/activities.
- *A*.5.3.- EBMS records.- The competent authority shall establish and maintain procedures for the identification, maintenance and disposition of social-ecological key records used in the system as well as the evaluation of the indicators selected for the desired vision**.**
- A.5.4.- EBMS audits**.-** The competent authority shall establish and maintain a program and procedures for periodic system audits to be carried out.

A.6.- Review phase

Figure-1

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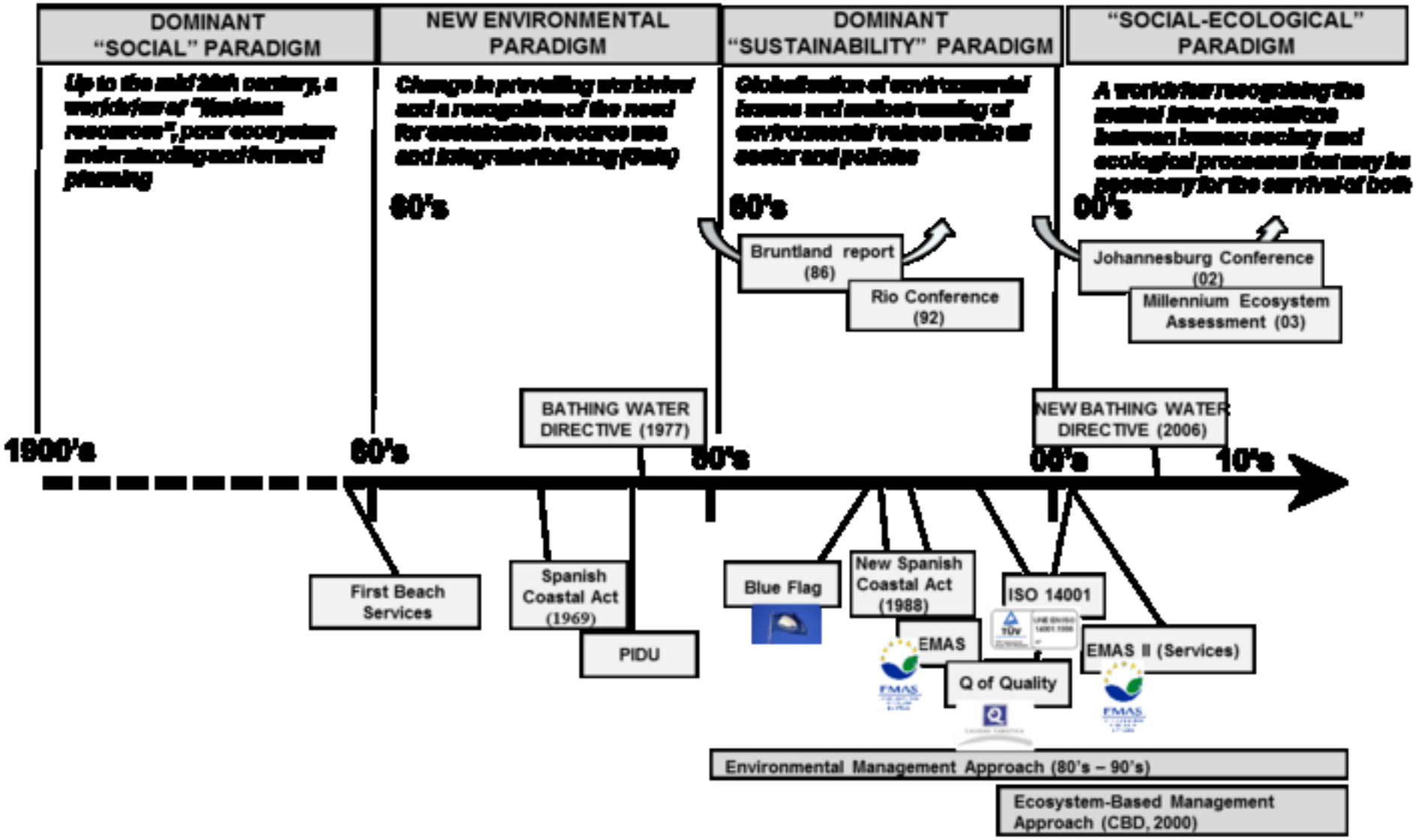

Figure-2

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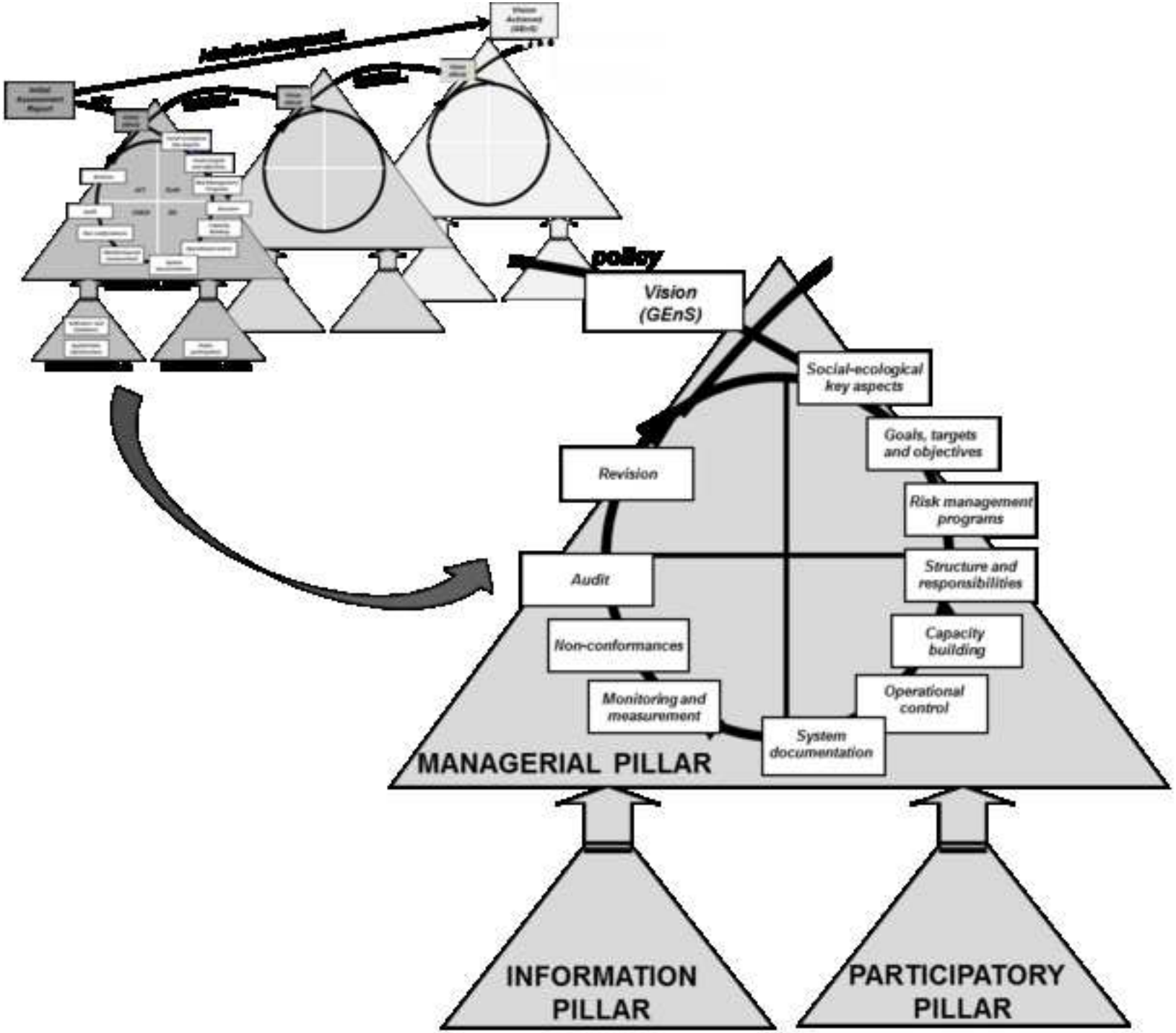

Figure-3

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Figure-4

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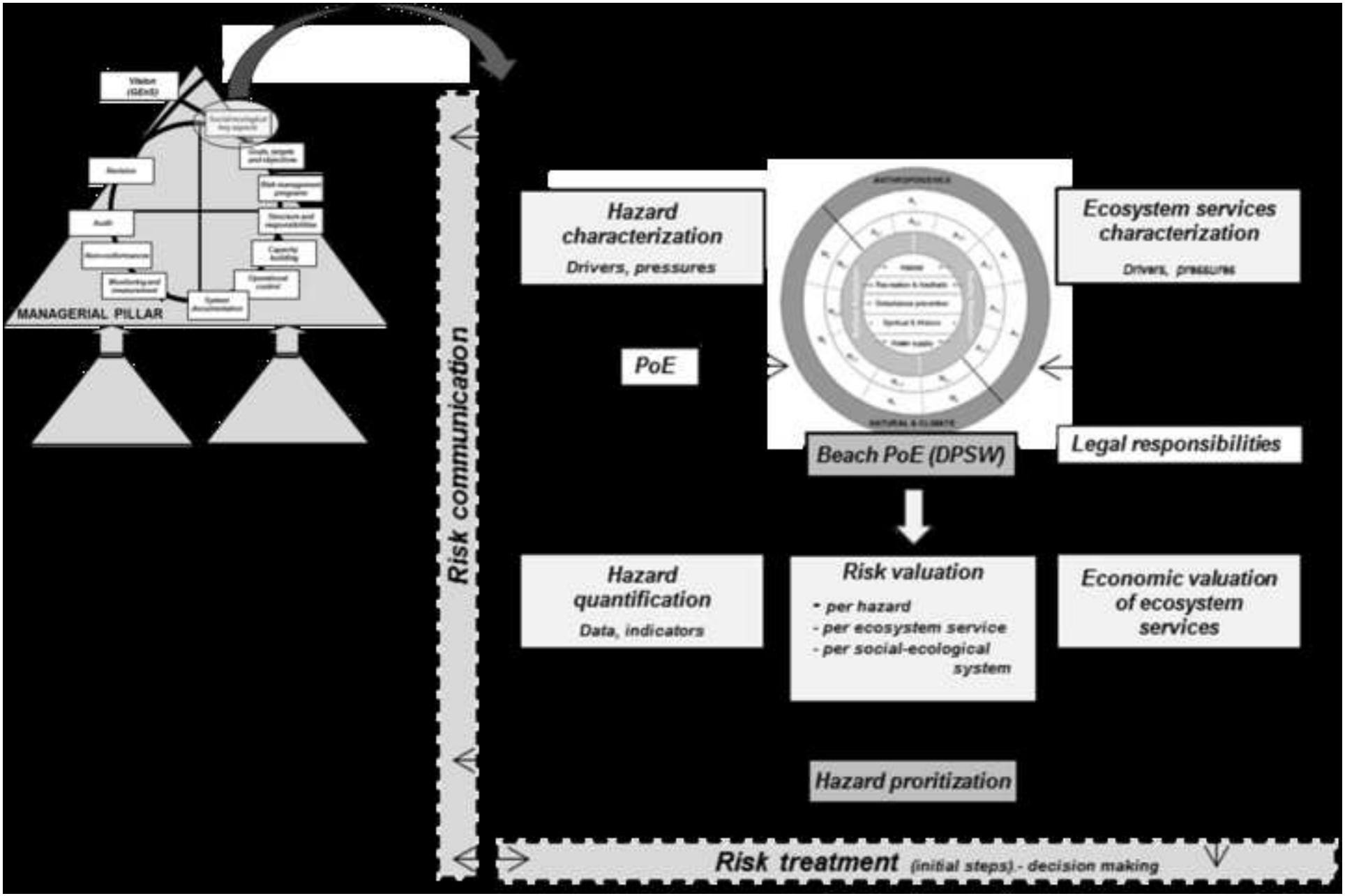

Figure-5
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