The Use of an Ecosystem Services Approach for linking Spatial Planning of Land and Sea

A Comparative Study between San Francisco and Hamburg

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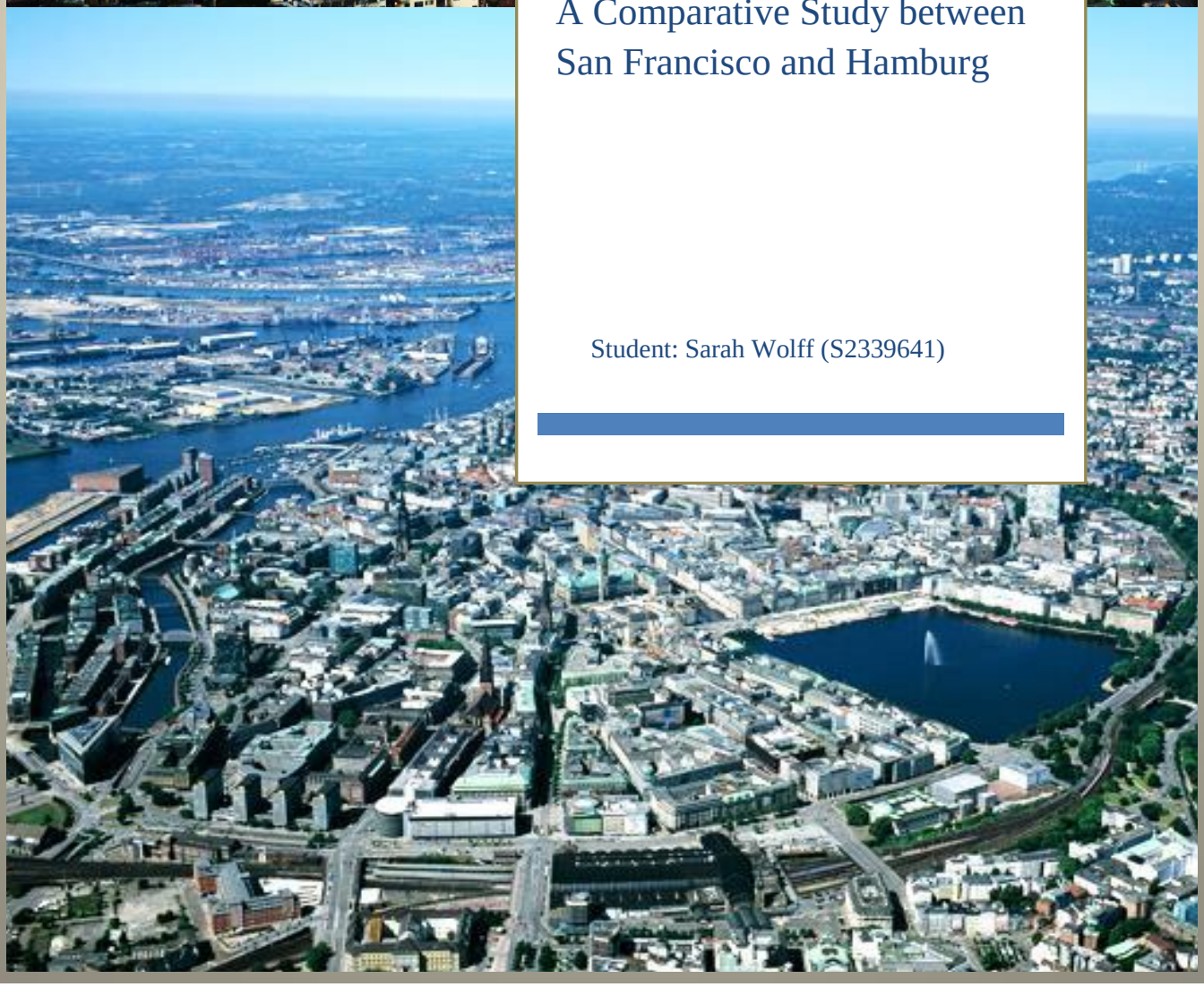

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A Comparative Study between San Francisco and Hamburg

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ABSTRACT

The Ecosystem Service Approach has received increased acceptance since the Millennium Ecosystem Assessment (2003). A variety of tools for assessing Ecosystem Services (ESS), such as mapping, valuation or modeling have been developed for decision-making and spatial planning. The central question of this study is how and to what degree the ESS Approach has been translated from science into policy and strategic planning. A focus is laid on the field of urban land use- and coastal -planning by comparing different planning frameworks, focusing on the coastal cities of Hamburg (Germany) and San Francisco (USA). The success of the incorporation of the ESS Approach in the city's planning frameworks is investigated by revising the legislation in place, inter-institutional coordination, and the division of responsibilities for the regional planning with regard to water- and land -use and city development. Results show a strong emphasis on ESS within strategic planning with a focus on those ESS prescribed by the general law in place. Planning instruments (environmental, land-use, urban) also tend to be oriented towards specific ecosystem components such as habitats or water quality. In consideration of the ESS Approach for institutional organization in both regions, it appears as if there is still a certain mismatch between policy needs and institutional organization. The implementation of a coordinating agency seems as a possible means for applying ESS approaches and for incorporating them into (strategic) planning. To move towards a stronger inter-sectoral and cross-border management and a more efficient consideration of ESS in decision making, vertical and horizontal cooperation is required, as is a better inter-institutional coordination and a stronger consideration of land-sea processes. Besides developing new instruments, the ESS approach should be incorporated into existing spatial planning instruments and should finally find a place in legislation. Collaboration, and the integration of innovative ideas on several scales is crucial for capacity building and ESS Approaches.

Key Words: Ecosystem Services Approach, Coastal Zone Management, Land Use Planning, Strategic Planning, Institutions, Integration

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LIST OF ABBREVIATIONS

GP General Plan

BCDC San Francisco Bay Conservation and Development Commission

BNatSchG Bundesnaturschutzgesetz

CICES Common International Classification of Ecosystem Services

CMSP Coastal and Marine Spatial Planning

CZM Coastal Zone Management

CZMA Coastal Zone Management Act

CZMP Coastal Zone Management Program

DEFRA Department of Environment, Food and Rural Affairs

EBM Ecosystem Based Management

EES Ecosystem Services

EU European Union

FFH-Directive Flora and Fauna Directive

F-Plan Flächennutzungsplan

IBP Integrierter Bewirtschaftungsplan des Elbeästuars

ICZM Integrated Coastal Zone Management

InVEST Integrated Valuation of Environmental Services and Tradeoffs

IPBES Intergovernmental Platform on Biodiversity and Ecosystem Services

MA Millennium Ecosystem Assessment

MSP Marine Spatial Planning

SFO San Francisco

TEEB The Economics of Ecosystems and Biodiversity

WFD Water Framework Directive

1. INTRODUCTION

Marine and terrestrial ecosystems are highly connected to human survival; they not only contribute to our well-being, but are the very basis of our existence. In the last decade, ecosystems have become increasingly subjected to human impacts and environmental changes, such as fast population growth and development, related pollution and resource scarcity, induced by our growing demand for resources. Since the Millennium Ecosystem Assessment (MA), it has become apparent that these trends threaten the life supporting capacities of our ecosystems and endangering the provision of services our ecosystem supply for us, such as for recreation, nutrition and safety. Ecosystem Services (ESS), defined here as *"benefits humans obtain from the environment"* (Millennium Ecosystem Assessment 2005) rely on dynamic processes for their functioning. The coastal zone which connects land and sea plays an important role in this regard (Àlvarez-Romero et al. 2011). Most of the impacts at the sea are direct results of human activities on land. In this coastal zone most industrial cities are located, where several human activities greatly impact the environment, with serious consequences such as flooding, water scarcity or pollution. These problems often directly result from both mismanagement and weak understanding of ecosystem functioning and services and their relations to human well-being.

In order to manage our coastal zones in an adaptive, flexible and sustainable way, and to insure the provision of ESS in the future, management needs to adapt to these global trends, while policy needs to understand management impacts on natural systems. Decisions and evaluations thus need to be based on sound knowledge of our ecosystems and the services for society they provide. As such trade-offs between services and their connections can be better understood and integrated into policy and decision making, balancing environmental protection and societal/economic benefits obtained from the environment and to ensure the provision of ESS in the future (Hancock 2010). This is a prerequisite to maintain human health, well-being, as well as economic prosperity. With the ecological and economic importance of the coastal zone, increased understanding of the spatial and temporal dynamics of land-sea processes/interactions is imperative as a basis for integrated management.

Many approaches for linking spatial planning of land and sea have been developed in recent years, such as Integrated Coastal Zone Management or Ecosystem Based Management. However, since the Millennium Ecosystem Assessment (2005) the Ecosystem Services Approach has received increased acceptance internationally, as the new framework for developing environmental policies, which follow integrated, cross-sectoral and more concrete, strategies for the sustainable use and management of land, water and its living resources (Holt et al. 2011). This has been reflected in recent policy developments such as the European Water

Framework Directive (2000/60/EC) and the Marine Strategy Framework Directive (2008/56/EC) (Holt et al. 2011).

The Ecosystem Services Approach aims to explicit identify the benefits provided by ecological processes (Ecosystem Services) to improve social, economic and environmental considerations within strategic decision-making (Pittok et al. 2012). It places ESS in the center of decision making by capturing their interdependent relationship with human well-being. The complexity between the human-ecosystem relationships, makes the ESS approach a bridging concept to bring natural- and social sciences closer together (Braat & De Groot 2012). This can contribute to institutional capacity building, due to the need for increased cooperation and coordination between different disciplines, sectors and functions in order to understand science underpinnings, the link between biodiversity and ESS but also societal/economic preferences of the benefits our ESS provide. In this regard, it can bring urban land use planning and environmental planning with its economic and environmental goals closer together.

The ESS Approach has also been linked to spatial planning, offering instruments for ESS assessments. As such, attempts have been made towards integrating the ESS Approach into land-use planning. This has been achieved, by methods such as economic valuation of ESS and their integration into socio-economic impact assessments made prior to infrastructure or development projects (European Commission 2010). In other cases, mapping and modeling ESS and biodiversity was done to assess the implementation of different spatial planning scenarios (such as InVEST by TEEB 2010). Efforts towards the specific integration of this approach into marine, land use- and coastal planning differ across regions. The development has been slower as for land-use planning, since appropriate and sufficient data for marine/coastal systems have been lacking (Reiss et al. 2010, Atkins et al. 2011, Heymans et al. 2011; in: Holt et al. 2011). Ecosystem services tend to be incorporated within environmental legislations and strategic planning in a way that a focus is put on single species or specific ecosystem components, which calls for a replacement by a more holistic legislative framework that deals with all relevant relationships between our ESS and human benefits obtained (Holt et al. 2011). Due to several benefits, the concept of Ecosystem Services has been highly propagated by scientists around the world, as has the need to consider these within current management practices.

Central to the here presented study are the questions of how ESS are practically considered within strategic planning of coastal cities in the USA and Germany, and what are the instruments presently in use. The objectives of this thesis are (1) to comparatively study the ESS derived from the coastal zone of Hamburg (Estuary) in Germany and the San Francisco (Bay Estuary) in the United States, respectively, and (2) to evaluate to what extend and how ESS are

incorporated in current policies and decision-making, focusing on urban land use planning/coastal planning of both regions.

It is expected, that the investigation of each study case with its key ESS and benefits, strategic planning and institutional socio-political arrangements will show different approaches to the integration of the ESS into land use and coastal planning. In addition, the potential of the Ecosystem Services Approach to link spatial planning of land and sea by increasing integrated and coordinated management of common ecosystems is evaluated and discussed. A central aspect hereby is to investigate the disconnect between current land use- and coastal- planning policies in the Hamburg and San Francisco study cases and to assess the potential of the ESS Approach, identifying gaps and lessons to be learned from their current management frameworks. The study aims at showing the current state and future potentials of an ESS Approach by comparing different institutional contexts and their set ups, and may help to inform future developments and policy making towards more adaptive planning and management.

1.1. Problem definition

Our ecosystems are exposed to an enormous pressure from environmental change and urban developments. To ensure their future functioning for our well-being, such as the provision of drinking water, pharmaceuticals, food resources, climate regulation, recreation or the protection of floods, decision-making needs to take these developments into account (Pritchard et al 2000). Over the past decades, a tremendous loss of biodiversity has been observed, due to ecosystem degradation and the lack of incentives provided by the society to sustain our ecosystems and their services. In this respect, the ESS Approach has increasingly received attention within the decision making process as a way to include ESS within strategic planning and policy.

The modern term of Ecosystem Service originated in the 1970 to connect ecosystem functions with benefits the ecosystem provides to society and economy and to help increasing public awareness for the need for conservation (European Commission 2010). With the concept of sustainability and the Millennium Ecosystem Assessment that followed, Ecosystem Services were widely defined by different authors (See for instance: Daily, 1997; Constanza et al. 1997; Boyd & Banzhaf 2007; Fisher et al. 2009; TEEB Foundation). After CICES (2011), Ecosystem Services can be divided into three main categories which are direct outputs from ecological systems and which can be consumed or used by society (Haines-Young 2012). These are: *Regulating and Maintenance, Provisioning,* and *Cultural and Social services*. Regulating or also referred to as *Supporting Services*, such as nutrient cycling, are responsible for processes and the functioning of our ecosystems and are the basis for other services. As they cannot be directly used, their inclusion into decision making is hard to capture.

The weak understanding of ecosystem functioning and services, and the externalities which have often not been included in planning procedures, are used as arguments for the need to improve ESS approaches such as valuation techniques. Here it is argued that if costs and benefits associated with ESS are well-estimated, a greater conservation of biodiversity can be achieved at lower costs and with higher benefits (Chan et al. 2011).Valuing and integrating ESS into decision-making may thus change the way ecosystems are perceived and managed and how decision-making operates. If ESS are well understood in terms of their benefits to society, trade-offs can become more efficient. Showing the direct benefits for humans gained from conservation efforts can also support funding, and synergies between conservation and economic development. In addition, the integration of the ESS Approach in decision making can increase the understanding of ESS and their cumulative effects (Ruhl & Gregg 2001).

There are several challenges with regard to ESS- policy, -management and -planning. The first, which is hampering both scientists and decision makers, is still the lack of understanding of the dynamic and complex relationship between ESS and human well- being (Hancock 2010). The study of goods and services crosses-disciplines and thus requires an interdisciplinary approach for decision-making and collaboration (Beaumont et al. 2007). The socio-ecosystem is a highly complex, non-linear system, which evolves in an unpredictable way (Folke at al. 2007). However, since there will never be a complete understanding of the complex relationship between ESS and humans, nor a full certainty and predictability, coastal zone management and planning needs to rely on simplification, leaving space for flexibility and adaptation over time (Townsend et al. 2011).

Another challenge besides environmental and social factors, is rooted in institutional arrangements and the fact that policy is often fragmented with diverse strategies followed by different sectors and actors (e.g. economy, housing, tourism, nature conservation). This can lead to conflicting outcomes or inefficiencies, even if sustainable development is a shared goal. Governance fragmentation, but also single species conservation efforts lead to inflexibility and poor adaptive capacity towards environmental and socio-economic changes. In addition, uncertainties arise for institutional arrangements due to spatial-temporal changes of ESS.

To overcome poor planning as related to agency fragmentation, a more holistic approach is required to increase cooperation, the share of information and best science, and to strengthen sustainable development and conservation of the coastal zones. As ecosystems and institutional arrangements differ between countries and geographical regions, as well as their patterns of change over time and space, it is crucial that techniques and institutional frameworks are being fitted to local resource patterns and ecosystems. Only then, a flexible and adaptive management and governance scheme may be achieved (Folke et al. 2007). Policy coherence would thus require vertical and horizontal policy integration due to the intersectoral nature of ESS.

Within the application of ESS Approaches, such as mapping and valuation, it needs to be considered that they are always temporally and spatially contextual. Where ESS are produced is not always the area where they are used, so that benefits may be felt elsewhere. For example, most of ESS are produced in rural areas, but are mostly benefitting urban areas. They are therefore not fixed, but under a flow between their production and use sites (Slootweg & Beukering 2008). The relationship between urban areas and ESS of the coastal zone is therefore central to be better understood. Besides the spatial context, ESS may change over time as well as do ecological processes, and societal preferences. This interconnectedness of temporal and geographical scales leads to the fact that decisions made now are likely to influence the provision of ESS in the future. This temporal and spatial uncertainty puts a challenge to ESS integration in decision- making and institutional capacity building. An institutional framework is therefore needed for governing human uses and the form of resource allocations, but also the intensity, time and spatial patterns. Within new understandings of these relationships, institutions need to continually adapt to developments (Folke et al. 2007).

1.2. Research objective and expected outcomes

The research objective of this thesis is to give a review of the ESS which are provided in both coastal cities by the ecosystems they are embedded in and to demonstrate ways on how to link spatial planning of land and sea through a more concrete strategy, the ESS Approach. Spatial planning and its policy regimes of land and sea shall be analyzed in terms of their integration of an ESS Approach. It is expected that with the application of the ESS Approach as a mechanism to link spatial planning of land and sea, knowledge is increased, exchanged and integrated between policy plans and institutions, which should lead to a more effective, adaptive, integrated and coordinated approach and thus improve the way our costal zones, including both land and sea are managed and sustained.

An important aspect here is to investigate if and how the ESS Approach has been translated into strategic planning and management practice. Therefore, regional institutional arrangements of both coastal areas are investigated and analyzed. The focus here is laid on comparatively studying the ESS which are derived from Hamburg and San Francisco, respectively, and to evaluate to what extend these are connected to current policies and decision making. Institutional arrangements will be analyzed to show different approaches to the integration of this ESS into land use- and coastal planning and to finally investigate potential successes and institutional organization which is needed for land sea integration. As a result, there should be an increased understanding of the organization of land use and coastal planning policy in the San Francisco and Hamburg region on the one hand, and the utility/use of the ESS Approach on the other hand. This can give rise to understand how ESS science has been translated by institutions into policy and strategic planning/management practice. The study results are

expected to support the assessment of future potentials of an ESS Approach by comparing different institutional contexts and their set ups (matureness of the systems), in order to inform future developments, policy making and institutional capacity building.

1.3 Research approach and questions addressed

The research is concerned with the key question of how (and if) the ESS Approach is currently being integrated into planning of land and sea in Hamburg, and San Francisco USA.

A theoretical background is given, elaborating on the ESS Approach and its relation to other coastal zone management approaches such as ICZM or EBM and tools such as MSP. This is important as the ESS Approach is often mentioned within a range of frameworks. Further, the importance of the coastal zone and estuaries for the provision of ESS shall be emphasized and thus the need to link spatial planning and management of land and sea. Finally, the state of approaches to integrate ESS into decision making are presented, after which the state of research about general policy integration is given. Within the theoretical background the following questions are considered:

- What is understood by the Ecosystem Service Approach?
- How is the Ecosystem Service Approach related to other coastal zone management approaches?
- Why is the integration of spatial planning of land and sea so important?
- What are different approaches, tools and methods to integrate ESS into coastal decision making? How are these approaches translated into policy so far?

After a theoretical background both cases (Hamburg and San Francisco) are considered separately by focusing on the following questions:

- What are key ESS of both regions, including uses and benefits derived from the coastal city?
- What are the key institutions/organizations which form the framework for land use- and coastal zone planning?
- How and to what extend do policies of land use and coastal zone incorporate these Ecosystem Services in both regions?
- How are Ecosystem Services assessed or valued in the context of spatial planning?
- How is planning of land and sea integrated in terms of Ecosystem Services?

After answering these questions the case studies are compared in terms of challenges and institutional contexts. Here, the key questions are:

- How are ESS considered within strategic planning in both coastal cities?
- How do results relate to management frameworks and institutional organization?

1.4 Research framework

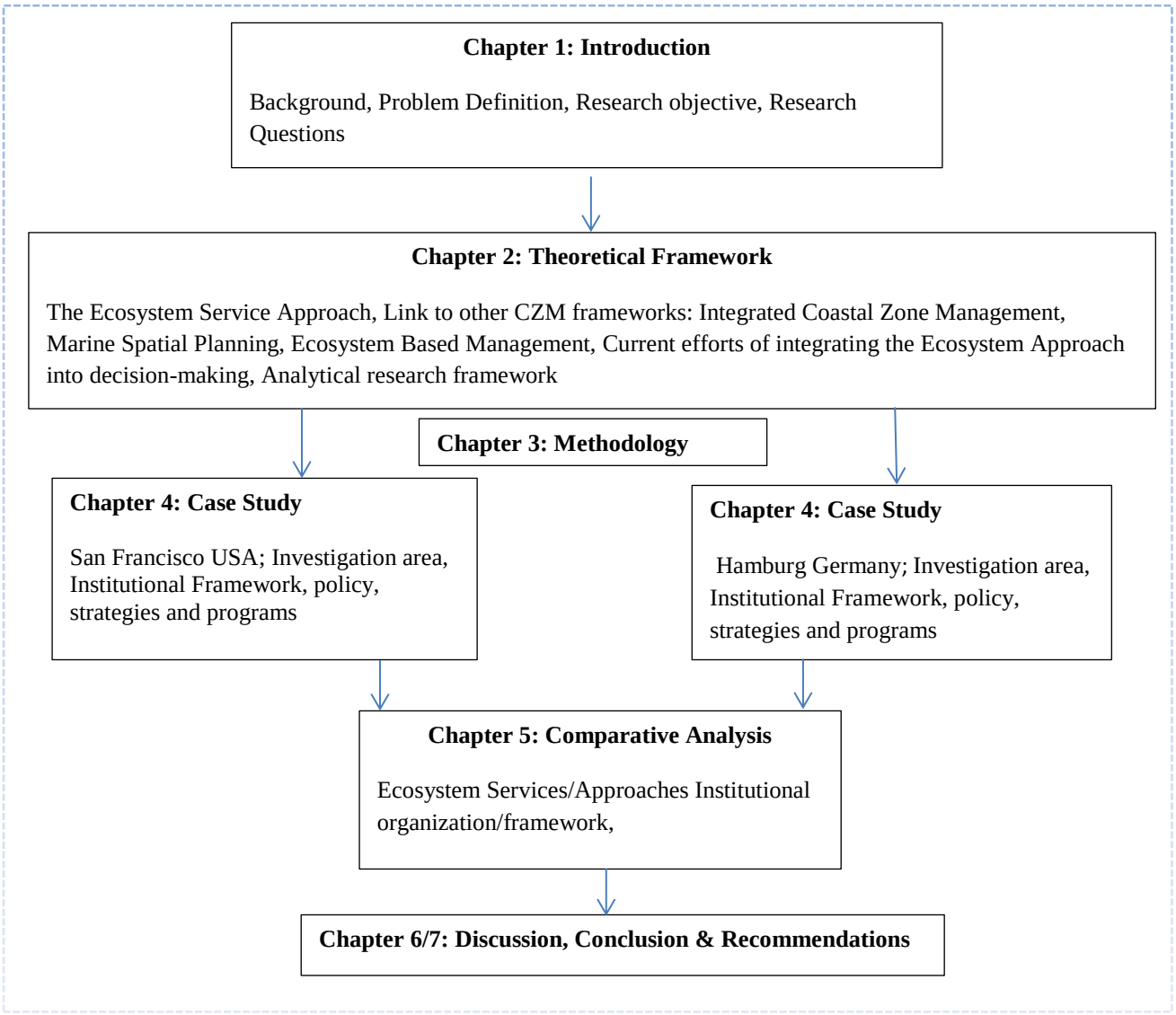


Fig. 1.1: Research Framework

2. THEORETICAL FRAMEWORK

Within this chapter the theoretical framework is given to guide and frame this research and to clarify and define relevant concepts. Therefore, relevant literature and research was studied, leading to the specific scope and framework of this study. First, to support the need for integrated land-sea approaches to management, the relevance and dynamic character of coastal zones is illustrated. After clarifying the Ecosystem Services Approach, its link to other coastal zone frameworks is illuminated, to better understand the connections and hierarchies between them, as well as the institutional and management frameworks, which relate to marine and coastal management. This assists the understanding of if/how the ESS Approach can be integrated to the existing frameworks and their instruments. The chapter is concluded with a description of current trends and developments of the ESS Approach, specifically how it is currently translated into policy and decision-making.

2.1. The need for linking spatial planning of land and sea

Coastal zone environments are located between terrestrial and marine systems and are affected by the processes of both components. The coastal zone is comprised of many habitats and provides the area were ecosystem processes, both important for land and sea, take place. Coastal zone ecosystems provide rich natural resources, which are essential for human well-being and survival. They serve as vital habitats for many marine species and their juvenile stages, as a sponge-like receiver of terrestrial pollution for marine systems, and for buffering land from wave impacts. Besides these functions, coastal areas provide fishery resources, sources of raw materials, recreational areas and can protect the land from flooding (Koch et al. 2009). The coastal zone is particularly sensitive to anthropogenic impacts and changes happening mostly on land. Here, most of the human population lives often in major growing coastal cities. Due to the close connection between land and sea processes, the change in one system can have direct impacts on the functioning of the other, thus threatening important ESS, on which we depend for our survival and well-being. For instance, through the development of coastal cities surface water run-off is often increased, leading to pollution and eutrophication of the coastal waters, which can greatly alter ecosystem functioning, threatening the carrying capacity to these ecosystems. To wisely mange these ecosystems, there is a need to shift research priorities to the better understanding between connections of land and sea processes instead of considering both components in isolation (Ruttenberg & Granek 2011).

The decline of coastal and estuarine ecosystems is threatening a number of crucial ESS and thus benefits derived from them. Examples are marshes (wave attenuation), sea grass beds or mangroves (pollution control), sand dunes (coastal protection/biodiversity) and beaches (recreation) (Barbier et al. 2011). The connectivity between land-sea gradients is high, especially for the provision of ESS. This requires integrated management of land and sea and research collaboration on ESS Approaches and their incorporation into improved institutional and legislative management frameworks. A benefit of doing so lies in the cumulative effects of these dynamic systems, which in turn provide cumulative benefits, more valuable than those obtained by one ecosystem component alone. Coastal and estuarine habitats are excessively used in many parts of the world. Research on their influence has seen the decline of three critical ESS: fishery (33% decline), the degradation of nursery habitats, such as sea grass beds and wetlands (68% decline), filtering and detoxification services, provided by vegetation, and wetlands (63% decline) (Barbier et al. 2011). These losses go along with a decline of important benefits such as protection against storms and flooding, biological diversity (threatened by invasive species) or the provision of clean water (decline in water quality).

Management of the coastal zone still hampers on the linkage between land sea systems and their connection in research and management. Boundaries between land and sea often directly divide management and jurisdiction between different governmental levels, which characteristically lead to conflicting or overlapping priorities for their management. Communication and coordination between different agencies, which deal with land and sea often fail to efficiently manage the dynamic processes. This is especially due to sectoral concentration of policy but also due to financial constraints to addressing issues behind their managed area. A better linkage between management and planning of land and sea can increase efficiency and institutional capacity building, allowing for better exchange between disciplines and latest scientific research. To make planning more efficient, adaptive and resilient in the long-term, there should be "*increase efforts to bridge the marine–terrestrial and science management disconnects"* (Ruttenberg & Granek 2011).

This is not an easy task as resource management of integrated marine and terrestrial systems is highly complex. In the San Francisco Bay delta, stakeholders and agencies make efficient management challenging, due to the fragmented responsibilities, and lack of coordination with river management (Gerlak & Heikkila 2006). To counteract the transformation of valuable ecosystems, a better understanding of critical benefits we obtain from these services is a first important step for changing policy and legislation. Successful implementation of coastal zone management has thus shown to be challenged by the *"wicked problems of the coastal zone"* (Rittel & Weber 1973, Jentoft &Chuenpagdee 2009; in: Ruttenberg & Granek 2011). To work

towards better integration between land and sea management, both systems should be considered as a whole by using ecosystem based approaches to better understand both systems managing land based activities in harmony with the ecological processes taking place in the coastal zone. Governance support to counteract the fragmented policy and legislation can be in form of applying an ESS Approach, which may improve cooperation and legislations through legal guidelines. This is crucial, especially for complex problems such as those facing the coastal zone, and which therefore require agency collaboration and coordination for developing common goals (Ruttenberg & Granek 2011).

Estuaries are regarded as the most vulnerable habitats of the coasts; they provide important ESS such as buffer zones against flooding, stabilize shorelines and protect coastal areas. On the other hand they are highly threatened from global environmental change, which in the long run influences local economic vitality. Yet, urban centers are increasingly located around estuaries, such as in the case of San Francisco and Hamburg. Therefore, it is important to consider the services these ecosystems provide in planning and decision making as well as the close relationship between land- and sea- use; thus the urgency to integrate ESS in any decision. About 70 percent of the world's population lives in urban regions, which are expected to increase further. Most of the large and industrial cities are located within the coastal zone, dominated by infrastructure and intense resource uses. With the high growth of urban areas the demands for natural capital is increasing. Most sectors and activities depend on its ecosystem for tourism, recreation, flood protection or the provision of raw materials. The city as a -center of resource use can be seen as a socio-ecological system which depends on the ecosystems and their components to ensure long term-well-being. Coastal cities should therefore no longer be considered as decoupled from surrounding ecosystems but as a component of them (Gómez-Baggethun & Barton 2013).

2.2. The ecosystem service approach

The modern term "*Ecosystem Services*" originated in the 1970's, framing ecosystem functions as benefitting society and economy to raise public awareness for the need for ESS conservation (European Commission 2010).The concept of Ecosystem Services was developed by ecologists and economists to show the inter-linkage between services provided by ecosystems, human well-being and economic development, by building on the concept of sustainability (Pittock et al. 2012). The first use of the term *"Ecosystem Service"* was by Ehrlich & Ehrlich (1981), within the concept of sustainability and later with the Millennium Ecosystem Assessment (2005). Since then, Ecosystem Services were widely defined by different authors (see for instance: Daily, 1997; Constanza et al. 1997; Boyd & Banzhaf 2007; Fisher et al. 2009; TEEB

Foundation). A general definition by the Millenium Ecosystem Assessment considers ESS as the *"benefits humans obtain from the environment"* (Millennium Ecosystem Assessment 2005). More specifically, Pittock et al. (2012) defines ESS as a direct result of resource outputs which humans can use or benefit from. Constanza et al. (1997), emphasizes the benefits themselves which *"human populations derive directly or indirectly, from ecosystem function"*. Often ESS are divided into three main categories which are direct outputs from ecological systems and which can be consumed or used by society (Haines-Young 2012). These are specifically: provisioning, regulating, and cultural services. Supporting services, such as nutrient cycling, are what other services depend on, responsible for processes and the functioning of our ecosystems. As they cannot be directly used, their inclusion into decision-making is hard to capture. Some examples of each service can be seen in the Figure 1, taken from the Millennium Ecosystem Assessment (2005).

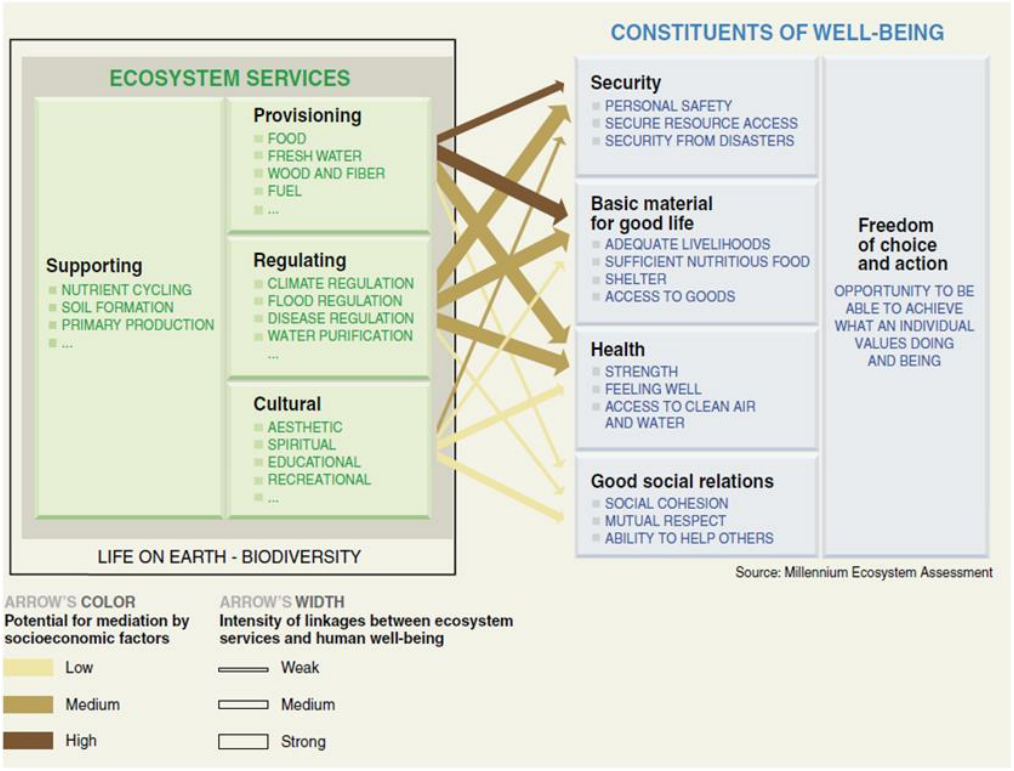


Fig. 2.1: Ecosystem Services and their direct linkage to human well-being (Millennium Ecosystem Assessment 2005)

CICES Section	CICES Division	TEEB Categories			
Provisioning	Nutrition	Food			
	Water supply	Water			
	Materials	Raw materials	Genetic resources	Medicinal resources	Ornamental resources
	Energy				
Regulating and Maintenance	Regulation of bio-physical environment	Air purification	Waste treatment (esp. water purification)		
	Flow regulation	Disturbance prevention or moderation	Regulation of water flows	Erosion prevention	
	Regulation of physico-chemical environment	Climate regulation (incl. C-sequestration)	Maintaining soil fertility		
	Regulation of biotic environment	Gene pool protection	Lifecycle maintenance	Pollination	Biological control
Cultural	Symbolic	Information for cognitive development			
	Intellectual and experiential	Aesthetic information	Inspiration for culture, art and design	Spiritual experience	Recreation and tourism

Fig. 2.2: Relation of CICES grouping and TEBB Classification of Ecosystem Services (Haines-Young 2012)

The Common International Classification of Ecosystem Services (CICES) has proposed a classification scheme of ESS, which can be directly or indirectly used by society. However, this classification is a proposed structure rather than a fixed one and should be developed as to adapt to different needs by keeping a flexible structure (Haines-Young 2012).

For the ocean or urban areas for example, classification has been adapted or developed differently for using methods such as ESS mapping, assessment, as well as accounting. These classifications are helpful if ESS are to be incorporated into decision-making. Here, biodiversity is the central typology, as many other ESS depend on it. Understanding the link between ESS and humans, thus what it involves and how it can contribute to sustainable development, is important to make effective decisions (Braat & De Groot 2012).

The consideration and inclusion of ESS within decision-making has led to the so called Ecosystem Service Approach, which aims to explicitly and systematically identify the benefits provided by ecological processes to improve social, economic and environmental considerations within strategic decision-making (Pittock et al. 2012). It is an approach to *"integrate ecological, social and economic dimensions of natural resource management"* (Cork et al., 2007). Central to it is the identification and classification of the benefits that people derive from ecosystems, including market and non-market, use and non-use, tangible and non-tangible benefits. By doing

so, a monetary valuation of ESS is a central objective of the ESS Approach (von Haaren & Albert 2011). It emphasizes on the role of consumer and producer for maintaining and improving ecosystems for well-being and communicates the ESS role in terms of human benefits derived from natural and modified ecosystems (Cork et al. 2007). To enhance the understanding of ESS to the public, education is facilitated with the assumption, that collaborative activity can support the public sense of responsibility towards nature (von Haaren & Albert 2011). However, the ESS Approach is not a separate process to be carried out but rather integrated into regular policy development, in all stages of decision making (Defra 2010). It can help to achieve several goals such as sustainable development or climate change protection by taking into account the environment, which delivers and contributes to these overall aims. In terms of policy objectives, opportunities for delivering these can be assessed by working with the natural system in a way of considering positive and negative impact of policy options and services within impact assessments. Likely outcomes of applying such an ESS Approach is a thinking, which is long term, large scale, outside traditional policy boundaries, and the consideration of producers and consumers/beneficiaries of ESS in policy development (Defra 2010).

2.3. Linkages to other coastal zone management frameworks

Even though the ESS Approach has been widely considered for better integrating environmental management, it has also been questioned how far this *"new"* approach differs or resembles other already existing approaches to sustainable environmental management (Pittock et al. 2012). Therefore, the similarities and differences of coastal zone management frameworks, to link spatial planning of land and sea are compared, and reflected. Specifically, relevant frameworks include Integrated Coastal Zone Management, Marine Spatial Planning, and Ecosystem Based (Marine) Management (EBM).

2.3.1. Integrated coastal zone management (ICZM)

Integrated coastal zone management (ICZM) received prominence within the UN conference on Environment and Development as one of the principles of chapter 17 in Agenda 21, which dealt with coastal resources. States were called to set up ICZM strategies to manage local marine and coastal biodiversity, as well as conflicting interests of the coastal zones resource use in order to ensure sustainable development. Emphasis was put on integration and coordination across land and sea by better understanding the land-sea interactions. In 1996, the EU commission launched the ICZM Demonstration Program and in 2002, Recommendation Strategy for ICZM. Recommendations of the European Parliament and the Council emphasized a strategic approach to the management of the coastal zone by protecting the coastal zones environment, based on an

ecosystem approach, insuring environmental integrity, function and overall sustainable management of natural resources of marine and terrestrial components of the coastal zone. Further climate change threats, such as natural disasters need to be taken into account by protecting the coast as a cultural heritage area for coastal settlements, and economic activity. Social and cultural systems, in local coastal communities need to ensure access to recreational activities and aesthetical values (Council 2002). This is an important component of coastal zone management in the US. Whereas CZM has a long tradition in the US, within Germany and the European Union (EU) the concept still struggles with practical implementation due to fragmented policies, the lack of a leading authorities and general institutional gaps.

2.3.2. Marine spatial planning (MSP)

Marine spatial planning (MSP) can be understood as land-use planning, applied for marine systems, as a tool for decision-making processes. A key characteristic of MSP is that it aims at integrated planning across policy fields and sectors; therefore it can be seen as a tool for the coordinated management of marine uses including all activities, by implementing, enforcing, monitoring and reviewing plan-making activities. It has a strong orientation into future developments, thus it is a marine planning tool for ensuring sustainable development (DEFRA 2006).

A definition given by DEFRA (2006) considers MSP as *"an integrated, policy- based approach to the regulation, management and protection of the marine environment, including the allocation of space that addresses the multiple, cumulative and partially conflicting uses of the sea and thereby facilitates sustainable development"*. What should be noted though is that MSP is about planning and managing human activity in the marine space. Ecosystems or their components are only considered in terms of human activity. The general characteristics are listed below:

- Ecosystem-based, balancing ecological, economic, and social goals and objectives toward sustainable development
- Integrated, across sectors and agencies, and among levels of government
- Place-based/ area-based
- Adaptive, capable of learning from experience
- Strategic and anticipatory, focused on the long-term
- Participatory, stakeholders actively involved in the process (Ehlers & Douvere 2009).

For ecosystem based marine spatial management, MSP is an essential tool. It was developed to manage multiple uses within the marine space across sectors and boarders, to improve decision-

making and to make use of an ecosystem-based approach to manage the multiple, conflicting activities of the marine environment. MSP was stimulated to develop marine protected areas, to conserve marine biodiversity as well as to plan and manage uncertain developments of marine space. Decision-making in MSP therefore builds on ecological principles, taking uncertainty into account. It is used for achieving sustainable development and biodiversity conservation of ocean and coastal areas. MSP does not require a specific legislation; however some countries have adapted special legislations for MSP such as the United Kingdom with its Marine and Coastal Access Act (2009)[1]. Other countries such as the Netherlands and Germany have made use of existing land-use planning legislations, which they have extended to the sea to deal with MSP specifically (Katsanevakis et al. 2011).

MSP is a tool to plan marine activities, which can lead to use conflicts between user groups (human uses conflicts) as well as conflicts between human uses and the marine environment (user-environment conflicts) which may weaken the provision of ESS. The understanding of spatial distributions of marine spatial diversity over time is important which can be supported by mapping approaches, not only for activities but also for ecosystems and their services. The marine environment allocates several goods and services. Demands can however not all be met simultaneously. The common property character of marine resources puts another challenge on its management. Valuation schemes used by the market cannot be used sufficiently; therefore MSP serves as public process to decide about the mix of goods and services, which are produced by the sea (Ehler & Douvere 2009).

MSP is similar to ICZM in many regards. Both are integrated, strategic, and participatory approaches while dealing with conflict resolution between human use- and user-environmental - conflicts. However, within ICZM, the extent of the defined coastal zone including land and sea has been limited in most countries to a narrow part of coastline within a kilometer or two from the shoreline. The inland boundaries of coastal management rarely include coastal watersheds or catchment areas. To the other side coastal management rarely extends into the territorial sea and beyond the exclusive economic zone. MSP can serve as a missing piece of ICZM as it focuses on the human use of marine spaces and places. Spatially it can foster a better integration for planning from coastal watersheds to marine ecosystems (Ehler & Douvere 2009).

2.3.4 Ecosystem Based Management (EBM)

EBM has been mentioned as the application of the ecosystem approach to management, whereas more recently ecosystem based marine spatial management (EB-MSM) has been mentioned as a multi-disciplinary management approach, which takes into account interactions of marine ecosystems including humans, with the goal to*" maintain marine ecosystems in a healthy,*

[1] See DEFRA (2012): http://www.defra.gov.uk/environment/marine/mca/

productive and resilient condition so that they can sustain human uses of the ocean and provide goods and services humans want and need" (Mc Leod et al. 2005 in: Katsanevakis et al. 2011). It is concerned with the linkage between marine and coastal ecosystems in the regional scale, whereby MSP and ocean zoning are seen to strengthen ecosystem based management. In contrary to sectoral management, the interdependent nature of marine and terrestrial ecosystems is central. Marine spatial planning and marine protected areas can be seen as area-oriented management tools within the framework of ecosystem based management. However, for the all-encompassing integration between marine and terrestrial ecosystems it is insufficient due to its area fix. Stressors on the marine environment are rarely spatially fixed but rather dynamic and fluent such as climate change, land base pollution or ecological processes. Therefore, more integrated approaches such as ICZM, EBM or EB-MSM are able to translate ESS goals more holistically by making use of available tools such as MSP or land use planning.

Ecosystem based management as "*a multi-faceted, integrated approach that strives to maintain healthy productive and resilient ecosystems that provide goods and services required by resident and migrant user populations, including human"* (Robinson & McLeod 2005) can be seen as an umbrella concept for several ecosystem-based principles, which are incorporated in core elements, supported by EBM tools. The components together set a toolkit to build on existing management approaches. There are several common principles throughout the literature, such as its place-based focus, considering a specific ecosystem and the range of activities affecting it, including physical and biological processes and human activities. The protection of ecosystem structure, functioning and key processes should be based on science, requiring a management which accounts for the interconnectedness within the systems, the importance of interactions among many target species or key services and other non-target species. Further, EBM addresses the interconnectedness among environments, such as air, land and sea while integrating ecological, social, economic and institutional perspectives, recognizing their strong interdependence and mutual influences. To make wise decisions, the interactions and relationships among components of the social system are considered within management sectors, thus emphasizing the need for collaborative governance processes (Robinson 2009).

Robinson and McLeod (2005) state that efforts towards conserving ecosystems such as through the setting up of marine protected areas or zoning are only temporary if policy is not fitted to continuous environmental change and human impacts. Ecosystem-based management as the umbrella concept for cumulative impacts of different sectors can increase the efficiency of such tools capturing the complex relationship between ESS and its management.

The conservation and functioning of ESS within management is central for ensuring the delivery of services into the future, including provisioning, regulating, cultural and supporting services. Therefore, management must be integrated across multiple sectors, without losing its sector specific function (A). Different sectors might have different interests but they directly depend and influence each other. Coastal development, as an example, brings infrastructure and waterfront development with it, which can be to the expense of fisherman and water quality. fishery or water quality management are important tools to ensure the functioning of ecosystem processes and services, they are however not sufficient if the coastal zone management allows for endless development without considering environmental quality standards, policy and legislations. This emphasizes the cumulative impacts of management action of each sector on the stocks and flows of ESS. Therefore cumulative effects of sectors through time and individual effects need to be examined (B). These effects stand in direct interaction with ecosystem functioning, structure and processes and therefore should be monitored. Central to EBM is the aim of maintaining key ESS (D) which result from ecosystem structure, functioning and

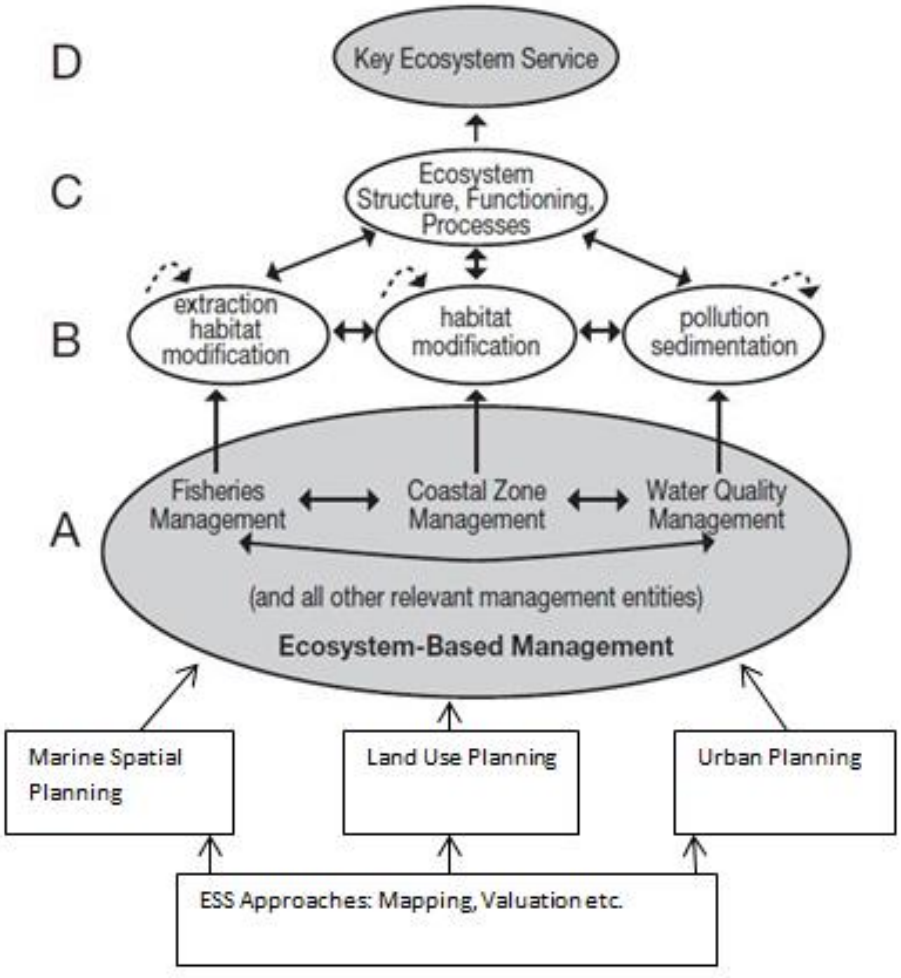


Fig.2.3: Ecosystem-Based Management and its relation to other CZM frameworks/tools (modified after Rosenberg & McLeod 2005).

processes (Rosenberg & McLeod 2005). It is crucial to control cumulative effects on land, along the coast as well as the ocean, which needs to be taken into account within policy.

Considering the approaches mentioned, it can be seen that EBM focuses on the ecosystem and that it is concerned with multiple species and sectors and their cumulative impacts, important as many of the ESS are highly interlinked. It serves as an umbrella concept; thus connecting EBM goals with tools which support decision making about ESS such as mapping or valuation of ESS, as well as planning instruments such as MSP, land use planning or urban planning can contribute to a more integrated strategy making/development.

2.4. Present translation of the ecosystem service approach into policy and decision -making

Even though the ESS Approach is relatively new, current applications of the ESS Approach is increasingly being considered by a range of policy-makers with the awareness that making decisions on the basis of nature is more cost-effective than technical solutions. This has supported the integration of the ESS Approach into planning and policy. Different approaches or methods exist how to integrate ESS into decision-making such as mapping, valuing or modeling. The EU Biodiversity Strategy 2020 (European Commission) addresses the need to account ESS through biophysical mapping and valuation and the need to integrate biodiversity sufficiently into economics and policy (European Commission 2012). Recently, the concept of ESS has been identified as a pillar of the assessment of impacts in preparation of the 2012 commission's blueprint to safeguard the future of European water by 2015. Ecosystem Service restoration and preservation is additionally identified as one of the six priorities of the rural development in the proposal of EU´s common agriculture policy (CAP). Within the USA, the National Ocean Council implementation plan, emphasizes on the need for *"a framework for effective coastal and marine spatial planning (CMSP) that establishes a comprehensive, integrated, ecosystem-based approach to address conservation, economic activity, user conflict, and sustainable use of ocean, coastal, and Great Lakes resources"* (White House Council on Environmental Quality 2010).

The explicit integration of the ESS Approach for regional measures has been done within the Helsinki Commission Baltic Sea Action Plan, where the ecosystem health of the entire regional Baltic Sea was assessed including costs and benefits to society (Backer et al.2010).

Decision support tools such as mapping, modeling or valuation schemes have been increasingly developed and applied with different approaches and at different scales. Mapping ESS has been conducted by the Natural Capital Project, the ESS partnership Intergovernmental Platform on

Biodiversity and Ecosystem Services (IPBES) which serves for scientific information exchange related to ESS and between governments and practitioners. The inclusion of ESS into decision-making has occurred for instance in conservation polices, natural resource management, or in economic matters, where companies have been striving to assess risks and opportunities of ecosystem functions. The rational for mapping ESS is to evaluate how biodiversity relates to the spatial scale, to analyze synergies and trade-offs between and within ESS, to see trends, estimate cost and benefits of their use of conservation, to compare ESS supply and demand, value biophysical quantities in monetary terms or find priority areas for spatial planning and management. Modeling ESS can assist assessment scenarios and can help to increase understanding of spatial and temporal flows of ESS. Additionally, scenario modeling can help to assess policy alternatives and to show possible synergies, trade-offs or conflicts among policy goals and ESS. Challenges remain as the lack of a consistent typology and a clear definition of different ESS and methodology can lead to diverging results even in the same study area, thus hampering the comparison between studies (Maes et al. 2012).

These decision support tools are more developed for terrestrial systems. For marine systems, science and politics try to increasingly assess marine ecosystem services. However, concrete tools have been lacking, or only address single services. This is due to different challenges of applying the ESS Approach to marine systems compared to terrestrial systems. On land, human uses and activities take place on the land surface, whereas for marine systems, activities take place at different layers, including the sea surface (i.e. shipping), water column (i.e. diving, fishing) as well as benthic habitats (i.e. cable laying, mining), which are under a dynamic flow. In addition, whereas land is commonly owned privately, there is limited private ownership of marine environments, which leads to a characteristic of a common good, which requires an effective management approach (Guerry et al. 2012). By taking into account the land-sea connection, and the interacting processes and flows of ESS, the management/institutional fit remain a challenge for environmental resource management. The promising approaches, which have been developed in recent years, should be effectively translated into policy and institutions by adapting best available knowledge to local circumstances.

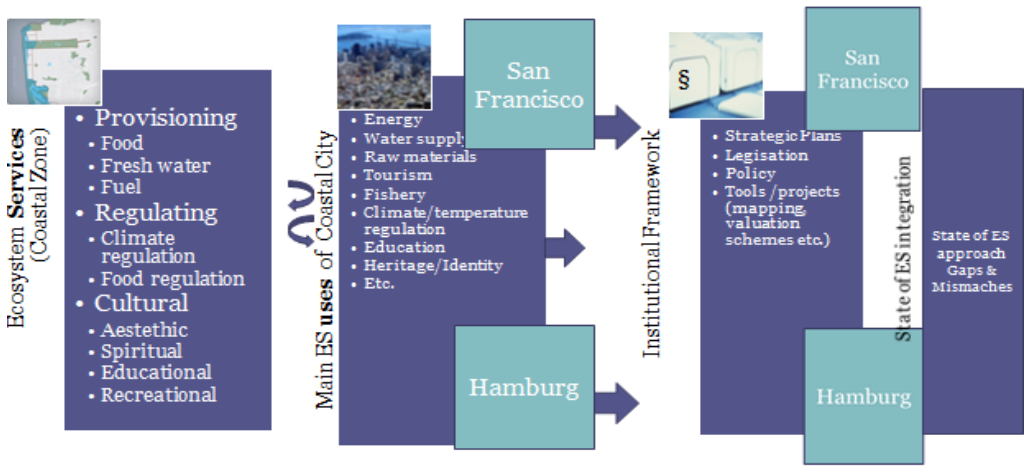
2.5 Analytical research framework

The ESS Approach is increasingly tested with developed tools and methods such as valuation, mapping or modeling of ESS by aiming for explicitly and systematically identifying the benefits provided by ecological processes to improve social, economic and environmental considerations within strategic decision-making (Pittock et al. 2012).

Within this theoretical background, the role of the coastal city as main user of ESS but also as a key player for maintaining functional ESS on land (such as green spaces, parks) and at sea (water quality, habitat), is illuminated. Urban land use planning traditionally stops with its (geographic) spatial boundaries, rather than being integrated or fitted to the ecosystem scale it is embedded in (Breuste et al. 2013). Taking an ecosystem based approach to Hamburg and San Francisco, including its ecosystem and urban area as a coexisting system, can change this traditional consideration.

As different habitats and ecosystems provide different ESS and different urban areas can have different uses, the general classification needs to be adapted to local circumstances. Gómez-Baggethun & Barton (2013) have proposed a classification scheme with important ESS in urban areas and underlying ecosystem function and components. While their focus is on ESS provided by urban areas and peri-urban areas, the CICES definition is more general and focuses specifically on the final output or products from the ecological system which can be directly consumed or used by people (Haines-Young 2012). These are compiled and used for analyzing and coding the strategic plans, considering *provisioning*, *regulating* and *cultural* services (see Tab.3.1). This will give rise to the main uses and benefits obtained by the coastal city from its ecosystem it is embedded in. consideration within strategic planning, instruments and tools. Institutions and governance control effective management of ESS, thus their organizations can decide about the future potential for applying ESS Approaches within planning (Millennium Ecosystem Assessment 2005).

Fig. 2.4: Steps leading to results



3. METHODOLOGY

Starting with a general analysis of the theoretical background of ESS and approaches, their development and integration into planning, both coastal cities are analyzed through individual case study research to specifically investigate which ESS are derived from both coastal cities respectively and how these are integrated into their management framework. In order to find out if and how the approach is currently integrated into decision-making, selected strategic plans, legislations and policies are reviewed, whereas key strategic plans are analyzed in detail using a qualitative content analysis, supported by the program MAXQDA to manage and code the data. Plans were selected on the base of their relevance of the coastal zone management, including land, sea and the coastal cities at the regional scale, which were identified through case study analysis and deductively selected in reference to the ESS classification by the Millennium Ecosystem Assessment and CICES. Here it is investigated to what extent coastal zone management and planning, considers key ESS. Gaps of translation from science into management practices are identified and connected to institutional frameworks of both regions. Due to the limited scope of the thesis, two central strategic management plans were selected and analyzed in detail in terms of ESS. Here, plans were selected to cover urban land use planning as well as coastal planning of the region. These are for San Francisco the "*General Plan"* as well as the *"San Francisco Bay Plan"* and for Hamburg, the *"Flächennutzungsplan (F-plan)"* and the *"Integrierter Bewirtschaftungsplan des Elbeästuar (IBP)".*

To find out about the state of integration and application of the ESS Approach into land use- and coastal -planning within Hamburg, and San Francisco, both institutional frameworks are reviewed. For the comparative study, the use of the ESS approach is analyzed within the different institutional contexts and the mechanisms (instruments, tools) used for decision-making. The comparison is driven by a study of the current process of policy making in regard to ESS and their relevance to coastal zone planning and management. The two cities were chosen, due to their geographical and socio-economical characteristics, since both are coastal cities, located within major estuaries, sharing some similar characteristics and problems of multi-uses and ESS. In addition, California and Northern Germany have different institutional structures and organizations, yet are known for their well-developed environmental management approaches, while keeping efforts towards EBM. Especially the USA has recently adopted a coastal and marine spatial planning framework (with the Ocean Policy Task Force, 2009) with an emphasis to preserve critical ecosystem functions and services (NOAA Coastal Service Center n.d). In order to see potentials and perspectives for a better integration of the ESS Approach into planning, differences between institutional frameworks are considered. The different economic, ecological and agricultural perceptions and institutional systems of Germany/EU and Califonia/USA are assumed to lead to different approaches in land use- and

coastal planning. As the ESS Approach is highly propagated by international directives, yet rather new for management, it is interesting to see how it is approached across borders within different regional institutional contexts (legislation, regulation, socio-economic setting etc.). Even though the success of integration will depend on the local geographical-, cultural- and institutional contexts of any country, a closer exchange of good and negative experiences may serve an important step towards greater awareness, adaptation and exchange of best practices towards the ESS Approach to management.

As Fisher et al. (2009) suggest *"classification of ecosystem services should be based on: a clear definition of ecosystem services; understanding the characteristics of the ecosystem or ecosystem services being considered; and an understanding of the decision context in which the ecosystem services are being used".* Criteria selection was derived deductively by reviewing information about both study areas (empirical) and inductively by referring and adapting them to the MEA classification of ESS (theory). The ESS Approach provides a framework for looking at the whole ecosystems in decision making by considering their systematic function for human well-being (Defra 2010). Therefore, the focus is on the socio-economic ecosystem services/benefits obtained within the region as well as their constraints. Incorporating the value of ESS requires assessments and understanding within decision making; the context in which decision making occurs is grounded in institutional contexts and is therefore analyzed as well within both case studies.

Case Study & Comparative Research

Case study research is concerned with the complexity and nature of the studied case. Within the case study there is a specific focus on the socio-economic use and benefits derived from the area and the ecological services provided by it. Furthermore, both institutional frameworks are analyzed. This step serves as a basis for the comparative analysis, which is grounded in the institutional contexts. Within the case studies the focus is laid on qualitative research in form of comparative research though content analysis. Cross-national and cross-cultural research is in the center by keeping the emphasis on the integration of the ESS Approach in spatial planning of land and sea. These specific aspects/phenomena are compared in both countries/states with the intention of comparing their manifestations in different socio-cultural, economic and institutional settings, using the same research instruments with a secondary analysis of documents (Hantrais 1996, in: Bryman 2012).

Contextual Review & Qualitative Content Analysis

For the analysis of documents, a qualitative content analysis is used. Content analysis is an approach for the analysis of documents or texts, while seeking to quantify content in terms of predefined categories in a systematic and replicable manner (Bryman 2012). It is used in research as a technique for the "*objective, systematic and quantitative description of the manifest content of communication*". The main quality of content analysis is that it should be objective and systematic (Berelson 1952: 18, in: Bryman 2012). Content analysis aims to produce quantitative accounts of raw material in terms of categories by specific rules. Within the analysis, the apparent content of the item in question (Ecosystem Services) is concerned. Emphasis is put on the meaning of the texts by searching for certain ideas, approaches within the text /document. This means, that general text segments which refer to Ecosystem Services are coded. This includes the ESS per se, instruments and tools which consider ESS (communicative, mapping etc) as well as how well their relationship between ecosystem and human well-being is understood and translated into policy. This approach is termed ethnographic or qualitative content analysis. More specifically, Mayring (2000), describes a qualitative content analysis as *"an approach of empirical, methodological controlled analysis of texts within their context of communication, following content analytical rules and step by step models, without rush quantification."* (Mayring 2000: P.2). The controlled analysis is done by creating content categories, which are revised and if necessary changed within the process. Content categories stand in the center of the analysis. These categories are then interpreted within the text analysis and by following the research questions. The research questions which are analyzed with a qualitative content analysis follow below: *How do current strategic plans and policies incorporate Ecosystem Services into coastal zone planning and management?* This question is answered by analyzing policies, strategic plans and regulations of the region in terms of its consideration of Ecosystem Services *What Ecosystem Service Approach (tools and methods) are used to integrate the ESS into decision making?* Here, the documents are also analyzed for these aspects. The last question in consideration of content analysis is how this approach is translated into policy: *Is this approach already translated into policy i.e. integrated in current legislation, and if so, how?* Texts are scanned towards indications of institutional cooperation especially between the land use- and coastal plans of the region.

Tab. 3.1 Ecosystem Services and Benefits adapted after MA, CICES & Gómez-Baggethun & Barton

ECOSYSTEM SERVICE	DEFINITION (Millenium ESS Assessment 2009)	CLASS (CICES)	Service Group (CICES)	HUMAN BENEFITS & SERVICES adapted from Gómez-Baggethun & Barton (2013)
Provisioning Services	Products obtained from ecosystems	Nutrition	Terrestrial plant and animal	Food supply (water, vegetables, sea food, plants, copping, animal production)
			Fresh water, plant and animal; Marine plant and animal	Drinking water; Subsidence fishing, commercial fishing, aquaculture, harvesting marine plants for food (fish species, algae, water cress, crustaceans)
			Portable water	Water storage & purification provided by wetlands, river, reservoir, lake.
		Materials	Biotic materials	Genetic and ornamental resources (shells, feathers, bones), timber.
			Abiotic materials	Raw Materials & Mineral resources (salt, aggregates, minerals)
		Energy	Renewable biofuels	Wood, fuel, energy crops, dung
			Renewable abiotic energy	Green energy through energetic outputs (Wind, hydro, tidal, solar, thermal)
Regulating Services & Maintenance	Benefits obtained from the regulation of ecosystem processes	Regulation of wastes	Bioremediation	Air and water purification, provided by vegetation or green space
			Dilution and sequestration	Wastewater treatment, filtration of aerosols and particles for clean water and air (Dilution and filtration, sequestration and adsorption provided by the ecosystem)
		Flow regulation	Air, Water & Mass	Water flow regulation and runoff mitigation, flood control, coastal protection, sedimentation, storage, erosion control, navigation, noise reduction provided by wetlands, woodlands and foreshore areas
		Regulation of the physical environment	Atmospheric regulation	Climate Regulation / C sequestration/Urban cooling Provided by biomass within the oceans, green spaces, trees in urban areas (stable temperatures, maintenance of precipitation)
			Water Quality regulation	Water purification and cooling, oxygenation (nutrient retention in buffer strips)
			Pedogenesis and soil quality regulation	Fertile soils for agriculture and biodiversity through the maintenance of soil fertility & structure, Earthquake
		Regulation of the biotic environment	Gen pool protection, pest and disease control,	Biodiversity, Pollination and seed dispersal, maintaining nursery populations such as fish, birds in green and blue areas
			Life cycle maintenance and habitat protection	
Cultural Services	Non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences.	Symbolic	Aesthetic Heritage	Cultural identity, wellbeing, happiness, (Enjoyment of scenery, landscape character, cultural landscape)
			Religious and Spiritual	Sense of place, identity (wilderness, naturalness, sacred places or species, cohesion).
		Intellectual and experiential	Recreation and community activities	Activities for recreational and cognitive development provided by e.g. urban parks, coastal zone (hunting, collecting, angling, wind surfing, diving, shooting, bird or whale watching, volunteering, conservation)
			Information and knowledge	Scientific research, education (school excursion, beach clean ups, volunteering, ecosystem research)

The categories of ESS (Tab. 3.1) were used for coding the text. Here, parts of the texts, which refer to these categories such as a policy, finding, tool/method, were attributed to the specific classes. The output is a structures text which was summarized and analyzed based on the raw material (excel sheets) in terms of ESS, tools and instruments as well as institutional cooperation.

In Social Science this tool supports inter-subjective comprehensibility of the analysis and allows for comparison between studies and to assess reliability of results. Within the content analysis double counting can occur, as many services are addressed more often in different ways. Some benefits or services are overlapping and can be referred to more than one category. However, the results can shed light into the emphasis or priority on specific services which is central here.

The detailed analysis towards the incorporation of ESS is done for key land use- and coastal zone management plans which are shown in table 3.2 below.

Table 3.2: Overview of relevant plans and its components/elements

City	(Urban) Land-use Plan	Coastal Zone Management Plan
SAN FRANCISCO	**The General Plan** 1. Introduction 2. Housing Element 3.Commerce and Industry 4. Recreation and Open Space 5. Transportation 6. Urban Design 7. Environmental Protection 8. Community Facilities 9.Community Safety 10. Arts 11. Air Quality	**The San Francisco Bay Plan**
HAMBURG	**Flächennutzungsplan** (Land use Plan for Hamburg) 1. Erlaüterungsbericht	**Integrierter Bewirtschaftunsplan der Elbe** (engl. Integrated Management Plan of the River Elbe) 1. Integrierter Bewirtschaftungsplan Elbeästuar-Teilgebiet Hamburg und Schleswig Holstein 2.Funktionsraum B-2 Hamburg

4. CASE STUDY RESEARCH

The case study research is divided into three main parts: First, a description of the investigation area and the key ESS (derived from literature). Second, an overview of the institutional and management framework for coastal- marine- and land use planning is given, and third, a detailed analysis of the two identified strategic plans for each region is done, which are chosen due to their representativeness for both regions and which shall illuminate the current integration of ESS into coastal zone management.

Within the first part a focus is laid on the provision of services provided by both the Elbe Estuary for Hamburg City as well as the San Francisco Bay for San Francisco as these are context dependent. However, it is argued that measuring all ESS is impossible and decision support tools of the ESS Approach need to build on existing knowledge, governmental system and institutional frameworks, while ensuring cross-sectoral and -ecosystem communication (Primmer & Furman 2012).

A regional approach is taken in relation to the integration of an ESS Approach to planning and management of both coastal zones. After giving a short description of the investigation area, including the estuaries provision of ESS, threats and uses, the institutional framework for coastal zone management and planning for both regions/states is analyzed. In this context, not only hierarchies are evaluated but also relevant regulations, policies and strategic plans while considering specific categories of ESS, which are derived from both coastal cities. To make results comparable, the classification is taken form CICES and Gómez-Baggethun & Barton (2013). In addition to the ESS Approach found in strategic and legal documents, tools are investigated for both areas as these so called *"tool boxes"* support the practical application of the ESS concept.

4.1 San Francisco, USA

4.1.1. Investigation area

San Francisco (SFO) is a growing economic city with 8.4 [2] Million inhabitants. It is located along the San Francisco Bay and Pacific Ocean were urban life highly benefits from and depends on ESS provided by its geographical location. The major ecosystem within the SFO Bay is the estuary which is made of several water bodies such as the Carquinez Strait, San Pablo Bay, Honker, Richardson, San Rafael, San Leandro, and Grizzly Bay. It is a wide river mouth flooded by the sea which is influenced by ocean tides. The mixture of salt and fresh water makes the estuary a place of biological richness; its importance for society makes it at the same time one of the largest and heavily managed estuaries on the pacific coast (Robinson 2009).

Fig. 4. 1: San Francisco Bay Estuary

The Bay encompasses several ESS. Marshes and mudflats provide food and habitats for biodiversity. Several species of fish such as salmon and other anadrome fish species, return to the bay regularly for reproduction, while mammals, seals and plants settle in the Bay. Further, it is a highly important resting and feeding area for birds migrating between the Arctic and South America. The Sunshine Marsh alone comprises about ten percent of all remaining natural wetlands in California, critically for waterfowl during droughts. The direct relationship between the San Francisco Bay as an important ecosystem and place of human activity or well-being is apparent. The Bay and its ecosystems provide functions and services which cross regional borders. Even though fish and other species are not necessarily caught in in the bay, the fact that they spend their breeding time in the shallow Bay allocates a direct benefit in terms of food provision and recreation for people and tourists but also economic livelihoods. However, there has been a decline in fish abundance, which has become the greatest resource concern in the area. A crucial provisioning service is salt, which is harvested from the Bay water and used as an important raw material for the cities industry.

[2] http://www.city-data.com/city/San-Francisco-California.html

Beside the Bay's function as a natural habitat for many species, and a place of great biodiversity, it is the fifth largest U.S. port in crude oil handling (oil refineries are located at the bay) and the fourth as a container port (industries located there). It is, therefore, a place of high economic importance, military activity and cultural interaction. Many shorefront industries receive their raw materials from the Bay or produce goods moved by ships. The urban area directly benefits from the Bay as it serves as a noise and danger reducer as planes depart and arrive over the water of the bay instead of the residential areas.

Commerce, defense, transportation, recreation and economic prosperity are thus important benefits directly obtained from the ESS of the Bay. San Francisco as the main coastal city located in the Bay area lives from these sectors, especially tourism, which is the main user of these services. This becomes also apparent by considering the function of the Bay as a climate regulator for the area. The consistent temperature of the Bay water cools the whole surrounding region in the summer and warms it in the winter making area a livable place all year round.

Cultural services such as scenic values and fish and wildlife attract many tourists, fisherman, hunters and divers. Quality of life is counted high in the Bay region, which is therefore one of the most desirable places to live in the US. This is reflected in high housing prices, limited space for further development (State of California 2007) and a dense cluster of urban areas. The estuary provides a source of water for a large part of California, where more than ninety percent of the original wetlands have been lost to development in the past century. Since the region is highly urbanized, remaining wetlands are threatened by agricultural, industrial, and municipal contaminants. Yet, the paradox of the estuary is found in the richness of its natural resources (USGS Western Ecological Research Centre, n.d).

The water provides important ESS such as fish, sand and water as provisioning services, cultural services such as recreation, windsurfing, sailing or regulating services such as regulating the bay's temperature, which has a strong influence on urban life. Infrastructure, including schools, railways, airports and wastewater treatment plants, oil refineries ports, marinas and others support San Francisco's economy (Robinson 2007). Increasingly, coastal development and shipping contributes to water pollution, which in turn leads to declining water quality cumulatively influencing fishing activities, swimming and recreational economic activity. Urban uses within the Bay area account for 90 percent of the whole water consumption, which is imported from the delta watershed outside the area (Gunther et al 2011). In addition 80% of water pollution found in the Bay comes from land uses. The direct relationship between human well-being and ESS are apparent within San Francisco Bay, as well as the threats, which go along with this relationship. Accurate management of this multiple uses and the consideration of the coastal zone including the city and waters as one dynamic system are required for effective management.

4.1.2. Institutional framework and policy, strategies and programs

The institutional framework for land use and coastal zone management provides the basis to understand planning and decision-making around ESS. Therefore, a general overview of the different institutions, agencies and governance of the region and how they relate and cooperate with each other is presented. The Bay area is managed by a variety of stakeholders including federal, state, and local agencies, as well as non-profit organizations. Besides the Coastal Zone Management programs, other federal programs include the Coral Reef Conservation Program, Coastal and Estuary Conservation Program, U.S. Environmental Protection Agency, U.S. Coast Guard, U.S. Fish and Wildlife service and U.S Corps of Engineers, which have a legal interest in the management and maintenance of the Bay (Robinson 2009). Several jurisdictional boundaries are located along the Bay.

The coastal zone management, as well as the land- use management framework is presented, whereof two central documents and agencies are chosen for a more closer analysis, which is the San Francisco Bay Plan (San Francisco Bay Conservation and Development Commission), which serves as the coastal zone management program for San Francisco Bay, as well as the General Plan (San Francisco Planning Department) of the city of San Francisco. This plan can be considered a land-use plan which requires developments taking place in the city to be in consistency with this plan; it is the central land use planning document and finally presents the vision of the city´s future.

4.1.2.1 Coastal zone management

To understand coastal zone management in San Francisco it has to be considered in the broad framework of US planning. Coastal zone management in the United States is under the main framework of the Coastal Zone Management Program (CZMP), which was established under the Coastal Zone Management Act (CZMA) in 1972. It is a form of environmental law, which is the foundation of coordinated coastal zone planning and management in the USA. The CZMA was created due to public concern about the degradation of the environment, which was accompanied by the Federal commission's report in 1969 (The Stratton Commission), highlighting the importance and value of coastal areas and the inappropriate management thereof. State-wide CZMPs need to fulfil the requirements, which are stated within this law in order to get funding and to be implemented; however the specific implementation remains flexible to the individual state. CZMPs are comprehensive state-wide plans for regulating coastal development and to develop management plans which are tailored to the site, its main activities and issues. The federal agencies have to prove that all actions which are proposed to take place in the coastal zone are consistent with the CZMP. State programs have to take into account local specific peculiarities, but still consider national interests, such as the siting of energy facilities, port

development or recreational shoreline access. Therefore, consistency is about getting a good federal-state dialogue. The main goal of the CZMA (1972) is *"to preserve, protect, develop and, where possible, to restore and enhance resources of the Nation's coastal zone"* (CZMA 1972).

Within the program there are set standards for intergovernmental cooperation and public participation. As a prerequisite for integrated coastal management it demands strong partnerships among governmental agencies at all levels. This needs constituencies among the public and affected stakeholders who understand and actively support the program's goals and management approaches. There are centralized principles, as well as a decentralized implementation. This is reflected in strict top-down measures or principles on the one hand, and flexibility on the other hand in a way that individual states regulate land use, coasts and tidelands and coastal management themselves as long as they fulfil the requirements stated in the CZMA. Approved state programs, tailored to local circumstances, are then the foundation of programs, agencies and their activities which influence their coastal zone. These federal activities need to be consistent with the CZMP and its policies (Paisley et al. 2003).

The central government office (Office of Coastal Resources Management) provides direct financial and technical support for local coastal management initiatives. This provides a strong federal-state partnership, by involving the federal government directly into state issues due to certain requirements, evaluation, approvals and sanctions. Technical and financial assistance, which is provided by the government, assists the individual states to implement the program. This creates incentives, but also tensions about the degree of power of the central government to influence state policy and activities. And this is related to political changes, which can have direct influence on the support and future development of such programs. Long-term coastal sustainability may therefore be somewhat difficult to assure, if it relies on fluctuations of state funding. The states and stakeholders which are making decisions at the local level therefore have an important role to keep committed to the programs and its aims. A further characteristic is the mainly voluntary nature and flexibility of how to implement specific programs. This is reflected as the CZMA only states some minor requirements about the process of coastal management, where states can identify main issues and ways how to address these themselves. These conditions may contribute to the widespread success of the CZMP in the states, as well as to the political acceptability of the programs. This is also a requirement due to the high diversity of political, economic and institutional cultures in each of the states, which would not allow for *"one-fits all"* approach.

For closer consideration of California, the CZMP of California (approved by NOAA 1978) plays the regulatory framework to all activities in the coastal zone including participation. The program is valid for the whole Californian coast except San Francisco Bay. Here, the San Francisco Bay

Conservation and Development Commission administrate a part of the CZMP for the San Francisco Bay region. There are two programs, which approach coastal zone management and development comprehensively. The State Coastal Conservancy is responsible for monitoring and funding coastal programs in the range of the CZMP. It is also responsible for dealing with acquisition of coastal property. There are, therefore, three main segments of the CZMP, which are responsible for permitting and reviewing federal activities which take place in the coastal area, and which have to be consistent with the policies of the state programs (The California Coastal Commission 2012).

California is famous for its "*superagency"* approach to coastal zone management as all relevant planning and regulation powers are concentrated in one single agency, the Coastal Commission and for San Francisco within The Conservation and Development Commission (Humphrey et al. 2000). The California Coastal Zone Management Act is administered by three major agencies: The California Coastal Commission, The California Coastal Conservancy as well as the Bay Conservation and Development Commission, as an extra agency which focuses on San Francisco Bay. With the approval of the CZMA, these agencies manage development along the coast, where for San Francisco, the San Francisco Bay Conservation and Development Commission (BCDC) fulfils this task (The California Coastal Commission 2012).

The San Francisco Bay Conservation and Development Commission (BCDC)

The special commission for the San Francisco Bay Area, The San Francisco BCDC was created by the Californian legislature due to broad public concerns of the future of SFO Bay. There are 27 members within the commission, including members of the local government, as well as of state /federal agencies. For any planning activity along the shoreline of the Bay area, a permit is needed from the commission, including the first 100 feet inland from the shoreline along the Bay. Further jurisdiction of the commission concerns developments in the open water, marshes and mudflats of greater San Francisco Bay, including the bays of Suisun, San Pablo, Honker, Richardson, San Rafael, San Leandro and Grizzly, the Carquinez Strait; Parts of the Suisun Marsh-including levees, waterways, marshes and grasslands- below the ten-foot contour line, as well as portions of most creeks, rivers, sloughs and other tributaries that flow into San Francisco Bay. It also includes salt ponds, duck hunting preserves, game refuges and other managed wetlands that have been diked off from San Francisco Bay. For these areas the BCDC is charged with the regulation of all filling and dredging in San Francisco Bay, the protection of the Suinsun Marsh by administering it (with the cooperation of local governments) (BCDC 2007). All new developments in the region, which take place within the first 100 feet inland from the Bay need to ensure that public access to the Bay can be provided to the most feasible extent possible. Pressure on the Bay needs to be minimized by ensuring the suitable use of limited shoreline area for

priority water- oriented uses reserved for ports, water- related industry, water-related recreation, airports and wildlife area. Another responsibility is to see that the program remains active by studying up-to date Bay issues by applying best available information for policy and plans. They also prepare a long-term management strategy (LTMS) for dredging (materials) in San Francisco Bay. Even though the Bay has an own commission, participation with the other regions is prescribed.

The central documents under which the BCDC operates, authorizing regulatory planning and enforcement decisions are the McAteer-Petris Act and The San Francisco Bay Plan. Since 1977, the Suinsun Marsh Preservation Act is also under its jurisdiction due to the need to increase its protection. Within the document analysis, the San Francisco Bay Plan is chosen for detailed analysis as it reflects on the higher jurisdiction (due to its consistency approach) but also reflects on the local peculiarities of the region including shoreline and waters. Furthermore, its policies and findings are based upon multiple sectors and human uses, rather than being place or habitat based such as the Suinsun Marsh Preservation Act. The plan takes a regional approach and reflects on current strategic planning of the coastal area/Bay area. The San Francisco Bay Plan was first completed and adopted in 1968. The Coastal management program of SFO was approved in 1977 as a segment of the California coastal zone (The San Francisco Bay Plan 2007).

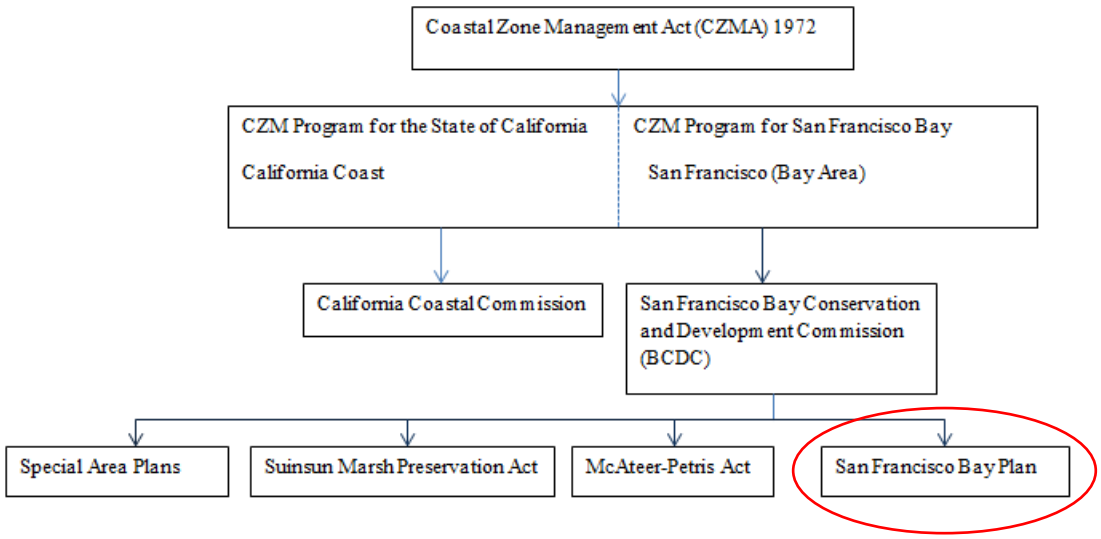


Fig. 4.2: Organization of Coastal Zone Management for San Francisco Bay Area

4.1.2.2 Land Use Planning

Land use planning in the USA is rather strategic where goals, policies and objectives are high on the agenda. There is no national law for land use planning in the USA, but rather a fragmented set of regulations, which influence land use planning on the state level. The state law (San Francisco Planning Code) sets the rule that local governments need to prepare comprehensive plans. Such as

within coastal planning, the state allocates financial support for the preparation of plans but also gives penalties for not doing so. However, land -use planning and regulation in the USA is a rather local exercise rather than a national one (Kayden 2000). Different from many other countries such as Germany, the USA has no national land use law. There are two basic tools for land use planning: comprehensive zoning and general planning. Zoning separates the municipality into districts, regulates building and structures therefore and manages how land can be used. General planning is broader; it is the central guiding tools for the comprehensive and coordinated planning of the city. It sets the visions and objectives for future developments. Zoning serves here as an instrument to get there, to fulfil these visions by zoning land efficiently. Both planning tools are closely interrelated and become only effective in combination (Goldfarb 1967). Zoning is specified in a legislative policy (the San Francisco Planning Code). The California planning law requires that each city has a planning agency and planning commission, which is for San Francisco City the San Francisco Planning Department.

San Francisco Planning Department

This department is the central planning office responsible for creating dialogue with citizens about the future of San Francisco City, guiding long-term development of the built and natural environment. The department evaluates the regional growth management policy, as well as monitors and updates the city´s General Plan, ensuring general compliance of the planning and zoning code, draft land-use policy, as well as the development of sub-area and urban design plans. The department works in connection with the San Francisco Planning Commission and the San Francisco Historic Preservation Commission by guiding and supporting their work. Its environmental division is doing environmental reviews on projects in terms of its environmental impacts (Environmental Impact Analysis) in consistency with the California Environmental Quality Act (CEQA) as of 1970. Subject to this review are developments mostly related to infrastructure and transportation projects or regulatory changes and permit applications, which need to consider 17 different environmental resource factors. The department is overall responsible for fulfilling the objectives of the General Plan, as well as for the review of permits in terms the San Francisco planning code; provide people the opportunity to participate in land-use decisions (City and Council of San Francisco 2010-13).

The central document within the San Francisco Planning Department is the *"General Plan"* (GP) first amended in 1996. Under state law this plan has to include land use, circulation, housing, conservation, open space noise and safety, but leaves space for additional sectors or issues. The planning department develops and maintains the GP, which embodies the vision of San Francisco´s future. In accordance with the GP, the department develops area plans for individual city areas. All developments which shall take place within the city property and which need to be

in consistency with the general plan are reviewed by that department. Planning policies get a high emphasis on being developed to ensure a high quality of life and human well-being. This strategic and long term plan is the second central document, which will be analysed in detail as it has a broad scope on *"land based"* planning within the coastal city. The General plan guides changes within a balance of social, economic and ecological issues and ensures that the qualities which make San Francisco unique are preserved. In doing so, multiple central aspects are contents of the GP: residence, commerce, industry, recreation and open space, community facilities, transportation, community safety, environmental protection, urban design and arts. The plan is, however, open to additional contents, which may emerge over time (The General Plan 1996).

4.2. Hamburg

4.2.1. Investigation area

The city of Hamburg is the second largest city of Germany and has 1.7 [3] Million inhabitants (Statistisches Amt für Hamburg und Schleswig-Holstein 2013). The city is located at the river Elbe, which has an important role for its economy. The estuary is the main artery not only for metropolitan Hamburg but is also crucial as federal waterway. The Hamburg port located within the estuary serves as an international hub for containerships being the largest in Germany. Shipping is the main driver for regional economic development, which is increasing with further industrial development. Besides, their economic activity, the waters provide a source for renewable and nonrenewable energy sources as well as a sink for toxic substances. On the other hand, the estuary is a unique habitat for biodiversity, highly specialized flora and fauna due to its tidal influence of the North Sea. Especially a diversity of fish resides in the estuary that returned after major water quality improvements in the early 1990s. Mudflats, wetlands and foreshore areas within the estuary provide a crucial habitat for migratory birds that rest there for breeding. Almost the entire Elbe (thirty protected areas) is set under nature protection law (FFH-Directive/ Natura 2000) due to its specific value for specific species and habitats, which need to be conserved. The urban area of Hamburg, however, is not under the Natura 2000 protected area network, but remains with a special position as it connects the river ponds between the protected areas, which surround the port of Hamburg. The network of protected areas, which surround the city of Hamburg is a mixture of flora and fauna habitats (FFH) and bird sanctuaries, aiming to sustain the biodiversity of Europe. Recreation and tourism is another sector, which contributes to human and economic well-being, especially for water sports or beach tourism. It generally serves as cultural, ecological and economic space. The lands, which surround the river are fertile and allocate agricultural spaces (TIDE 2012).

Fig. 4.3: The Elbe river/estuary (Hamburg is seen within the orange)

[3] 1. 724 309 Inhabitants according to the recording of the census 2011

Besides the high ecological value of the estuary, shipping and navigation is what drives the regional economic development. This requires the maintenance of the waterway within the natural tide currents. This is challenging as the flood tide currents are stronger than the tide current, therefore much sediment is transported and accumulates in the Hamburg region (TIDE 2012).

However, these natural processes remain important for ecosystem functioning. The trade-offs between economic and port development and nature protection are highly apparent in the region. Developments within the whole river estuary influence the city of Hamburg, calling for the consideration of river developments within regional planning. The continued deepening of the river has contributed to an increase in tidal range of 2m, which require several flood protection measures. This shows the direct trade-offs of ESS, as deepening the river for increased navigation and shipping, leads to habitat loss and increased flood risk. There have been massive human impacts on the ecosystems of the Elbe due to multiple uses of space. This results in cumulative developments, which are felt strongly by the bordering cities but especially in Hamburg, the economic center of the region. Without efficient coastal protection, economic activity to the current extend would not be possible (Ratter & Weig 2012). To ensure future sustainable development of the region, land-sea interplay between urban development and integrated river management is crucial to counteract negative mutual effects.

4.2.2. Institutional framework and policy, strategies and programs

Spatial planning in Germany is conducted through a hierarchic and well organized structure. Land based development, which includes the coastal city, is mainly under the responsibility of the Urban and Land Use Planning Office. Spatial Planning is an interdisciplinary task, which is largely decentralized in Germany. Thus, a lot of responsibility is given to the states in conducting spatial planning. Different than in the USA, ICZM in Germany is a rather new concept (emerged in the 90s) and is administered by the land use planning offices rather by new administrative structures (e.g. coastal commission). Therefore, ICZM may not be much different than other planning approaches, which deal with sustainable (coastal) development and conflict resolution. In consideration of the coastal city and the waters surrounding it, coastal management and land use planning fall more or less together. As the city is located within the Elbe estuary, waterways and shipping administration (WSV) is an important player as they are responsible for managing the Elbe, for its maintenance as a waterway including its administration and regulation of shipping. Within the state and region of Hamburg the waterway is under management of the city of Hamburg (Hamburg Port Authority). At the seaside end of the river the Exclusive Economic Zone of the North Sea is administered by the Federal Maritime and Hydraulic Agency (BSH 2013). Land use planning and marine spatial planning together form the basis for ICZM, thus a strong integration within these levels is desirable. In this section the institutional framework for

these planning approaches is presented to understand on what basis the strategic documents were selected, what they cover and in which context the results can finally be understood.

4.2.2.1 Coastal zone management

There is no national law for coastal zone management in Germany, similar to the fact that there is no national law for land-use planning in the USA. Rather there are more than 30 European and national laws, regulations and directives such as the *"EU Meeresschutzstrategie*" or the "*EU Strategy for Sustainable Development"* which influence coastal management in a way that they fulfil sectoral requirements. However, the Federal Government adopted a national strategy for ICZM in 2006, where ICZM is seen as a process and instrument rather than a strict law. Due to the variety of laws there are several institutions which are responsible for coastal zone management on the federal, state and local levels for land and sea. Competences are split within spatial boundaries, which make ecosystem- based approaches challenging calling for a more inter-sectoral legislative management framework for ICZM. The German coastal zone is managed by the five coastal states or *"Länder"* which are: Lower Saxony, Schleswig- Holstein, Mecklenburg-Vorpommern, as well as the city states of Bremen and Hamburg. Here, coastal management is mostly covered by the integrative hierarchical spatial planning system (see Fig.4.4), where legally binding land- use plan through regional planning is the central document and which is updated over time. Planning authorities are, therefore, the leading authorities for implementing ICZM in Germany, which have to deal with an increased complexity of issues and management strategies for land and sea which need to be incorporated into spatial planning. Rather than having a new system, the existing system is improved and adapted to fulfil the requirements of ICZM. A problem of ICZM in Germany is the water and land-sea boundary. Coastal planning, as it falls within regional land- use planning, stops within the coastline. Further into the sea, the Federal Government conducts MSP for the Exclusive Economic Zone (12 nautical miles from the shore), as these waters are not subject to land- use planning anymore (but since 2004 included in the Federal Spatial Planing Act). Problematic is that the coastal zone needs to be managed as a whole due to the strong land- sea connections for the function and structure of ecosystem services. This is also crucial to ensure cooperation and coordination between land and sea administration (Schernewski 2001).

Since 1990s, ICZM has become a topic on the European agenda due to increased environmental concern to sustain the coast as an ecological, economic, social and cultural entity and to ensure that recreation can be sustained in the future. Within several studies of the state of the coast and needs for its management several recommendation have emerged which aim at cross border cooperation and common problem solving due to the common resource problems. This EU strategy recommends that the EU states follow a strategic approach to coastal management which

- Protects the coastal ecosystem/environment by making use of an Ecosystem Approach to ensure a sustainable management of natural resources for land and sea.
- Prevent coastal areas from the impacts and threats of climate change
- Maintain favourable conditions for a sustainable economic development and employment situation
- Support a functional social and cultural system for the commonwealth
- Better coordinate the interplay between land and sea by the responsible agencies

As a subordinated objective, the EU emphasises the role of ICZM to ensure a long-term balance between the interest of economic development and the use of coastal areas for human uses, the interest in the protection, preservation, restoration of coastal areas, the interest of minimization of loss of human life and property, and to ensure public access and joy of the coastal zones, within the natural boundaries and the natural dynamics and carrying capacity (BUNR 2006).

Hamburg, as a city state, administers only a small part of the coastal zone; however, its high development has a strong impact on the coastal waters and there is a need to manage a multiplicity of uses. Spatial planning is conducted here in the framework of land- use planning. The city has no regional strategy for ICZM, such as the other federal states have, but has several projects and initiatives to work in this direction. As emphasised, Hamburg is a centre of the maritime economy of the country. Thus, the success of ICZM to ensure sustainable economic development is crucial for the success for the country as a whole. Hamburg and other coastal states have a high responsibility in implementing the EU legislations such as Strategic Environmental Assessment, The Water Framework Directive or Natura 2000 on the regional scale, which are important for the future potential of implementing ICZM (BUNR 2006).

Following the ICZM strategy, coastal states need to include the coastal zone into spatial planning to ensure cross-border cooperation. In order to do so, there are different initiatives and demonstration projects such as spatial planning concepts for coastal areas and communication platforms. In Hamburg, several projects try to implement components of integrated coastal protection such as the Tide Elbe Concept and the integrated management plan for the Elbe together with Lower Saxony and Schleswig Holstein. As there is no strategic plan for ICZM as such, its integration into sectoral plans such as the integrated management plan is therefore analysed more in detail, as it reflects efforts towards ICZM, which can be considered further in its regard to ESS.

The Hamburg Port Authority & Waterway and Shipping Administration (WSA)

The central authority or institution is the Hamburg Port Authority which, within the state and region of Hamburg, manages the waterway and is under management of the city of Hamburg. The city itself is managed under the Urban and Landscape Planning office which is responsible for the land-use plan (Flächennutzungsplan), as well as the town plan (Bebauungsplan). Marine spatial planning or setting of marine protected areas is also the task of this office. These plans show where urban land- uses and building developments are allowed. The Elbe is managed by the Waterways and Shipping Administration (WSV) which is responsible for the maintenance of the Elbe as a waterway.

4.2.2.2. Spatial and environmental planning in Germany

Spatial planning in Germany has the central task to develop, protect and align space in an integrated, cross-sectoral way by taking regulatory and strategic measures for coordinating and harmonizing different requirements of spaces, areas, and locations. Emerging conflicts should be balanced on the specific planning level, while taking precautions for individual land uses and functions. In the center stands the guiding principle of sustainable spatial development (Umwelt Bundes Amt 2012).

In terms of institutional organization, the German spatial planning system is highly decentralized, yet grounded within a legislative and institutionalized framework for spatial planning (Schmidt 2009). The federal structure of spatial planning in Germany is characterized by the role of federal, state and local government. As the highest level is the Federal Spatial planning Act (Raumordnung ROG), which needs to be respected within any planning actions at lower levels. Planning is thus legally, institutionally and organizationally very differentiated, yet linked through the counter-current principle (Gegenstromprinzip) as well as its requirements for cooperation, participation and compliance. Federal spatial planning provides a guiding legal framework/principle for the individual state planning as well as sectoral planning. At the state level, principles and objectives are developed with the federal principles of spatial planning, while at the local/municipal level, final planning goals are developed in compliance with both federal and state spatial planning specifications. Local authorities have therefore a high authority in regulating the use of land for building and other purposes at the lowest planning level and carry a high responsibility in Spatial Planning (Pahl-Weber & Henckel 2008).

State Spatial Planning Acts are developed in accordance with the guiding principles of the federal spatial planning act. Through participation of lower municipal levels a mixture of top-down and bottom up approaches is used. Local interests need to be considered, while goals and principles of national and state spatial plans need to be respected in local planning. Urban land-use planning has to be in accordance with state development objectives to make planning efficient.

Below, the state level of spatial planning, regional planning is concerned with the detailed elaboration, sectoral integration and implementation of the goals of state spatial planning. Accordingly, it mediates between state spatial planning and local urban land-use planning (Akademie für Raumforschung und Landesplanung 2013). As Regional planning must be in consistency with federal and state spatial planning it is a good reflection of the whole spatial planning system for the general aims of German spatial planning. As Hamburg is a city state, the land use plan overtakes the role of the regional development plan. Therefore the central document for the region and city of Hamburg is the land-use plan (Flächennutzungsplan), which is analyzed in detail as it reflects not only on the city area but also on the whole state while reflecting on the aims of the *"Raumordnung"* and urban development. However, specialized planning for transportation, water or energy can influence planning by sectoral plans (Fachpläne) which are developed independent from spatial plans and integrated by planning authorities. Within the aim of regional planning is the safeguarding and improvement of environmental quality, land uses and of the urban framework. The content of the land- use plan and development plan needs to be adapted to the federal and regional planning Act and ensure a sustainable urban development including nature conservation and renewable energy. A special consideration is given to ecosystems including water, air, soil including the provision for raw materials and climate regulation, which are however grounded specifically in the landscape program and Nature protection Act. The different levels of German planning are shown in Fig.4.4.

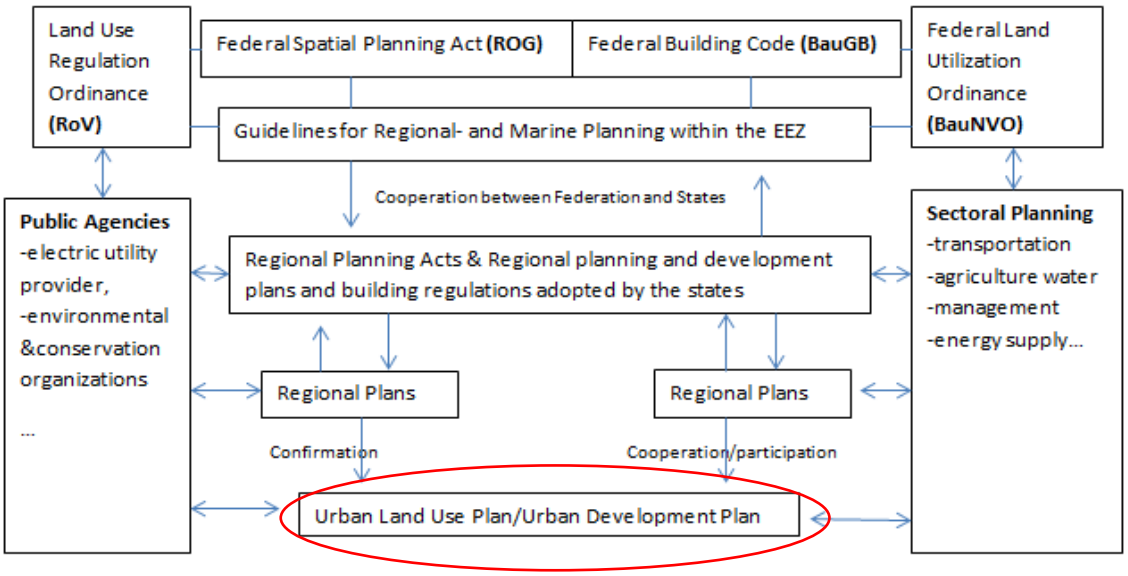


Fig. 4.4: Levels of the German Planning System (federal, state, regional, and municipal/local

4.3. Results

In this part the results of the content analysis of the strategic coastal and land use plans are presented. For each city the plans reference to the main ESS classes were summarized to provide

a reflection on the understanding and assessment of the link between Ecosystems and human-wellbeing as well as to give an overview of ESS, which are mentioned. In addition, it is shown how ESS are considered, emphasized and assessed through planning tools which are applied within land use and coastal planning. Specifically, the question of how and to what extend policies of land use and coastal zone incorporate Ecosystem Services in both regions is considered here.

Thereafter, institutional cooperation and the integration between the urban-land use plan and coastal management plan for both regions/cities is discussed. Besides instruments and tools to integrate ESS into decision making, it is crucial to consider how the ESS approach is fitted to the current institutional settings. Therefore, if the ESS approach wants to hold, it is important to consider the institutional fit and setting which are required for sound integration as well. The results of the content analysis will be linked to the broader planning contexts of both regions.

4.3.1 San Francisco

4.3.1.1. Land use planning (The General Plan)

"The setting of the San Francisco Bay Area -the bay, the ocean, the mountains, the three large city centers and the other communities along the bay and the inland valleys - is a fundamental part of its celebrated quality of life."(The General plan 1996)

This is a citation taken from the General Plan, and reflects on the values laid on the Bay and ecosystems for well-being and quality of life. The General Plan of San Francisco is comprehensive covering many ecosystem services, crucial to the area. However, there is a clear emphasis on cultural services (58%) which are provided by the ecosystems of the Bay and the green spaces in the city. The recreation element alone mentions the term *"open space"* 355 times as relevant to recreational purposes through providing physical and visual access to it. Generally, there is a strong focus on visual and aesthetic aspects within all sectoral plans and policies. These include the Bay, the ocean, parks, historic buildings or other recreational places such as the golden gate bridge and hills. The plan also points out that the maintenance of cultural

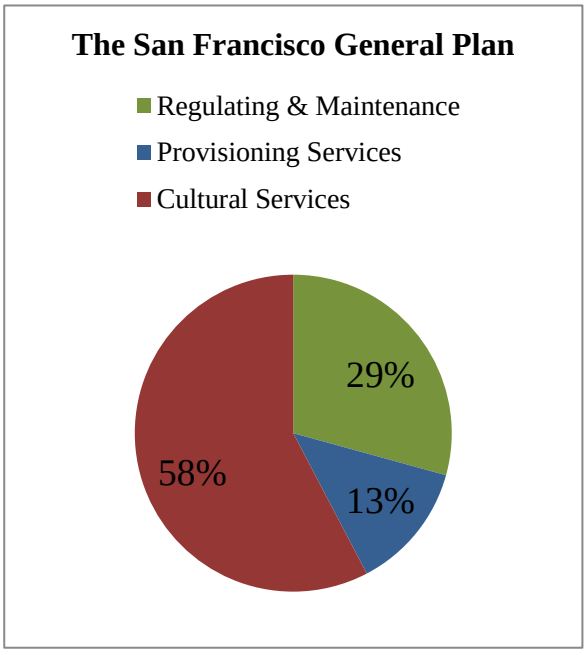


Fig.4.5: The General Plans share of reference to ESS components Regulating, Provisioning and Cultural

services depends on the provision and conservation of regulating services. This might explain that these were addressed with a share of 29%.

The plan takes a cross-sectoral, cross-regional and comprehensive approach to land use planning. It is a strategic, long-term document with a broad scope and prescribes that growth and development of the city should occur in accordance with that of adjoining cities and countries and that of the Bay region. The plan contains the following (sectoral) elements: *Residence, Commerce and Industry, Recreation and Open Space, Community Facilities, Transportation, Community Safety, Environmental Protection, Urban Design and Arts*. Area plans and land use indices complete the plan. The Elements were analyzed separately but are here summarized together in terms of the ESS. The results show that all elements consider ESS and aim for a balance between the *preservation* of natural resources- and further *development*- of their uses. For the urban area, the most important use of nature is what provides maximum public benefit (such as by recreation and visual aesthetic pleasure). Especially these natural resources, areas or views need to be protected. The urban land use plan takes a regional approach and emphasizes on the need for collaboration with multiple stakeholders of the bay area for ensuring natural quality and supply for a sustainable urban development. As a national leader in sustainable urban development, San Francisco has many initiatives for green developments and renewable energy, alternative transportation models and others are part of the urban vision. The city takes a long-term perspective and follows the guiding principle of smart growth and the efficient allocation of space, ensuring that man and nature can live in harmony (The General Plan 1996).

Cultural Services

Cultural services hold the greatest share within the General Plan of the city. Here, the physical and aesthetic beauty of the bay plays a key role for recreational uses, cultural and heritage values, human well-being and economic prosperity due to tourism, which relates to these characteristics. Within all sectoral developments, public access to the bay, shoreline and other open (recreational) spaces has to be ensured. It includes visual and physical access and is central in the development of the city. It is emphasized that the Pacific Ocean, SFO Bay and shoreline are the most important natural resources in the city

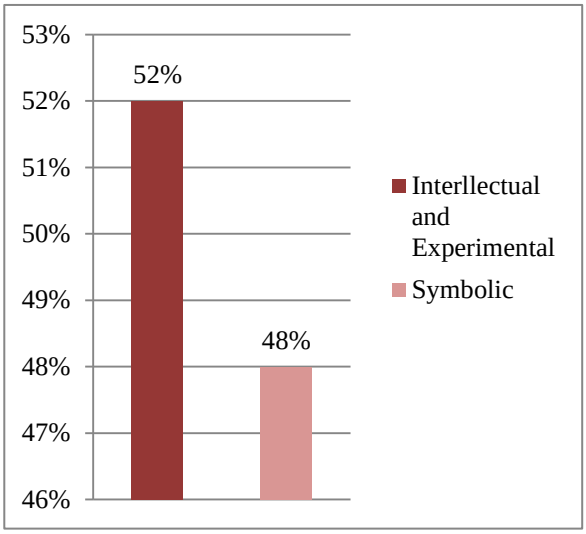


Fig. 4.6: Cultural Services- The General Plan

and are its natural capital. Recreational activities are prescribed to be given priority. These benefit from recreational places and aesthetic and visual quality of the Bay. Therefore, the natural environment should be preserved for these uses such as walking, hiking or biking. Public access to these recreational areas needs to be maintained and enhanced by reducing other uses such as traffic, which causes noise, pollution and disharmony. Housing, transportation and other sectoral interests have to ensure that these are not to the expense of the environment. It is emphasized that there is a high community value attached to parks. Through water based transportation by ferries and ships, goods and tourist are shuttled across the Bay. The city and landscape has a natural structure, which should be preserved and restored by protecting views and by maintaining its character as a port destination.

Productive harmony between people and their environment, natural amenities and values should get appropriate consideration in urban development, which should be balanced with economic and social considerations. Some urban areas are assigned a specific value due to its location benefits such as the urban water front. These areas need to be designed to allow for maximum physical access to the water, enhance visual and physical connections between the City and the Bay. Development need to be fostered that strengthens local culture sense of place (identity) and history (heritage). But also environmental justice issues should be included within developments. An interesting aspect is that the city strived to become more livable by *"offsetting the imbalance between the natural and man-made environments"* and to make man and technology an interrelated part of the environment and not a physical exploiter. Many resource problems such as erosion of dunes and other areas are approached, but in reference to increase recreational value thereof. The Urban design element strongly aims at strengthening the relationship between people and their environment, by trying to preserve especially cultural services provided by the natural environment (The General Plan 1996).

Provisioning Services

Provisioning services are addressed the least in the GP accounting for 13 %. Within these services, energy or renewable abiotic energy was mostly referred to, followed by nutritional fish and a lower share of materials. The strong emphasis on renewable energy such as solar energy relates to the aim to improve air quality and is supported by land use policy and regulatory codes. A lot of incentives and

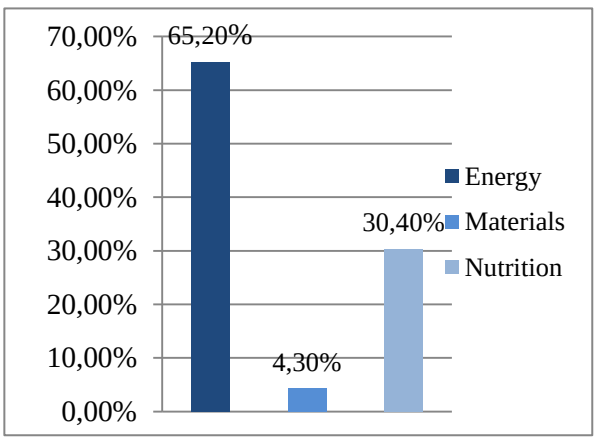


Fig. 4.7: Provisioning Services- The General Plan

public education and information programs are conducted to encourage the installation of these technologies. Hydro, oil and natural gas comprise the primary energy sources used to generate electricity, with lesser amounts coming from geothermal and nuclear fuels. Also sustainable construction is encouraged by making use of natural resources and traditional construction styles to increase safety against natural disasters. In addition, buildings should provide their own power and filter water from natural run off. These policies aim to reduce the dependency on nonrenewable water and energy sources. Next to water reservoirs in the city, the city owns and manages about 60,000 acres of watershed lands, which serve as major water source for the city. These sources are important for safeguarding adequate fresh water to meet the present and future needs of the city for drinking and firefighting supply. While the fish industry shows a declining trend (due to unavailability of fish and high costs of land and facilities), policy prescribes that it should be restored as fishing benefits the city as an employer, retailer and as part of the large tourism industry. Restoring the fishing industry includes expending commercial fishing, processing and businesses. Undeveloped land should also be protected for agriculture and landscape plants (besides recreation, conservation of natural resources and other) (The General Plan 1996).

Regulating Services

Regulating Services have a share of 29%. These are overall underlying for the recreational and maritime potential of the city (navigation and marine-based activities) which developed historically due to the natural advantages of its location as a port. With increased impacts of climate change its underlying factors are considered within building, transportation and other sectors. As there is an increased risk of flooding, ecosystem vulnerability and services should be evaluated. The element of *"Community Safety"* directly refers to the storms, earthquake and environmental changes and that they have partly been human induced. For the threat of landslides which can occur with heavy rains, soil compositions such as weak soil structures have developed because of natural erosion, and human activities such as undercutting and the change in ground and surface waters. Soil compositions (strong or soft soils) play a role for housing development and its condition needs to be reviewed within projects in regard to slope instability.

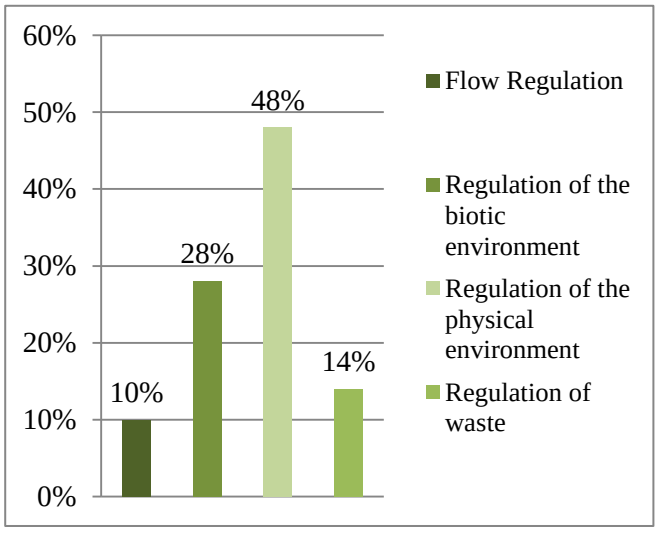


Fig. 4.7: Regulating Services- The General Plan

To counteract increased run-off waters, the use of storm run-offs for irrigation as well as urban forestry and other green structures are seen as imaginative solutions. In terms of urban storm water run-offs and overflows, natural systems are seen as effective supplement to absorb water and pollutants. It is emphasized that natural systems should be included in building and site developments wherever possible. This includes natural vegetation, landscaping and gardens to reduce storm water runoff. Discharge capabilities are here mentioned to have the potential to be strengthened by planting green on site walks, roads or rooftops. Further the green spaces within public spaces such as planting of street plants, urban forests, city parks and gardens, should be maintained and expanded as to contribute to cleaner air and the quality of life in the city.

The reduction of the quality of urban life is argued to have a strong link to the depletion of the natural resources and related factors such as air pollution or flood impacts or erosion. San Francisco´s healthful climate is seen as a factor contributing to overall well-being and attractiveness of the city and place. Sunlight is highly appreciated within the city and should be preserved in public open spaces, and is considered in all developments as the diminishing of the sunlight changes the utility of open space and changes the climate composition of wind, humidity and ambient air quality. It is also emphasized that the climate of SFO is dominated by the sea breezes characteristic of maritime climates influences by the sea breeze and regulates the climate (less extremes in temperatures).

The plan addresses biodiversity and gene pool protection. Natural vegetation and marine life should be protected and restored by replanting native vegetation and combat exotic invasive plants and species. Habitats which are located in the city are important for seasonal shorebirds birds and wildlife populations and needs to be maintained. In this regard the potential to reintroduce marsh and mudflats is investigated to restore these habitats for native flora and fauna. The value of watersheds for water quality and filtration capability is recognized excluding the watershed property from large scale public recreational use. Other habitats for rare, threatened and endangered species, identified by the U.S Fish and Wildlife service, need to be protected. Connectivity should be considered; were one or more protected sites are adjusting, they together can support a larger and more diverse natural habitat. Generally, plant and animal life in the city should be protected to maintain ecological balance between wildlife and plant. For identifying important habitats and species the planning department cooperates with other environmental agencies to maintain the relatively natural environment.

The plan describes trees to impart a sense of nature, to provide shade and moderate the microclimate. Therefore, new trees should be planted, by increasing its diversity adapted to soil and climate conditions. Waste disposal and drainage take soil structures into account, recognizing their relevance for earth quakes, landslides and other natural changes/disasters. The ocean is the

major open space and focus for human views and activities. Therefore, a maximum interference of land and water should be maintained. The functioning of natural areas such as sand dunes and cliffs provide important undisturbed ecosystems, these and other resources should be protected to maintain the balance between conservation and the functioning of the city including the development of guidelines for the use and development of air, water and land. The beauty of the natural areas is determined by the functioning of them.

The plan emphasizes on the interconnectedness between sectoral planning. Wise land use planning and transportation planning have a direct effect on air quality which in turn benefits visual quality, health, living standards and the economy. Environmental sensitive coastal areas which are important for local economic activities are protected by the city. Here, the city participates in the State coastal policy review to make sure to include local concerns within federal decision making. The usefulness of land for recreation, however, should not necessarily determine whether or not land areas ought to be preserved. Features of a scenic, geological, topographical, and ecological nature are also important criteria of their value as open space (the General Plan 1996).

Planning Tools and Instruments

Urban land use planning refers to plans and elements only from specific natural resources, which concern the city. These include waters of the Bay and ocean, fish and other marine animals, the shoreline, air, fresh water for the consumption or firefighting, land, plants and animals of the city's land area and lakes. Due to the fragmented land ownership, a major planning tool is acquisition of land or open space for public use. In the city of San Francisco, public spaces are owned by the Recreation and Park Department, other city agencies and the State and Federal government. Additional spaces, which fulfill special criteria, such as its location at the shoreline, and which are available should be acquired for recreation and enjoyment. Due to limited financial resources, only some areas can be acquired, which are determined by their relative importance of the site as a natural area.

Education and Outreach: Education is done by providing public information and education through programs, information points, exhibitions or volunteering. But also by providing open space for recreation and visual enjoyment. This should raise awareness, understanding and appreciation of natural values and ecosystem functions/benefits provided by them as well as about its environmental problems (The General Plan 1996).

4.3.1.2 Coastal zone management (The San Francisco Bay Plan)

"San Francisco Bay maintained and enhanced as a magnificent body of water that helps sustain the economy of the western United States, provides great opportunities for recreation, moderates the climate, combats air pollution, nourishes fish and wildlife, affords scenic enjoyment, and in countless other ways helps to enrich man's life" (San Francisco Bay Plan 2002).

The San Francisco Bay Plan has two main objectives: to protect the Bay as a great natural resource for the benefit of present and future generations as well as to develop the Bay and its shoreline to their highest potential with a minimum of Bay filling. Further it is divided in parts for the Bay as a resource, including findings and policies, the development of the Bay and shoreline including findings and policies as well as area maps and special area plans. It is apparent that the Bay serves human needs and improves well-being and that its services can be improved further.The most important uses of the Bay are emphasised to be those providing public benefit. To ensure that these uses can be maintained, lands which are not under the decision making power of the comission should be aquired to the most extend possible. All developments should account for the loss of natural resource areas (San Francisco Bay Plan 2002).

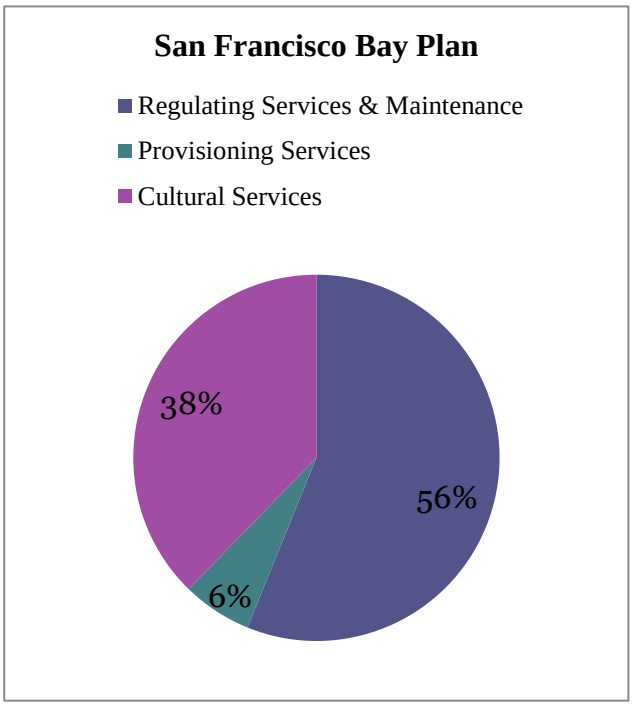


Fig. 4.8: San Francisco Bay Plan – Reference to ESS, Regulating, Provisioning and Cultural

The Bay plan is comprehensive for coastal management of the Bay area, which has a long term-vision. It emphasizes on the cumulative effects and inter-connectedness of ecosystem function and used as a single *"physical mechanism".* The Bay is considered as one body of water and ecosystem ("*great natural resource*") where changes in one part affect the entire ecosystem. For protecting the Bay, a regional approach is therefore taken. Policies are developed from findings, which are mostly referred to any form of ecosystem services, their relation and role for other services and their trade-offs. Further, the plan connects to several sectors of the General Plan or issues, which are covered by it, such as transportation or air quality. Due to highly fragmented ownership of the Bay, wetlands and the lands, which surround it are managed by a multitude of stakeholders; institutional cooperation is an important aspect therefore and collaboration

mentioned in many respects. All developments taking place around or within the Bay need to ensure not to block views to the Bay and to provide public access to the shore (physical and visual access).

Filling of the Bay is emphasized in many respects and mentioned to be allowed only if it improves public access or recreation to the Bay. The plan emphasizes on the important role of the Bay not only for the city, but for California and the economy of the western United States, allocating several services from its natural assets. Therefore, the plan points out that the Bay is to be managed as a body of water and not a *"real estate",* which should drive decision-making, is all accounts. Opportunities for a diversity of public access and recreational activities should be maintained now and in the future. This is of considerable importance as the Bay is a major visitor attraction for the tourist industry. Beside recreation, the Bay and shoreline moderates the climate, combats air pollution, nourishes fish and wildlife, affords scenic enjoyment, and in contributes to overall well-being (The San Francisco Bay Plan 2002).

Cultural Services

Cultural services are valued high within the San Francisco Bay Plan with a total share of 38%. Here, especially intellectual and experimental benefits (including recreation and community activities, as well as information and knowledge) are derived from the bay by providing opportunities and resources for recreation, scientific research and education which are high on the policy agenda. The Bay and its shoreline provide unique services to the region. They are capital for the tourist industry and inspiration for arts and other activities. To protect the Bay is therefore of central importance and argued to be only achievable with ongoing scientific research. In this regard, the SFC Bay commission is responsible for the establishment of a comprehensive Bay sediment research and monitoring to understand sediment processes necessary to sustain and restore wetlands. Newest scientific information is also emphasized for better understanding other services of the Bay and to be able to adapt to changes.

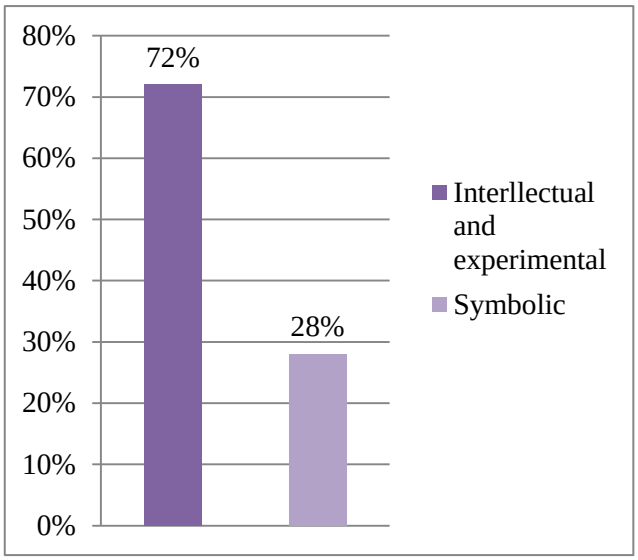


Fig. 4.9: Cultural Services- The San Francisco Bay Plan

Even though several ESS are addressed, in the center of all developments and activities stands the maintenance of the Bay for public benefits and uses. Developments of the shoreline or the conversion of uses are encouraged if the new uses provide a high share of public benefits, generally more than the former use would provide to the region. For example, filling or diking should be only allowed if alternative developments provide more public benefit than the availability of the shells, or other resources. To further enhance the cultural services, increasing recreational opportunities should be made available or extended to Bay Area residents in all areas. The Bay and its shoreline offer particularly important opportunities for recreational development in urban areas where large concentrations of people live close to the water but are shut off from it. Aligning space so that physical and visual access to the water can be maintained is here a central aspect.

Animal species such as fish and other aquatic organisms and wildlife found in the Bay and land are mentioned to provide opportunities and substantial public benefits and therefore should be protected. There is a close relationship found between regulating and cultural services. As an example, there is a close interplay between water quality and recreational boating, swimming, health, fishing, navigation or aquatic habitats. These areas are thus designated by the water quality board to manage adverse effects of contaminants on water-oriented recreation uses, enjoyment, and aesthetic values and aquatic and wildlife. For ensuring the aesthetic beauty of the water, ecological functioning, and health of people such as swimmers in the water or consumers of (contaminated) fish. Aesthetic values such as scenic views, Bay overlook points, and historic areas and structures should be preserved and incorporated into the site design. Multiple uses and ESS need to be taken into account within planning. Public access (visual and physical) to the Bay and shoreline needs to be maintained within all single sector projects and developments such as transportation projects. Commercial fishing continues to be a valuable part of the Bay Area economy and culture. Visitors are attracted by commercial fishing activities and constitutions a part of the tourism industry and image of the city. Fish has therefore not only an economic but also a cultural and biological value. Salt ponds are not only crucial to the economy for salt production but also hold a spiritual value as salt was harvested by Native Americans and early Spanish and Mexican settlers (San Francisco Bay Plan 2002).

Physical access to the Bay needs to be located and managed to avoid significant adverse effects on wildlife and their habitats, and should not interfere with commercial navigation or security and exclusion zones or pose a danger to recreational boaters from commercial shipping operations. If not properly located, improved or managed, recreation activities can have adverse effects on wildlife. Therefore accurate (area) planning, cooperating between agencies, and tools for reconciling habitat and wildlife conservation is important to ensure proper location and improvement and management of different uses. Parks should emphasize hiking, bicycling, riding

trails, picnic facilities, swimming, environmental, historical and cultural education and interpretation, viewpoints, beaches, and fishing facilities. Water-oriented recreational crafts, such as kayaks, canoes and sailboards, should be provided in waterfront parks where feasible.

Accurate characterization of current and future site, habitat and wildlife conditions, and of likely human activities, would provide information critical to understanding potential effects on wildlife. New or remodeled bridges across the Bay should be designed to permit maximum viewing of the Bay and its surroundings by both motorists and pedestrians. Guard rails and bridge supports should be designed with views in mind. Managed wetlands also provide for a variety of recreational opportunities including hunting, fishing, wildlife viewing, and hiking, and contribute to the open space character of the Bay. Understand effects on habitats, wildlife and ecosystem which results from recreation and other uses.

Policy is concerned that the continued operation and maintenance of managed wetlands for waterfowl hunting, as game refuges, or for waterfowl food production should be encouraged. Accordingly, property tax policy should assure that rising property taxes do not force conversion of the managed wetlands to urban development. Development should provide the maximum public access to the Bay, consistent with the project while avoiding significant adverse effects on wildlife.

No comprehensive estimate of the value of fish, other aquatic organisms and wildlife for these purposes is available, but it is stated that they enhance the intrinsic value and aesthetic appeal of the Bay. Designated waterfront parks and wildlife refuges contain historic structures or landscapes, archaeological or cultural resources, vista points. Several Historic structures and districts listed on the National Register of Historic Places or California Registered Historic Landmarks have to be preserved consistent with applicable state and federal Historic Preservation law and should be used consistent with the Bay Plan recreation policies.

Visual access to the Bay is considered as a critical part of public access. The Bays appearance contributes to people’s enjoyment of it as a scenic resource and the enjoyment of daily life in the Bay Area. To enhance the visual quality of development around the Bay and to take advantage of the attractive setting it provides, the shores of the Bay should be developed in accordance with the Public Access Design Guidelines. All Bay front development should be designed to enhance the pleasure of the user or viewer of the Bay. Maximum efforts should be made to provide, enhance, or preserve views of the Bay and shoreline, especially from public areas, from the Bay itself, and from the opposite shore. All developments, which take place at the shoreline have to maintain visual and physical access to the bay as much as possible, where developments in favor of these uses should be designed so to orient and lead the traveler to the Bay (as in the main approaches to the Golden Gate Bridge). Similar consideration should be given to the design of infrastructures

(highway and mass transit routes paralleling the Bay). Guardrails, fences, landscaping, and other structures related to such routes should be designed and located so as to maintain and to take advantage of Bay views. Clustering shoreline development should support views within open spaces. Besides allocating spatial with visual access to the Bay, viewpoints which already exist should be maintained by appropriate arrangements and heights of all developments and landscaping between the view areas and the water.

Regulating Services

Regulating Services were addressed most with 56%. Within this class the regulation of the biotic environment plays an important role, especially in regard to life cycle maintenance and habitat- gen pool protection. The plan is very detailed, elaborating on specific services and its relation to each other (oxygen, waste regulation, habitats, climate change etc). It also takes a comprehensive view on climate change planning and impacts, dredging and sediment management as well as sub tidal habitats (which were addressed most). Trade-offs between human impacts such as diking or public access on natural resources has a high importance and therefore studies are conducted. The inter-connectedness within the Bay is emphasized. However, fragmented land ownership puts a burden on the protection and management of regulating services. To counteract this problem, acquisition is used as a tool to acquire land, which is not owned by the public. If specific habitats such as managed wetlands are withdrawn from their present use, every effort is made to buy these lands and restore them to tidal or sub tidal habitat, or retain, enhance and manage these areas as diked wetland habitat for the benefit of multiple species. Land acquisition in this regard, has a high priority for any public funds available. The Bay plan reflects well on the goal of the federal Coastal Zone Management Act, which states to *"preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone."*

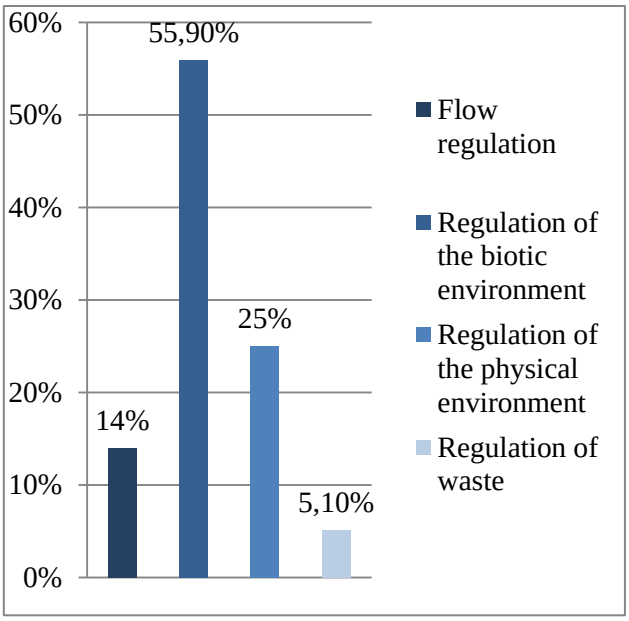


Fig.4.10: Regulating Services- San Francisco Bay Plan

Regulating Services also provide many benefits to urban area. The surface area of the Bay water helps to moderate the regions climate and prevents smog. The Bays water also provides an open area for aircraft to take off. This contributes to increased safety for the population. By taking the

regulation of the Bay into account, harmful pollutants can be reduced by maximizing the Bay's capacity to assimilate, disperse, and flush pollutants by maintaining and increasing the volume and circulation of water flowing in and out with the tides and in fresh water inflow. The Bay plays a significant role in determining the climate of the Bay Area as it maintains a relatively constant temperature and moderates temperature extremes.

Habitats such as wetlands and marches are addressed often within policies. Their significance lies in providing habitat for aquatic plant and animal populations but also for providing several benefits to humans. They serve as a link in the ecosystem's food chain and so ensure the continued diversity of plant and animal communities, are an essential feeding and resting place for migratory birds on the Pacific Flyway.

The development and uses of the Bay need to be balanced with conservation. Therefore resources as well as trade-offs are addressed. Salt ponds contribute to the open space character of the Bay and the levees surrounding the ponds, although not designed or maintained for flood control, help to protect adjacent low-lying areas from tidal flooding.

Gen pool protection, biodiversity and threats on invasive species are addressed often. In this regard the unique flora and fauna is seen as providing many benefits and well-being to humans who are recognized within the plan. It is crucial that the well-being of many plant and animal species, currently at risk of extinction, can be safeguarded. Specific habitats need to conserve, increase or prevent the extinction of any native species, which have been identified by the California Department of Fish and Game as endangered or threatened under the California Endangered Species Act. The plants and animals of the Bay provide many benefits to humans: tidal wetlands improve water quality, store carbon and can provide flood protection. Some parts of the Bay are particularly important to certain species of fish, other aquatic organisms and wildlife due to their high native biodiversity, productivity or scarcity such as deep water over sand shoals, the mixing zone, oyster reefs or eelgrass beds.

Climate change impacts are addressed comprehensively. Findings of the plan show that climate change will change ecosystems in a way, which may impair the system’s ability to rebound and function. In this regard, research is crucial for adapting the ecosystem better to changes. Also water quality and flow/circulations are approached. Well-functioning circulations of the Bay benefit aquatic life and maritime navigation. The dependency of economic activities on natural dynamics is apparent. Safe navigation is highly dependent upon changing maritime conditions of winds, tides and currents. An adequate supply of sediments is necessary to ensure resilience of the Bay ecosystem as sea level rise accelerates. Aspects which are threatening are the deposition of dredged materials in the Bay, which extensively modify habitats. Such projects could also result in significant adverse impacts to Bay water circulation and quality and cumulatively habitats and

organisms that depend on it. For example, tidal wetlands improve water quality, sequester carbon and can provide flood protection. Other vegetation and green spaces can stabilize the Bay shoreline slopes and banks to reduce excessive erosion and sediment deposition.

Filling is often mentioned in the Bay plan as it can destroy the habitat of fish and wildlife. It can disrupt the ecological balance in the Bay, which has accrued with former fills, endangering the existence of some species of birds and fish. The plan considers the impacts to be ecosystem based, as all parts of San Francisco Bay are important for the perpetuation of fish, other aquatic organisms and wildlife because any reduction of habitat reduces their numbers in some measure. Therefore, wildlife refuges, shown on the Bay Plan Maps, include national wildlife refuges, state wildlife areas and ecological reserves, as well as other shoreline sites around the Bay whose primary purpose is the protection of threatened or endangered native plants, wildlife, and aquatic organisms.

The connectivity of the Bay ecosystem including open water, mudflats, and marshlands, is a complex biological system, in which microorganisms, plants, fish, waterfowl, and shorebirds live within natural balance and which are sensitive the little impacts such as filling. These small impacts may have far-reaching and sometimes highly destructive effects. Therefore ongoing research has a high priority within the plan to ensure the maintenance of diverse habitats on which plants and animals depend on for their survival. Especially tidal marshes, wetlands and mudflats are mentioned more often due to their multitude of functions as a complex habitat for many species of fish, other aquatic organisms and wildlife.

Tidal marshes are mentioned to be an interconnected and essential part of the Bay's food web. Decomposed plant and animal material and seeds from tidal marshes wash onto surrounding tidal flats and into subtidal areas, providing food for numerous animals, such as the Northern pintail. In addition, tidal marshes provide habitat for insects, crabs and small fish, which in turn, provide food for larger animals, such as the salt marsh song sparrow, harbor seal and great blue heron. Diking and filling have fragmented the remaining tidal marshes, degrading the quality of habitat and resulting in a loss of species and an altered community structure. Mudflats support an extensive community of invertebrates of aquatic organisms, such as worms and shellfish, fish that feed during higher tides and plants such as algae or shorebirds which feed on tidal flats.

Sub tidal areas of the Bay encompass the land and water below mean low tide and are tied to tidal flats and tidal marshes linked to former parts of the Bay such as salt ponds, managed wetlands, agricultural Bay lands, and adjacent upland habitats. These areas include both shallow and deep segments of the Bay and are important for fish, other aquatic organisms and wildlife, such as bottom-dwelling benthic organisms, seabirds, waterfowl and some mammals, such as harbor seals, that move back and forth between deep and shallow water.

Agricultural lands along the Bay shoreline function as buffers that can reduce the adverse impacts of nearby land uses and activities on the Bay and tidal marshes and can also provide habitat for terrestrial species. Some undeveloped low-lying areas that are vulnerable to shoreline flooding contain important habitats or provide opportunities for habitat enhancement.

Policy prescribes, that dredged material are not to be placed in areas with particularly high or rare existing natural resource values, such as eelgrass beds and tidal marsh and mudflats, unless the material would be needed to protect or enhance the habitat. Projects should not or cumulatively with other projects significantly decrease the overall amount of any particular habitat within the Bay area. Public access improvements provided as a condition of any approval should be consistent with the project and the physical environment, including protection of Bay natural resources, such as aquatic life, wildlife and plant communities, and provide for the public's safety and convenience.

A variety of habitat types within the Bay sustain a multitude of plant, fish, and wildlife species. Many factors determine the habitat functions and values of a given area of the Bay, including water depth and clarity, type of substrate (rock, coarse sand, or fine-grained sand), type of vegetation, and salinity. Emphasis of extend research for a better understanding of the processes within the Bay. Major gaps in scientific knowledge exist about the sub tidal areas of the Bay due to the dynamic nature of the system and the complexity of linkages between sub tidal areas and the fish, other aquatic organisms and wildlife which depend upon them to rest, forage and breed. The SFO Bay Plan emphasizes that these gaps should be filled.

Policy states that restoration provides an improved probability of greater ecological success than resource creation, since the proper substrate may still be present in an area that once supported a desired habitat type and appropriate hydrological conditions may still exist or may be more easily restored.

The salt water from the ocean is diluted within the Bay waters and provides a gradual change from the salt water of the ocean to the fresh water flows of the Sacramento and San Joaquin Rivers. This relationship between fresh and salt water helps to determine the ability of the Bay to support a variety of aquatic life and wildlife in and around the Bay.

Waste regulation is addressed within the function of tidal marshes and vegetated areas at the shoreline. However, there is a need to help prevent the degradation of water quality from non-point source pollution by: filtering out contaminants; intercepting runoff; transforming and storing sediment, nutrients, and certain heavy metals; keeping channels intact by slowing runoff; dampening wave action; and reducing channel scour and bank erosion. Vegetated treatment systems, such as constructed wetlands and other vegetated landscapes, can remove sediment and

other pollutants from runoff and wastewater and can prevent pollutants from entering the Bay and its tributaries. Wetlands that are degraded by excessive pollutants no longer provide important water quality benefits, often become significant sources of pollution, and reduce oxygen in the water, making the Bay unsuitable for fish and other aquatic life (The San Francisco Bay Plan 2002).

Provisioning Services

Provisioning Services are addressed the least within the SFO Bay Plan, with a share of 6%. Energy is here referred to only in regard to the water for desalination and cooling of power plants which need large amounts of water. Especially materials of the Bay´s bottom such as silt, sand and clay and other sediments, brought to the Bay as tributaries. However, much of it circulates within the Bay, harbor and navigable channel also influencing flows and sedimentation. Part of the Bay is public and privately owned and managed for salt production (ca. 8000 acres). Salt production within the Bay is an important economic activity and therefore a key benefit obtained from its water. It is produced for food, pharmaceutics, agricultural and water softening uses. Due to the private share of salt ponds, it is emphasized that their use and maintenance should be supported, by raising taxes of property so that urban development will not take place within these ponds and other wetlands. This is important as the integrity of salt production system needs to be maintained. Salt ponds which are no longer needed are recommended to offer the opportunity to increase public access to the Bay and shoreline.

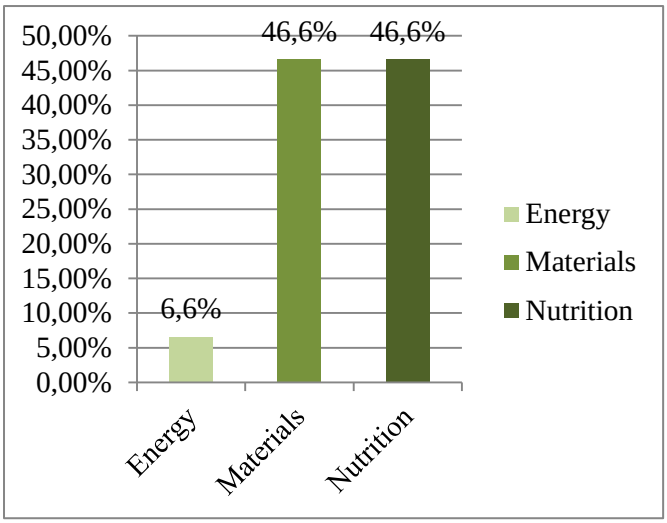


Fig 4.11: Provisioning Services- San Francisco Bay Plan

Oyster shells are another product obtained from the Bay and which as use of lime is used primarily for cement. The shell deposits are an important mineral resource because the other principal source of lime, limestone, is more distantly located in counties such as Santa Clara, Santa Cruz, and San Benito. Cement is expensive to transport over great distances, so a nearby source of lime is important to the Bay Area economy. Besides the use of the salt ponds for salt production, they may have continued commercial value for mariculture operations. Managed wetlands are low-lying seasonal wetlands which could be appropriate sites for construction of mariculture ponds.

In addition, brine shrimp are commercially harvested from salt ponds for aquaculture research and tropical fish food. A less amount of the waters is used for drinking by desalination. Fish, other aquatic organisms and wildlife of the Bay benefit humans for food and recreation. The commercial fishing industry derives fresh fish from the Bay to the area residents and restaurants and generates primary and secondary economic benefits to the state.

Planning Tools and Instruments

Public education and outreach: Within both plans, several communicative approaches were found, such as awareness raising, participation or volunteering. Educational signs and programs are conducted to raise awareness about the resources and the challenges for public access. This instrument is here argued to strengthen the relationship and understanding of the benefits received by their ecosystems for human-wellbeing. Providing recreational activities at the Bay and shoreline as such, can inspire the appreciation of the Bay and can motivate people to participate in the responsible management and protection of it, thus to increase stewardship and public safety. Education is also connected to the Bay value as a natural heritage. Historical and cultural education and interpretation provides interpretive information for describing natural, historical and cultural resources in waterfront parks. At vista points, exhibits and museums should explain the value or importance of the areas being viewed. Furthermore, waterfront parks and wildlife refuges should provide diverse environmental education programs, facilities and community service opportunities, such as classrooms and interpretive and volunteer programs. Beside these examples, the plan gives many detailed examples how and where education and participation can take place (e.g parks, events).

Mitigation banking: The Clean Water Act (1972) requires that mitigation banking should be applied in order to restore, enhance or mitigate the wetlands, resources or habitats to offset adverse impacts on nearby ecosystems. The value of the bank is called *"compensatory mitigation credit"* (EPA 2012) and can be produced at one place and sold to developers to offset unavoidable adverse impacts to existing resources/ecosystems. A mitigation bank is a site where resources are restored, created, or enhanced exclusively for the purpose of providing compensatory mitigation in advance of impacts associated with authorized projects. Mitigation *"credits"* are defined as the ecological value of the site associated with 4,000m². The credits are evaluated by specific agencies. Mitigation banks provide the opportunity to address cumulative effects of small fill projects that are too small to be mitigated individually. It can provide a timely, convenient, cost effective and ecologically successful mitigation option (San Francisco Bay Plan 2002).

Monitoring: There is much emphasis on scientific research such as a comprehensive Bay sediment research and monitoring to understand sediment processes necessary to sustain and restore wetlands. Monitoring methods are updated periodically based on current scientific information.

Acquisition: To ensure that public access can be maintained, the commission aims to purchases all legal rights to private property. This is important as ownership is highly fragmented within the Bay, hampering its holistic management especially in regard to ensure public access to the shoreline. Since the 1960s, the public has acquired roughly 90 percent of the over 41,000 acres of property used for production for the purpose of maintaining and restoring habitat.

Permits: The Bay Plan can conducted a coastal site plan review which includes public access findings and policies that address the compatibility of recreational activities with wildlife and their habitats when considering recreation-related development proposals. Permits also require being transparent and predictable within the decision-making process.

Special Area Management Plans: Area plans are important tools to harmonize different services and uses. Areas can show the compatibility of recreational activities that protect wildlife, inform the public, foster support for wildlife protection and expand opportunities for wildlife-dependent recreational activities and volunteer opportunities.

Private-public partnerships play an important role within land use planning for gaining financial support and by using privately owned spaces.

Zoning: Zoning is used as a planning tool to separate incompatible activities and is commonly used for protected area management and conservation.

Institutional cooperation- Land use and Coastal Planning

The San Francisco Planning Department cooperates with other regulatory programs of existing regional, state, and federal agencies dealing with the Bay, ocean, and shorelines. This is due to the awareness towards region wide problems and the need for region wide solutions. Managing the resources of the Bay and ocean and the abutting lands is under the regulation of a number of regional and state agencies. The city therefore has a representation on the multi-county agencies.

The city of San Francisco has the goal of conserving the resources of the Bay, ocean and shoreline. Due to shared ecosystems of the Bay, these come along with those of the other constituent counties. To achieve these goals, collaboration with regional, state, and federal agencies should be fostered for setting and achieving goals in this regard. Uses and developments of the shoreline area have to be consistent with the General Plan as well as the San Francisco Bay

Plan which central agencies (The Bay Conservation and Development Commission, and California Coastal Commission) cooperate with each other. These regional planning agencies set the framework, for the use and development of the shoreline which needs to be in accordance with policies of the General Plan. The latter ensures that the interests of the cities inhabitants are met (The San Francisco Bay Plan 2007).

There are several official regional agencies, which operate to regulate the use of the regions resources and which develop policies for specific sectors and areas. These include San Francisco Planning Department, San Francisco Bay Conservation and Development Commission, the Bay Area Quality Management District, the California Regional Water Quality Control Board (San Francisco Bay Region), and the California Coastal Commission. Policies which are already covered within these agencies/policies are therefore not included in the General Plan. Beside these official agencies, several private programs by voluntary or private organizations contribute to resource conservation of the Bay, ocean and shoreline. These provide a high value as they keep public conciseness and attention on essential enforcements and should therefore be encouraged. An example of voluntary involvement of the city groups is the assistance in water and shoreline monitoring activities and its effects on the environment.

The San Francisco Bay Conservation and Development commission manages and coordinates development and conservation of the bay up to 100 feet inland. For the General Plan, there is no single agency, which manages and raises financial resources for preserving open land uses. The General Plan emphasizes that there is a need to form such an agency to preserve enough open space in the future. The city now coordinates planning efforts towards maintaining open space with other open space planning agencies, private sectors, non-profit institutions in the region. However, valuable open space crosses city and county lines and individual municipalities have neither the regulatory powers nor the funds to retain them. Preservation of such spaces therefore depends upon regional action (The General Plan 1996).

Also within the managed area of the BCDC land ownership is fragmented, which requires that the coastal zone management program and plan cooperates with several agencies and boards. Management requires strong cooperation with public and private land owners to fulfill the objectives of the CZMA and the regional fitted objectives thereof.

4.3.2 Hamburg

4.3.2.1 Land use planning (Flächennutzungsplan)

The explanatory report and amendments of the Flächennutzungsplan of Hamburg includes the consideration of ESS. The plan builds on the development plan of the region. It is the central urban plan for the region and city and has the function as preliminary urban land use plan. Hamburg, Schleswig Holstein and Lower Saxony together cooperate within inter-state planning. Urban land use plans have to be adjusted with the neighboring municipalities.

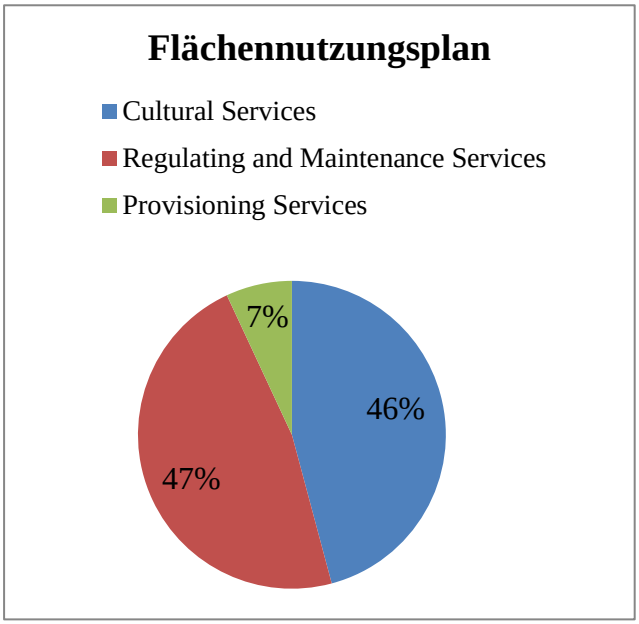


Fig. 4.12: Flächennutzungsplan and reference to ESS, Cultural, Regulating and Provisioning

Space fulfills several functions, which include the provisioning of fresh foods for inhabitants, the preservation of cultural landscapes and safeguarding of traditional land structures for recreation. Land used for agriculture and horticultural purposes have an important function for groundwater, soil conservation and the urban climate. Horticulture and agriculture should be protected and economical/political structures should support the employments within agriculture. Open space and natural areas should be safeguarded with the available planning tools. Within the plan, urban land use plans/concepts are included for specific areas and thematic developments (informal plans) as well as sectoral plans for transport, supply and disposal, which are based on laws such as Water Resources Act developed parallel. Only some aspects of sectoral plans are included to the F-plan, decided by the planning office. While it is guided by the federal spatial planning act and common land use planning (top-down), it is influenced by informal plans (bottom up) and sectoral plans. The F-plan only provides the framework for planning and leaves flexibility to the development plans (Bebauungspläne) which have to be developed from it. The wildlife conservation program (Artenschutzprogramm) and landscape program (Landschaftsprogramm), provide additional plans and deal mainly with environmental planning and nature protection. The F-Plan constitutes the land area of Hamburg as well as water areas, which include federal waterway and any other waters that have an area larger than 3ha (Flächennutzungsplan 1997).

Cultural (46%) and Regulating Services (47%) are referred to most within the F-plan. Preserving green open spaces for recreational uses but also nature protection are important aspects here.

However, the plan doesn't refer to other ESS or values given to society (such as birds, views, aesthetics). There have been long dated conflicts between ecological and economic aims within the estuary that were formulated since the 70s. Ecological potentials of the regions should be maintained and further developed; therefore land should be treated like a resource, which should be managed economically. Environmental protection need to be considered within all developments. The plan points out that Hamburg´s space is limited and that there are increasingly different claims of land uses. Planning should try to concentrate here on inner development rather than expanding it. Environment and city should become compatible in land uses, developing housing and industry in a dense spatial pattern to save space. The plan constitutes the possibilities for a development that safeguards the human valued environment, and protects it as an essential base for human livelihood. Urban planning in Hamburg is strongly connected to the harbor to ensure that economic development of the harbor area can take place in accordance with other functions (Flächennutzungsplan 1997).

The plan strongly refers to the development and protection of key regulating services such as air, climate, soil, however, the direct interplay between human well-being and the services of the ecosystems are not addressed.

Cultural Services

Hamburg is characterized as the "*Green metropolis*" located at the water. Open spaces give Hamburg a unique urban landscape and character and therefore should be protected and improved. These include especially these green spaces which are located within the city and the open spaces of the urban periphery including water areas. The use of resources and natural space for recreation, aesthetic values and scientific research get great attention within the plan. Recreational, leisure and aesthetic uses are especially provided by open spaces including parks, playgrounds, zoological and botanical gardens, historic gardens, other open space for sports cemetery as well as waters. Open space has several functions for the urban population for recreation, sports, leisure, and relaxation, for aesthetic and natural experience. Especially the rivers Alster and Elbe contribute to the attractively and identity of the city of Hamburg by providing multiple recreational services. Gardens have a socio-political and

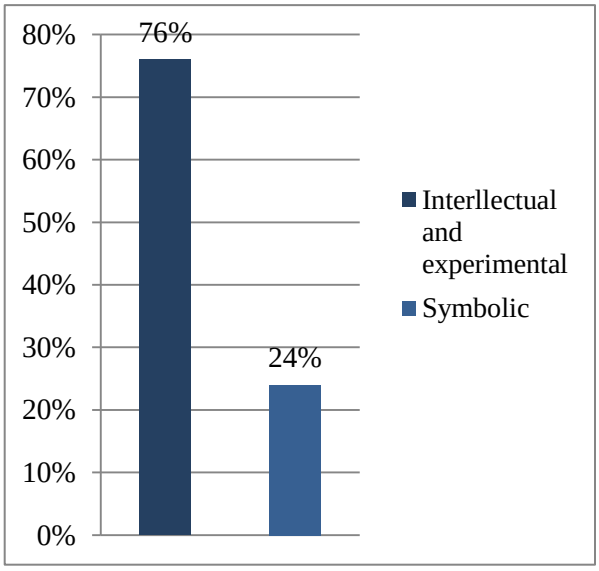


Fig. 4.12: Cultural Services, Flächennutzungsplan

culture historical importance for urban and ecological functions. They contribute to recreation and leisure of the population, and connect larger green areas. Resources are used for research and development or the use of wind and hydro energy but also the undisturbed landscape between the estuary from Elbe and Weser are of high scientific importance (Flächennutzungsplan 1997).

The guiding vision for the green metropolis is grounded in the Landscape Program (Landschaftsprogramm) and Protected Species program (Artenschutzprogramm). Ecological connectivity between and within open space with its components of green and park spaces, agricultural used space, forest areas, and natural landscapes and the functioning of habitats play therefore a crucial role within spatial planning in Hamburg. Space between build areas, are used for the preservation and safeguarding of ecological interdependency of nature areas of Hamburg with the urban hinterlands as well as the safeguards of functions of agriculture and forestry, the urban climate, the landscape and recreation. The allocation of open space for recreation and leisure is an important aspect to insure well-being and quality of life of the Hamburg. Therefore, the use of free space should not occur to the expense of these uses-recreation and natural environment. Green space and connections of these should be safeguarded as they play a role for broader ecosystem functioning and habitat connectivity. Developing green spaces along the rivers and other waters are here an important aspect. Even though there is a growing use of space recreational space needs to be maintained by preserving open space and connected habitats and landscapes and enhanced further for recreational offers of the population. Forest areas are primarily used for recreation and protection. These areas need to be protected and enhanced especially at the suburban area. Water areas serve the water economy and shipping and all kinds of water sports and recreation. Water sports contribute to the overall quality of the city as a place to live and spend leisure time.

For air exchange and climate, open spaces within the wetlands need to be protected from developments. Areas within the harbor are only assigned for development if at least ten percent is left for green space/development. Maintaining the ecological balance is crucial for the city. The use and function of the region for scenic, ecological and socio-cultural uses has a high importance. Especially forests and agricultural spaces can fulfill these functions and therefor need to be maintained. Marshes and other cultural landscapes have a function for traditions and heritage and therefore should be preserved.

Provisioning Services

The main provisioning service the plan refers to is drinking water. Drinking water is derived mainly from groundwater and with one third from the surface waters. As these are not adequately protected, the plan emphasizes on its protection towards contaminations within all developments. In this regard there are designated water protection areas within the plan and monitoring of the quality of ground water is prescribed. To ensure that security for drinking water can be ensured a rational use of water should also be encouraged. The plan also refers to agriculture and horticulture for providing fresh products for the citizens. Also here, designated areas for agriculture and horticulture are provided that are close by production areas and constitute the livelihoods of several farmers.

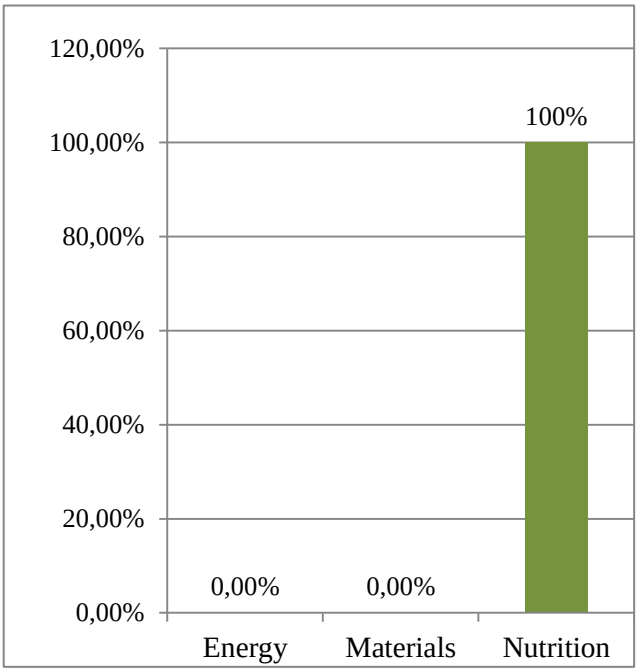


Fig. 4.13: Provisioning Services- Flächennutzungsplan

Regulating Services

The connectivity of open spaces within and outside the city should be safeguarded for regenerating the urban climate and air quality, for recreation and leisure and for habitats of plant and animal but also for protecting soil, water and air resources. Open spaces such as water, green spaces, forests, agricultural space and other nature specific spaces determine the ecological balance of the region, by regulating soil, air, and climate. These elements therefore gain a high attention within regulating services. These also contribute to healthy working and housing conditions and regulate water supply and habitat for flora and fauna. Property and space therefore should be smartly allocated. As the port plays a

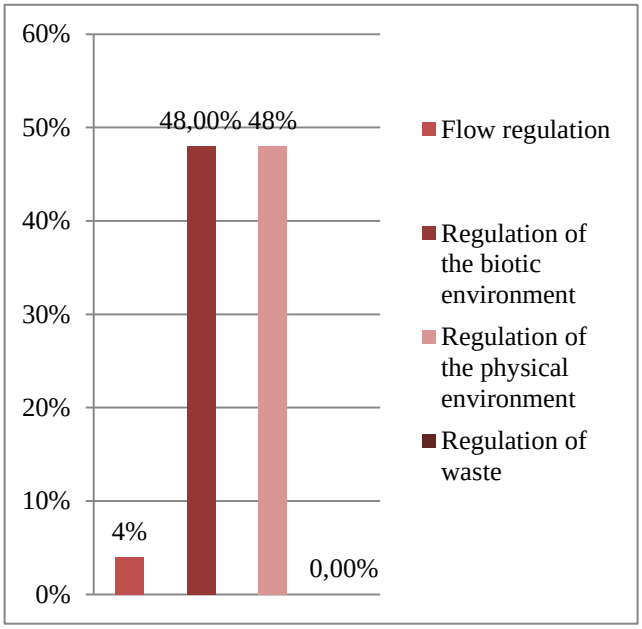


Fig. 4.14: Regulating Services- Flächennutzungsplan

significant role for the region's economy, and the provision of good and services, waterways for shipping and navigation need to be maintained and restored.

Within all plans and developments, area wide habitat mapping as well as species mapping is a prerequisite of the wildlife conservation program for species and biotope protection, for habitats and species and the habitat system. As the city is highly developed, the unsealing of surface areas should be supported to improve groundwater recharge, the urban climate as well as the diversity of biotopes.

Compensating measures are a central planning tool. The land use plan indicates that there are spaces, which are well fitted for compensating measures for interventions in connectivity of spatial pattern. Therefore, sometimes different interventions and compensating measures can be concentrated within space if it is more effective for ecosystems then doing several spatial isolated measures. There are open spaces used for nature specific areas, which should be preserved as such and considered within developments. There is an emphasis on the improvement of the ecological status of harbor and the Elbe, and therefore a structural plan should show possibilities for ecological configuration measures to improve aquatic life by restoring the river shoreline. In the urban periphery, ecological compensating measures within the housing development area as well as the preservation, maintenance, and rehabilitation of typical landscape structures are in the foreground. The idea is that some unused areas can strengthen the ecological balance. Therefore, these should be left open also for ensuring that air lanes can bring fresh air in the dense populated urban areas. This improves the urban climate and air quality. Some developed areas need to converted to agriculture for the delivery of portable water, ground water quality and biotope protection and function.

The greening of spaces of land and sea are associated with the improvement of the natural climate, the increase of air humidity, and temperature regulation. These have a direct impact on urban climate and hygiene. Modes of transport should be developed and planned in an ecologically sound way. Defined pollution on land and groundwater should be minimized; this should be done with restoring the land contaminations or by climate political and transportation measures. Measures for an environmentally friendly agriculture can also contribute to reduce emissions. Wastewater treatment should be improved, which lead to the Elbe and harbor, to improve the general water quality and to avoid contamination. Hamburg and the German government provide financial support with the implementation for measures to improve water quality in the newer states and Tchechisch Republic to. Compensating measures play a role, when interventions in the natural landscape cannot be counterbalanced. This requires that similar conditions have to be restored at another place. Soil and water conservation get a high priority within land use planning especially in consideration to port and shipping activities.

Planning Tools and Instruments

Impact Assessments: Planning is driven mostly by regulatory measures and influenced by directives. Strategic environmental audits have to be given to new developments (after the 2001/42/EG1 SUP-Richlinie). These have to consider higher raking environmental protection goals such as common, national or international conventions or aims, which the region has been entered and share common concerns such as the Water Framework Directive, the Convention for Biodiversity or the Kyoto protocol. On the EU-level, there are several defined laws such as the FFH- Policy (FFH-Richtlinie) which is incorporated in the national and regional Nature Protection Acts (BNatSchG). Special consideration is given to the following subjects to protection: *Soil, water, climate* and *air, Flora* and *Fauna* and *biodiversity*, protection of the landscape and cultural heritage, as well as the population and its health/well-being. This can be explained as these elements are incorporated within the landscape program (Landschaftsprogramm), rooted in the federal nature protection law. As the Flächennutzungsplan needs to consider these elements, amendments to the land use plan (Flächennutzungsplan) have to approach and evaluate its likely impact on climate and air, water, soil but also on its influence on habitats, biotopes and species.

Mitigation Planning: Where components are negatively affected, mitigation measures need to be taken before developments can take place. Different assets which are subject to protection are referred to such as vegetation and animals including biodiversity and change of the landscape. Habitats for endangered species get a high priority within developments and need to be highly protected. This is considered in reference to the prescriptions of the federal nature protection act (Bundesnaturschutzgesetz BNatSchG), to conduct research on habitats and species. A summary of the environmental report and considerations has to conclude the amendments to the land use plan.

Landscape Planning: The amendment statements have to include an environmental report including alternatives to the development between no development and the impacts on the environment, natural processes, the consideration of ecosystem components or species subject to protection and their interplay including air and climate, soil and water, vegetation and animal, biodiversity cityscape and landscape scenery. Not directly referred to the natural environment it also includes cultural and other real assets, the human being including its well-being and health, referring to components such as recreation and historic, aesthetic places and their interplay. Monitoring is a key tool for ensuring that these elements remain protected.

The plan is central to the preliminary urban land use plan (Bauleitplan) after the town and country planning code (Baugesetzbuch BauGB). Further, several sectoral laws influence planning, such as the special plan for the harbor (Hafengesetz). However, the Flächennutzungsplan contains aims

and guiding plans which leave flexibility for the realization and development of the land development plan.

Habitat and species protection/mapping: This is done especially in protected areas where developments could have adverse impacts on habitat or species. Habitat mapping provides the basis for compensation planning and is included into the Hamburg Nature Protection Law.

4.3.2.2 Integrierter Bewirtschaftungsplan Elbeästuar, Teilgebiet Schleswig-Hostein und Hamburg 2010 (IBP)

"A healthy estuary is a natural capital which constitutes several functions which humans directly or indirectly benefit from of perceive" (IBP 2010, translated).

The Integrated Management Plan for the Elbe Estuary (IBP) for Natura 2000 and the Elbe Estuary is based on the EU Flora and Fauna Directive (FFH-Directive) and aims first of all to ensure nature protection; it therefore has a strong focus in on biodiversity, invasive- and endangered -species as well as habitat connectivity. However, for ensuring the protection of the river as an ecosystem it aims to find balanced solutions, which integrate different uses and functions, trying to harmonize them with nature protection. Therefore, the plan directly approaches the synergies, tradeoffs, relationship and conflicts between the ecosystem (dynamics) of the Elbe estuary and the human-sectoral interests. More specifically, it considers different interests, synergies between functions such as tourism and recreation, navigation, living, environmental - and coastal -protection. It is an integrated plan in several aspects. First, it is collaborating with all the states and regions which are located at the river Elbe (from the city of Geesthacht to the estuary trough the states of Hamburg, lower Saxony, Schleswig Holstein) and therefore takes a cross- regional, but ecosystem based approach to the river. Due to the strong impacts of climate change on the ecosystem such as by invasive species, a continuous adaptation to the newest scientific findings is emphasized within the plan. The entire estuary is managed as an ecosystem including also bordering lands, which provide habitat and migratory routes for species of high biological importance.

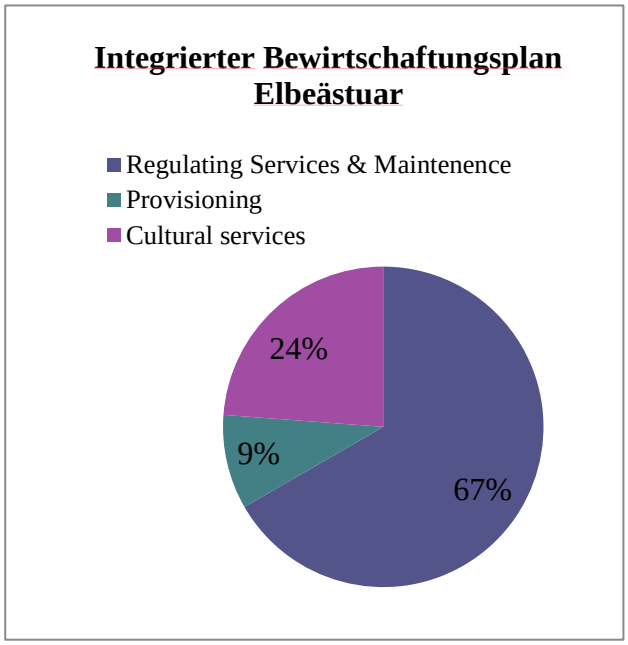


Fig. 4.15: Integrierter Bewirtschaftungsplan Elbeästuar

Within the EB-perspective and integrated river basin management, the plan puts emphasis on considering the river as an ecosystem including all bordering regions. The region of Hamburg (Functional area 2) has a special position, as part of the city including the harbor is the only area of the seven functional areas not being a part of the Natura 2000 network. Its river section however, provides an important link between the registered protected areas upstream and down the Port of Hamburg and therefore has a connecting function for the habitats of Natura 2000. The plan was established with the intention to harmonize nature conservation with harbor/economic development; the interplay between the functional area (Hamburg e.g.) and protected area/ the Natura 2000 are therefore the focus on this plan. Results of the analysis show that regulating services were addressed with the highest share (67% of all coded segments), followed by a smaller share of provisioning services (24%) and cultural services (9%).

The IBM has no binding or regulating power, however, it can be considered as a step towards increasing research and awareness in terms of harmonizing nature protection with economic development and to share this with the local people who live in the area by following a communicative approach. It also shows effort towards linking planning of land and sea by following an ecosystem based approach to river basin management, taking into account bordering regions, and sectoral interests.

Cultural Services

Cultural services are seen in relation to its estuarine ecosystem. Impacts on the cultural and ecological landscape directly impact cultural services which are obtained from this area. Invasive species for instance do not only threat biological functions but can have results on the human being such as impacting health, fishery, agriculture or general food production by reducing biodiversity. The plan addresses many cultural services by pointing on educational and communicative approaches. Therefore intellectual and experimental services are more addressed than symbolic services provided by the area. Central to achieve the objectives of the plan is to promote knowledge and awareness about the functioning of the estuary now and in the future, including threats and trends. It sees communicative, coordinated activities, foundations, nature conservation organizations as well as local initiatives or persons etc. Education and outreach can especially be effective within

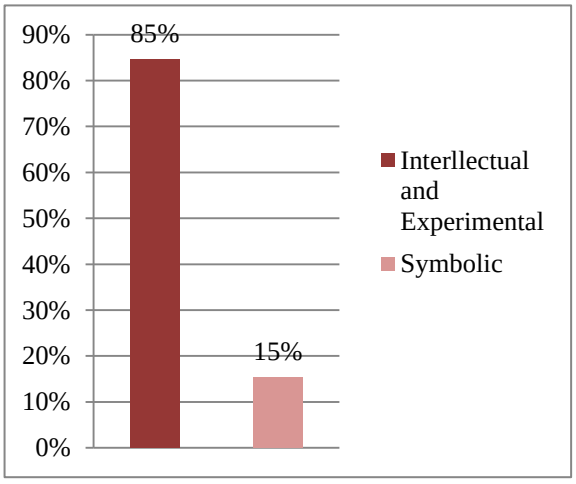


Fig. 4.16: Cultural Services- Integierter Bewirtschaftungsplan Elbeästuar

biodiversity conservation by exchanging best practice, key messages and convey the need of the cooperation between economic sectors and nature protection (Natura 2000) to achieve win-win situations by increasing the attractively of the area in both regards. For making the place more valuable for tourism it is important to strengthen the identity of the area. Therefore structures and arrangements for better information, the exchange of experiences and for the participation for the implementation of the IBP will be maintained and are to be achieved. Several information points relating the topic of Elbe flora are and will be further established. Experiencing the maritime landscape of land and sea including industrial shipping, and water sports has become an integral part for tourists seeking to visit the city of Hamburg. The Elbe estuary and its wetlands have a high significance as a local recreation area from people living within the metropolitan area of Hamburg as a space of multiple use including shipping and industry, fishery and agriculture, tourism, recreation and watersports. Its landscape has a high value for the people's identity and provides a high potential for enjoyment and aesthetic sense. Therefore, landmarked objects as well as land- and settlement-heritage sites are protected, which connect the people with their history.

Within the protected areas, shipping, land based and water sports as well as many other recreational activities constitute the most important uses. Besides, protecting nature, it is crucial to safeguard and develop the potentials of the area for tourism and cultural activity especially in regard to its function for water related recreation. Here, recreational activities should be environmentally sound and should take biological connectivity's into account. Doing so, recreation can take place while increasing the ecological function of the estuary.

Regulating Services

Regulating services are considered most within the IBP, which can be related to its origin in the FFH-Directive, which aims at nature protection and the establishment of protected area network (Natura 2000). Protecting the dynamics of the estuary is underlying for the function of the estuary and thus for goals such as biodiversity and climate change protection. Mostly addressed in the plan is therefore the regulation of the biotic environment, including especially biodiversity, pollination and seed dispersal, maintaining

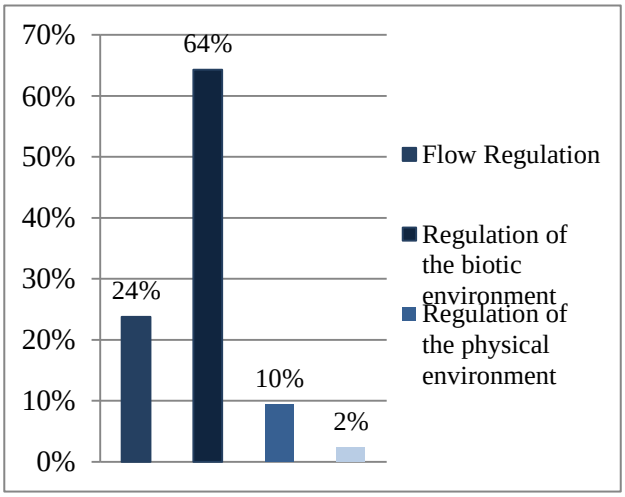


Fig. 4.17: Regulating Services- Integrierter Bewirtschaftungsplan Elbeästuar

nursery populations such as fish, birds in land and sea habitats through habitat connectivity. Concentration is also given to (water) flow regulation, as a functioning system can providing runoff mitigation, flood control, coastal protection, sedimentation, storage, erosion control and navigation, also key functions for the city. Flow regulation is threatened by the further deepening of the waterway of the port of Hamburg, which has led to an increasing tidal range and changing sediment behavior. Together with the impacts of climate change the sea level is rising and storm floods are expected to have a stronger impact in the future. To approach this problem, the plan therefore suggests to use natural dynamics of the tides for the sediment management to strive for the rehabilitation of the natural dynamics of the Elbe. This, in turn is argued to lead to a dynamic, self-restoring ecosystem, which is more adaptive and resilient towards the impacts of climate change. The dynamic interplay between land and water is seen important for maintaining ecosystem functioning and biodiversity. Therefore, the permeation between land and water shall be restored such as by the development of tide ways. The region of Hamburg plays a key role in sustaining entire biological populations of some endangered species, such as the shoveler. As regularly entering ships carry ballast waters, precautionary measures against invasive species are taken. The EU wide efforts for developing appropriate strategies for the management of invasive species are in the center of politics of nature protection and aim to combat invasive species to ensure that the natural habitat are maintained. The wetlands on the Elbe shoreline constitute a high amount of biodiversity. For one of the most endangered plant the *"Schierlings Wasserfenchel"* they provide an important habitat. The plan also aims to achieve its national and international commitments for the preservation of biological diversity through the good state of species and habitats by avoiding deterioration and preservation of biological diversity and use of species for hunting. Tools to towards goal achievements are working with habitat connectivity, natural dynamics, to ensure pollination and to create network areas for ensuring the survival of meta-populations.

Besides preservation of Biodiversity, the diversity of sustainable nature uses should be maintained. Therefore management aims are concerned with the maintenance and support of biodiversity of natural habitats at the Elbe and communicate the significance of the area as a habitat for biodiversity. For specific fish the Hamburg region of the Elbe constitutes a migrating way and is therefore a crucial part of a habitat network for the endangered *"Schierlings Wasserfenchel"* for ensuring that the population can be conserved. Hamburg, which is mainly build up and under shipping development. On the other hand it has to maintain the habitats of the estuary to counteract the extinction of the species and biodiversity. The Elbe needs to be maintained as a suitable resting area for migrating fish along their route. For the metropolitan area of Hamburg a special habitat network system has been developed "*das blaue netz*". Many objectives, and all objectives related to species and habitat are directly or indirectly dependent on

the preservation objective of the greater ecological area of the estuary. A main objective is to prepare the estuary and its habitats for the impacts of climate change and optimizing sediment management for reducing pollutant load without destroying the biological penetration. Regulating services are high on the agenda within the plan. This can be explained as the nation aims to achieve the national and international commitment of the water directives for a good ecological status for the waters also for swimming and recreational water activities (Water Framework Directive). For the estuary water is the most crucial connection. The loss of natural filtering function of the estuary has a strong influence on coastal waters, making overall aims of the WFD more challenging. In addition, the Convention of Biological Diversity as well as Climate Protection Initiatives play a role in the development of the plan objectives. But also the Flora and Fauna Directive emphasizes that the Elbe estuary and the bordering Waddensea is a key area for bird migration in Europe and therefore has a EU wide responsibility for the maintenance of migrating birds. There is a dilemma within the endangered plant, *"SchierlingsWasserfenchel*", which is dependent on the natural dynamics, which is hardly compatible with the nowadays most static landscape and other interests and uses or the estuary (especially shipping).

Provisioning services

Provisioning services are less directly addressed, even though regulating and maintenance services indirectly deal with securing ESS. Those which are addressed, focus on the maintenance of landscape and ecosystems for the provision of food. Central is the protection of habitats and species rather than the food products itself. Agricultural businesses and the fishing industry maintain the typical cultural landscape and produce high quality goods. Hunting is mentioned to be conducted in a way that it can be harmonized with the preservation objectives of Natura 2000, so that huntable species do not become extinct. Bordering regions of Hamburg are addressed as important regions for fruit growing and market gardening. The cultural landscape including several agricultural activities such as cattle breeding, agriculture and fruit growing, traditional cane economy is highly connected to the marches significance for migratory birds. The estuary has a regional and national economic significance as a fruit growing and other specialized cultivation area.

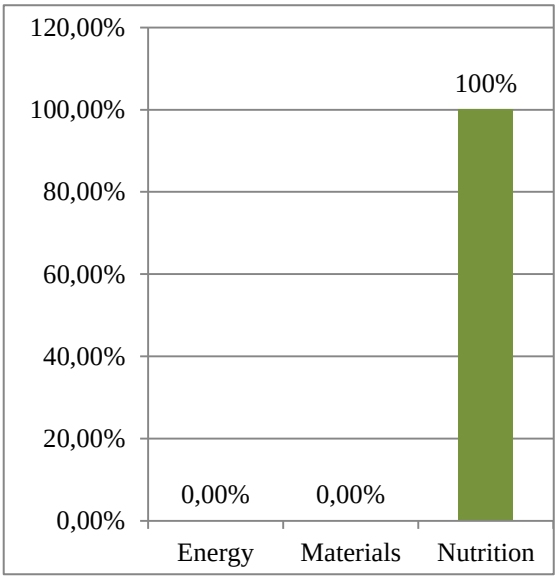


Fig. 4.18: Provisioning Services- IBP

Planning tools and instruments

The IBP is seen as an instrument per se, to ensure the implementation of the Natura 2000 goals and to facilitate impact assessments. However, sovereign instruments such as the designation of protected areas or landscape conservation areas are used for securing that specific areas can be conserved. The formulated aims of the IBP can be adopted by applying these instruments. The aims of the IBP and the relevant levels of the land use planning and regional planning such as through the *"Vorranggebiete"* (areas which have to fulfill a special function). Of special importance is the consideration or establishment of habitat connection by creating *"green infrastructures"* for Natura 2000 areas and by strengthen its coherence. Uncertainty is managed by adapting knowledge and actions on best available science (adaptive management).

Monitoring the natural status of habitats is set under natural law the FFH-RL. Here, all members of the EU have to monitor the status of flora, fauna and habitats and come up with a report about its status every six years. Besides monitoring, the plan stresses that the valuation or integration of these services into the political economy has not been considered sufficiently enough.

Valuation: The Economics of Ecosystems and Biodiversity (TEEB) was initiated from Germany and the European Commission, to provide an answer to the estimated financial losses of biodiversity to the economy. Efforts to conserve and reestablish the estuary are argued to have several benefits and can provide an answer to climate change. Compensating measures and eco-account/banking are considered also within financial terms (valuation). New developments along the ecosystems require strategic and environmental impact assessments by law (Garniel & Klempgen 2010).

Institutional Cooperation-Land Use- and Coastal Planning

To achieve some of the goals towards conserving the ESS mentioned, a strong interest lies within the interdisciplinary cooperation with the shipping and port authority/administration as key stakeholder. The Hamburg Port Authority (HPA) is the central institution within the state and region of Hamburg, which manages the waterway and the city of Hamburg. The Waterways and Shipping Administration (WSV) manages the Elbe as a river and is responsible for the maintenance of the Elbe as a waterway.

The Elbe's management is under the jurisdiction of the federal states Hamburg, Lower-Saxony and Schleswig-Holstein, which border and benefit from the river. Even though jurisdictions are divided, from an ecological point of view the Elbe estuary is an adhered system/space. Therefore the three states have agreed to develop this joint integrated management plan, for using the potentials and advantages of a coordinated management of the estuary. In this regard, the plan

includes recommendations with regard to economy, society and cultural as well as regional and local characteristics. Also the F-plan emphasizes that environmental impacts and developments have an influence across borders and therefore require cooperation with the neighboring countries in terms of nature protection, developments and recreation. Even through the IBP has no binding or regulatory power, it can, following a cross-sectional oriented approach, support the requirements and achievements of further policies and conventions such as especially the Water Framework Directive or the Marine Strategy Directive or Ramsar-Convention for the protection of wetlands of international significance and the OSPAR Convention for the Protection of sensitive Marine areas. Within the formulation of the IBP, several steps were taken which follow a joint agreed project structure. In all of the three states working/planning groups were established with the inclusion of the following interest groups: Responsible government (municipalities/countries), water economy (water and soil organizations). Coastal and flood protection, dike and harbor, shipping organization, nature protection, commercial fishing, hunting organizations, watersports as well as tourism, archaeology and heritage administrations. This emphasizes a cooperative and participatory approach and integrated approach to the river and land.

As coastal management is conducted under the framework of land use planning, the IBP reflects on the overall goal of the Federal Spatial Planning Act (Raumordnungsgesetz (ROG). Therefore, the coordination of different uses has to be considered within regional and federal spatial planning perspective in a way of sustainable spatial development. Hence, there is a need to support the mutual understanding for the needs/interests of the single sectors through information, exchange as well as co-management and to link al efforts to land use planning. The plan further emphasizes on the fact that efficiency of single measures and initiatives can be achieved through a coordinated higher ranking framework for better use and planning reliability which has not been developed so far.

Within the region of Hamburg, a strong cooperation between the WSV and the HPA but also with the agency for urban and environmental planning (Behörde für Stadtentwicklung und Umwelt) is a prerequisite to achieve a win-win situation for concrete implementation strategies. That all interests are considered and informed is seen as crucial to ensure mutual understanding for the needs/interests of the single sectors through information, exchange as well as co-management. Especially the cooperation with the WSV is imperative to achieve substantial improvements for flora and fauna in the future. The implementation will be constantly accompanied by the working group *"Unterelbe"*, which consists of representatives of the states Hamburg, Lower Saxony, Schleswig Holstein as well as the WSV of the federal state and the HPA. Between 2010-and 2020 first tests for the IBP will be made. The success is dependent on a functional communication between the different sectors as well as upper echelons and cooperation of the involved parties at

the sites. Here, the plan emphasizes the importance of strong cooperation not only within the planning phase but also during implementation. To increase the effectiveness of measures taken, synergies and conflicts with the aims of Natura 2000 should be analyzed.

Adaption to climate change is seen as high priority where Natura 2000 aims should be included in any adaptation strategy of the metropolitan region of Hamburg. The next ten years will be used to increase the understanding for climate and hydro morphological developments, and ongoing research shall be continued. As the hydro morphological and other ecological processes are complex and questions can only be answered within an interdisciplinary approach, collaboration with research institutions and other initiatives related to the management of the Natura 2000 area is imperative. The IBP hints to several gaps and therefore supports the need for further research projects especially with regard to future questions related to climate change impacts on the estuary, its bordering regions, endemic species and the protected endangered species (Garniel & Klempgen 2010).

5. COMPARISON OF CASE STUDIES

5.1 Role of ESS in planning approaches

Within both regions and their build up spaces strategic planning pays increased attention to important ESS provided or supported by their surrounding waters. Whereas the well-being of the city of San Francisco is mostly dependent on the Bays ESS with a strong focus on cultural services, Hamburg emphasizes regulating services provided by the river Elbe, especially for shipping, economic activities and nature protection. The dependency of both coastal cities on its surrounding ecosystems has thus become apparent and ESS are being considered within the strategic planning and policy discourse. Economic values and political ideologies are not anymore the most important factors, which determine visions of regional development but also the socio-cultural services ecosystems provide and the natural dynamics and interplay/interrelationship between human well-being and ecosystem state have become relevant concerns. This is reflected in both regions where strategic planning objectives emphasizes the need to balance nature -protection with -use. Even though the term *"Ecosystem Service"* is not raised once in all analyzed plans, all of their components are referred to with different emphasis and weights.

Regulating services are addressed most frequently in both cases due to their close relation with ecosystem functioning and cultural services, which depend on ecosystem functioning. Secondly, international and national directives such as the Water Framework Directive or the Flora and Fauna Directive require that environmental status, as qualified by the number of endangered species and water quality are maintained or improved and have fostered and financially supported research and projects towards achieving these goals. The IBP Hamburg indicates the strong influence of the legislative framework on the consideration of ESS within planning. The same holds for Natura 2000/Nature Protection Acts (BnatG). Also in San Francisco, the CZMA has an emphasis on the conservation of natural resources.

Cultural services have an important role in both regions. In San Francisco, they are more emphasized within urban land use planning, as the urban population and its wellbeing gets high attention, but also coastal management addresses several cultural services. Equity and environmental justice is an important aspect of planning in SFO, which frames and emphasized on a strong human-nature relationship. Aesthetics is an element of the CEQA and needs to be assessed within environmental impact analysis of all project developments. It is therefore directly integrated into the decision-making process of all developments.

In Hamburg, cultural and regulating services are approached with an almost equal share. This may be explained as the analyzed plan is influenced by elements of environmental planning of the

landscape and protected species programs and serves as a preliminary urban land use plan. Thus, there is a legislative influence on planning considerations. In the coastal plans, regulating services are addressed with the highest share in both cases.

In both regions the interplay between the waters, Bay and river, with the urban area are recognized by the planning agencies. Especially for the provision of ecosystem functioning, the plans of land and sea refer to each other. In Hamburg, planning of land and sea is grounded within one planning framework, even though the IBP has as yet not been included in a greater spatial planning. This framework is general for spatial planning (ROG) as there is no separate regulatory framework for ICZM in Germany. In the US, land use planning and coastal planning are seperately organized. Whereas land use planning is also more regulatory and deterministic in Hamburg, in SFO, the land use plan only provides guidelines to all sectoral city agencies. It remains therefore uncertain to what extend goals will be implemented by individual sectors. In the US uncertainties of implementation are accompanied by financial uncertainties, as planning is dependent on federal funding, which has no administering agency to do so (in the case of urban land use planning).

Provisioning Services are addressed least in both cases, probably because those services such as energy resources and food products/drinking water can be imported from outside the region. In addition, citizens not rely on local food products for their survival, nor do they dedicate land uses for these functions within the urban region. Economic activity is also not concentrated on these services. The plans indicate the direct relationship between regulating and provisioning services. Fish stocks for example are expected to improve with habitat improvement such as through the increase in water quality. Most provisioning services such as food and energy are also subject to sectoral plans, whereas nature protection is covered separately (such as is the case in Hamburg). Therefore, its relationship and tradeoffs are not holistically addressed within any one plan.

In both regions different planning instruments can be identified for land and sea. In SFO, most common planning instruments are land acquisition to counteract fragmented land ownership and limited decision making power over these lands. As prescribed by the California Environmental Quality Act, environmental impact analysis requires the identification of mitigation measures for all impacts on the environment. In the case of CZM, a typical tool is mitigation banking, which mainly focuses on prospective impacts on wetlands by applying valuation measures. It aims at mitigating impact on the environment by replacing the exact function and value of a site or wetland habitat that would be negatively affected by a proposed project. Education and outreach in several forms and respects is another central planning instrument, for raising public awareness and by including the public into decision-making. Local level planning in the US is important to keep people committed to the program as it is voluntary and highly dependent on federal funding.

In San Francisco, cooperation takes place among several agencies and institutions that own and manage space. The central planning instrument, land acquisition, aims at acquiring most privately owned land for public ownership to ensure open space to the public, as well as conservation of the natural environment.

In Hamburg, planning for land and sea is mostly conducted by land use planning, conserving ESS within protected areas as well as compensatory measures. Another typical planning instrument in Germany is the impact assessment prior to any development project, including environmental and strategic impact assessments, as well as landscape planning as an instrument for nature conservation and landscape management. Within landscape planning, mitigation and compensation measures need to be determined so that all impacts within the cultural landscape and spatial functions can be restored at another mitigation site to maintain ecological functioning. The impact mitigation then needs to be considered within local development planning. In this regard, the connectivity of open space and habitats is important within land and river based planning. This appears as a successful tool for ensuring that impacted spaces be maintained. Both plans of Hamburg emphasize that there is a cross sectoral and cross border cooperation with neighboring states as impacts and results of ecosystems do not stop at borders.

The IBP has also mentioned new tools which consider ESS such as valuation schemes and extensive mapping (see TIDE toolbox). What potentials these instruments may bring for the ESS approach will be part of the discussion. A comparative overview over tools and instruments found within the strategic plans is given in the table 5.1.

Tab. 5.1: Comparison Planning Instruments and Tools

San Francisco	Hamburg

• Zoning
  • Special Area Management Plans
• Education and Outreach
• Mapping
  • Permits
  • Land Aquisition
  • Public Private Partnerships
  • Environmental Impact Analysis
  • Mitigation Planning
  • Mitigation Banking (focus on wetlands)
  • Mitigation Measures (all projects which may have an impact on the Environment)
	• Protected Areas
	• Habitat species protection
	• Mapping (habitats)
	• Monitoring
	• Land use planning
	• Environmental Impact Assessment
	• Strategic Environmental Assessement
	  • Mitigation Planning
	  • Compensatory Measures

Besides the instruments found within the strategic plans, both regions are working on local initiatives, research projects and collaboration for developing ESS tools. In San Francisco, the city government in collaboration with the California Department of Forestry, the Fire Protection

and the Friends of the Urban Forest have launched an urban forest map, which has put an economic value on the ESS these trees provide. As an open web-based catalogue, this initiative works toward completing the census for city trees by including the public to collect comprehensive data. Benefits provided by the trees such as green-house gas mitigation, water storage or creating more lively communities are calculated in relation to the species. As a result a layer to tree assessments is provided which can be used for other geographic mapping by climatologists or city planners. As collaboration between government, non-profit organizations, businesses and the general public, information is collaboratively assessed (Urban Forest Map n.d.). The University of California Berkeley has assessed holistic impacts of climate change on the San Francisco Bay ESS and Biodiversity by taking modeling approaches, sponsored by the California Energy Commission (Ackerly et al. 2012). The San Francisco State University developed Geospatial tools for interdisciplinary understanding of coastal and marine conservation by modeling and predicting changes of habitat and endangered species in regard to climate change. This geospatial tools help to understand the value of ESS for the communities focusing on MSP (San Francisco State University 2011).

The Hamburg Port Authority initiated the development of a EU-cross estuarine toolbox "*Tidal River Developments*" (TIDE) for integrated estuarine management, funded by the INTERREG North Sea Regional Program and the EU. This toolbox includes decision support tools, methodologies and experiences, which aim at conflict resolution and understanding of ecosystem functioning, governance and measures. Together, a toolkit is developed including tools for understanding hydraulic dynamics, environmental determents of bird habitats. The exchange of best practice, tools and methodologies aims to increase the understanding of complex estuaries (Weser, Elbe, Scheldt) and their integrated management (Tidal River Development 2013). The Hamburg Port Authority has developed a communication platform to include the public into decision making. Environmental agencies, universities, the port authority are included. The project aims to assist the capacity building of institutional structures and connection between sectors. A holistic approach aims at an ESS Approach for the estuaries. In terms of urban ESS, the University of Hamburg in corporation with other universities works on a *"smart green city",* climate resilient city concepts and other ideas, which cover several ESS (Hafen City Universität n.d). These research projects and initiatives illuminate that tools, methods and data increasingly become available within different areas and governmental levels.

5.2 Relation to planning systems and institutional organization

The role of ESS within planning strategies and programs can be explained well within the framework of the planning systems. In San Francisco a more comprehensive framework exists which includes many sectors and laws in the development of the coastal zone management plans rather than creating environmental laws for single components like it tends to be the case in Germany. In Hamburg, several laws, sectoral plans and governmental guidance but also European directives influence land use planning. More specifically, German states share responsibility in implementing the EU legislations such as Strategic Environmental Assessment, and The Water Framework Directive or Natura 2000 on the regional scale, which are important for the future potential of implementing ICZM and ESS Approaches into planning (BUNR 2006). In the US, states are under a strong influence of federal agencies over land and water uses in coastal areas, such as within the regulation of activities and the provisioning of funding.

While San Francisco´s coastal program has already existed for several years, Hamburg is still experimenting with best approaches to manage the coastal zone in an integrated and ecosystem based way. The IBP can be seen as a first step towards this goal but also towards applying an ecosystem service approach to the river basin/estuary and bordering regions. Even though the plan has no binding power, it aims to reach several goals of different directives and interests (WFD, Natura 2000, Harbor development/shipping) with one holistic plan. This is communicative and adaptive as it aims to include the public and support ongoing research towards a better understanding of the interplay between land and sea. The Plan also builds capacity towards greater institutional communication and cooperation of central planning authorities (the neighboring states which border the river, the water and shipping administration of the city of Hamburg and the Hamburg Port Authority) and to protect ESS not only for Hamburg but also for Germany and the EU as a whole. With the parallel development of the estuarine "*tool box*" the plan and methods constitute a promising framework towards greater ESS Approaches. This may be the foundation of communication and common implementation of long-term goals. The hierarchical, integrated planning system reflects on the efforts and cooperation at all governmental levels. Due to the timely convergence of ICZM and developments towards ESS approaches, the developing trends may result in a promising holistic management framework.

The San Francisco Bay Conservation and Development Commission follows the goals of the CZMA (1978) to protect coastal resources, while providing public access to these resources to the most extend possible. The CZMA is based on environmental law and was developed due to the inappropriate management of coastal areas. Since then, efforts developed towards components of the ESS Approach including a collaborative management by making use of public education and outreach. Public access to parks, roads or piers is a result of coastal management permit

processes, which needs to balance human interests with coastal conservation and which is based on an environmental impact analysis. The strong focus on cultural services (provide public access to the shore as far as possible) and regulating services (protect coastal resources) can be referred to the CZMA. Values of historical, aesthetic and ecological value gain much attention (environmental justice/equity) and are assessed by participation and scientific studies. This fosters indirectly the consideration of these ESS and its protection. The holistic consideration of ESS in all sectors, especially transportation, can be related to their review and incorporation in environmental impacts (Environmental Impact Analysis), consistent with the California Environmental Quality Act (CEQA) as of 1970. Subject to this review are developments of infrastructure and transportation projects or regularly changes and applications for permits using 17 different environmental resource factors.

Even though the aims and contents of the plans look auspicious, holistic management of land and sea is challenged by institutional organization. The commission as a single agency for coastal management and development is a promising agency/institutional model; it is however limited in jurisdiction and authority of land based developments as it ends within 100 feet inland. Permit based developments and fragmented land ownership hamper cumulative and holistic management of the area, especially in regard to applying ESS approaches.

Despite different institutional frameworks, both systems result in a similar awareness of ESS and the need to approach and integrate them into decision-making. Especially coastal plans and policies seem to have a strong scientific basis and are intended to be adaptive. In both regions, coastal management is based on environmental law.

Urban-Land Use Planning

Urban land use planning also considers a variety of ESS. In Hamburg as a city state, planning covers the region and is conducted by a single office. In San Francisco, regional planning does not directly exist; there is more fragmented ownership and management by local, regional, federal and private sectors, which have different legal authorities. Planning in the USA is a rather local task, pluralistic and multi-leveled, where several interests hamper the application of holistic approaches such as those in regard to ESS. The San Francisco Planning Department is the central office, which developed the General Plan together with local participation. The plan emphasizes the social, ecological and economic relationship and how it should be integrated comprehensively into all sectors. The *"Flächennutzungsplan"* in Germany is the preliminary urban development plan which is binding for land use. The General plan, on the other hand, provides a guiding vision for the city and is non-binding.

A central difference is therefore the regulatory hierarchic planning approach in Germany versus a more voluntary and pluralistic approach in the USA.

In both regions the national planning frameworks of the CZMA in US and the ROG in Germany influences local/regional planning in several aspects. Especially environmental planning is highly influenced by regulation. In SFO, the CZMP requires a description of the institutional/organizational structure, which is needed and proposed to implement the management goal (fitted to the local circumstances). This had led to the BCDC, were all relevant planning and regulation powers are concentrated within a single agency. The CZMA includes many relevant aspects in regard to the ESS Approach. Due to the consistency approach and financial dependency on the federation, continuous research is conducted to identify areas of particular concern and to adapt to local circumstances, participation and research is high on the agenda. In Germany, research seems to be also driven by (EU) directives such as the WFD, FFH Directive, and national/state regulations such as the nature protection law. In regard to ESS Approaches it seems that efforts in Hamburg are initiated from top-down. In the US, participation within decision-making is more common than in Germany, where it is rather limited to organized stakeholder groups. An overview of the different characteristics of the planning framework can be seen below:

Tab. 5.2: Comparison planning framework San Francisco and Hamburg

SAN FRANCISCO	HAMBURG
Key Authorities: 1.) Land Based: SFO Planning Department 2.) Sea Based: SFO Bay Conservation and Development Commission	**Key Authorities:** 1.) Land Based: Urban Land Use Office 2.) Sea Based: Water and Shipping Administration, Hamburg Port Authority
Key characteristics: Pluralistic system, collaborative approach, diverse interests, permit based, local planning, decentralized, regional vision, consensus oriented, strong focus on public participation and education	**Key characteristics:** Vertical integrated system, regulatory basis, hierarchical, decentralized, increasingly influenced by EU directives and strategies, Regional/state planning
Actors within regional planning: Federal (allocates financial resources), state level planning (intervention), regional, municipal, NGOs, private sector, network of stakeholders	**Actors within regional planning:** Federal, state, regional, municipal, EU, private interests (non-competitive access to legislature) Strong role of the state, shaping law and institutions

Planning System: Comprehensive planning framework, land use management	**Planning System:** comprehensive integrated planning, one framework for spatial planning (legal basis); no regulatory framework for CZM
Main instruments: Permits, zoning, land acquisition, environmental impact analysis, public-private partnerships	**Main Instruments:** Landscape planning, environmental- and strategic impact –assessment

6. DISCUSSION

Spatial planning of land and sea (as presently in place) considers many ESS, which the region provides and the need to protect them for long term well-being. Both land use- and coastal plans refer to similar aspects but with different emphasis and therefore a stronger link between these components can make the use of ESS Approaches more efficient. However, planning instruments for including all ESS such as valuation schemes, mapping or scenarios explorations are not specifically addressed within strategic planning. The emphasis on trade-offs and cumulative effects within strategic planning could be supported by these tools (mapping, scenario explorations, valuation of ESS) which increasingly become available. This could help in reconciling conservation of natural resources with their use for recreation and public access. In Hamburg, the TIDE initiative increasingly offers methods, tools and experiences across EU estuaries, which is promising with respect to the successful implementation of the of the IBP objectives. In San Francisco, both plans emphasize the links between economic/human activity and specific ESS, as planning has to balance ecological protection with development. To make adequate decisions, ongoing research on these relationships is conducted, which allows for integrating the latest scientific findings within plans and to base policies on these. Research is also conducted by Universities with regard to impacts of climate change on biodiversity and ESS, as well as initiatives are being developed by collaborative associations. It seems that the multitude of stakeholders involved in the management of the Bay not only hamper cooperation, but also offer valuable input of ideas, financial support and research toward greater consideration of ESS Approaches. Cultural services are well understood and extensive activities related to information and knowledge or education, outreach and conservation/volunteering are used to raise awareness of the general public. Especially in San Francisco, the general public is actively included into planning and monitoring initiatives, such as counting trees for their valuation of ESS or by supporting conservation in other ways. This is an important characteristic of an ESS Approach.

Within coastal planning, San Francisco with its SFO Bay Conservation and Development Commissions has a *"superagency"* which coordinates activities and communicates with several other programs in the region. For applying ESS Approaches, this coordinating agency could propose to include them into the coastal management program for San Francisco Bay and make their inclusion a requirement for any permit processing such as in the case for mitigation banking. Different from mitigation planning, which captures the ecological value of the site, also cultural values could be assessed prior to any development. A challenge hereby is the major resource needs for evaluation and assessment of ESS. While a holistic ESS Approach seems to

be desirable in theory, it requires a profound understanding of the complex relationships between ecosystem function, processes and services, which might be hard to achieve in often short project frames or assessments.

A central question of this research was if the ESS Approach can assist the stronger linkage between spatial planning of land and sea. In SFO it can be said that the General Plan and the San Francisco Bay Plan share much of the same visions and interest. Coastal planning in both regions, build on environmental law, and is stronger focused on ESS approaches than urban land use planning, which rather focuses on cultural services. These elements could supplement each other well in theory. However, due to fragmented ownership and management within urban land-use planning, but also within coastal zone management, a stronger link between land and sea planning seems hard to achieve. The General Plan has no coordinating agency, which manages and raises financial resources and decides on the preservation and acquisition of open space. The strong fragmentation of land ownership in the region may be the strongest impediment for applying holistic approaches. However, continuous land acquisition of open space may lead to a greater success of ESS conservation in the future. So far, several academic, governmental and non-governmental organizations are active in the Bay Area, offering new ideas, knowledge and efforts and have wide public support for environmental protection and conservation. The multitude of stakeholder involved in the management of the Bay increase input for research, monitoring efforts, and the development of innovative approaches (Ackerly et al. 2012). As planning is voluntary, the success of actual implementations of the visions and guidelines of the General Plan as well as of the SFO Bay is uncertain. A benefit is however, the coordinating agency for coastal zone management and the regulatory framework it is embedded in, namely the Coastal Zone Management Act of 1972.

In Hamburg, there are no separate planning frameworks for land and sea and a stronger integration seems to happen in the near future. Planning here is based on environmental- and building- laws, which makes it more deterministic and organized, but also less flexible for adaptive management and the inclusion of ESS Approaches. For their effective consideration, these approaches would need to be integrated into several (higher ranked) laws which hamper the application of a holistic methodology. In Hamburg, EU directives and national laws motivate ongoing research projects often funded by the EU (such as the North Sea Regional Program). The IBP has shown that ESS Approaches can help in conflict resolution by supporting communication with the public about the benefits received from ecosystems, as well as risks and potential losses. For achieving the goals stated within the IBP, urban planning will need to cooperate stronger with Integrated River Basin Management of the Elbe to ensure that the aims of the Elbe Estuary as a whole can be achieved and that natural changes of the estuary can also be considered for land use adaptations. It appears that the German hierarchical,

regulatory planning framework may provide a good fit in this regard. However, as opposed to San Francisco, there is no single coordinating agency yet. With the implementation of the IBP, there are efforts towards the development of such an agency and cross-sectoral integration. As ICZM is still emerging in Hamburg, current actions seem promising in developing a sound framework to greater ESS consideration including the integrated river basin and the region.

Both the management framework of the regions and the inclusion and awareness of ESS into strategic planning can be related to the planning culture of both states/countries. As the IBP developed from the nature protection law (Natura 2000), the most fundamental, the regulating or supporting services are to be maintained, but might leave cultural services, the value gained from society for well-being, aside. However, the relationship between humans and their environment should be strengthened if sustainable development is to be achieved. It has become apparent that the most important institutions of the Hamburg region, the Urban Land Use Office, the Water and Shipping Administration and the Hamburg Port Authority only recently decided that their cooperation is imperative for sustainable development. How these will implement the goals of the plan, and how ecosystem components change will be seen in the future. It seems challenging to balance the conflicts between further developments of the marine industry and shipping facilities (economically most relevant for Hamburg) and the protection of ESS (such as sediment dynamics, biodiversity, coastal habitats for internationally protected species). Especially trade-offs between and within ESS will remain and depending on the instrument or approach for their evaluation, might benefit more the economy or environment. The results of the here-presented study have given rise about the awareness, visions, and the complex organization around planning and the use of an ESS Approach. To include it into decision-making in all planning arenas, it needs to be stronger incorporated into existing planning instruments such as environmental impact assessments, landscape planning or mitigation banking not by replacing existing instruments, assessments or policies, but rather assist them in doing better. Successful and holistic approaches should be then incorporated into higher legislation. Coastal and land use planning should work closer together to exchange efforts, knowledge and to better manage cumulative effects.

7. CONCLUSION & RECOMMENDATIONS

Our coastal zones have increasingly been subjected to pressures from coastal development, urbanization and environmental change. Several management frameworks have been developed and tested such as ICZM, or EBM, as well as tools such as zoning or MSP to counteract the decline of natural resources, which determine our well-being. Since the Millennium Ecosystem Assessment (2003), Ecosystem Services, as well as tools and methods to identify and quantify these, have received increased attention for developing or enhancing these management approaches, which can integrate ecological, social and economic dimensions into decision making by capturing the direct relationship between human well-being and components of ESS, by applying an Ecosystem Service Approach. With increasing research and understanding of ESS, tools, methods and data increasingly become available and are being tested within policy and planning. The incorporation of a holistic ESS approach into strategic planning and higher legislation has, however, not been achieved so far.

Within this thesis, the two case studies of San Francisco and Hamburg were analyzed as good examples of the apparent interplay between activities within the coastal city and the coastal zone. The results of the analysis indicate the need for a stronger cooperation between both components. Strategic plans of land and sea planning show that several findings and policies address all classes of ESS, which were developed by the MEA/CICES. This reflects on the understanding of the value of ecosystem function for human well-being. However, complex and fragmented institutional organizations in both countries make the regulatory incorporation of such approaches difficult. Especially in Germany, the application of a holistic methodology of ESS Approach is hampered by the nature of legislation. A possible advantage, on the other hand, is that here spatial planning is conducted under a single planning framework. Since ICZM is relatively new compared to the US, there is still much potential for integrated management frameworks.

In the USA to the contrary, coastal and land use planning are conducted under different frameworks. The development of a coordinating agency, which deals with the consideration and assessment of ESS can build capacity for a stronger integration between land and sea, and by making ESS Approaches more effective.

Extensive communication of the ESS Approach with the public is a good step towards raising the awareness about the benefits received from ecosystems and the risks of potential losses and to identify and include them into decision and plan making processes. In the US, planning is very collaborative considering also equity and ethical consideration between the environment

and humans. In Germany, collaborative approaches are increasingly being considered; the Integrated Management Plan (IBP) of the Elbe estuary has shown efforts in this direction and may assist in setting the foundation for stronger including cultural values/services into decision making.

Existing planning instruments such as impact assessments, zoning, mapping or compensatory- and mitigation -planning, may show potential towards the greater inclusion of ESS. However, these only consider specific ESS based on general law in practice. The development of tools, methods and data should support their extension for including of all ESS. More research should help developing new planning tools, which consider ESS and the stronger link between land and sea. A major challenge will lie in the conflicts between economic development (such as shipping) and nature protection (Natura 2000), as well as trade-offs between ESS. Mapping ESS and land uses may allow for identifying suitable lands, multiple benefits or conflicting demands. This could support wise decision making and better trade-offs between services. Until now, mapping is mainly concerned with components such as habitats or suitable areas. The inclusion of further mapping layers considering different ESS seems imperative. In the case of Hamburg, a coordinating agency could assist in implementing such tools and coordinating activities and sectoral planning. For San Francisco the BCDC could overtake this task.

In order to successfully implement ESS Approaches, planning has to be adjusted to a manageable area (Ecosystem Based), for which sectors and governmental levels can be integrated. By focusing on a specific scale, which is based on the natural system (such as the coastal zone), cumulative impacts can be better understood and decisions support tools tested and applied. For the coordination and application of tools a coordinating agency is imperative. For now, challenges remain in knowledge gaps, legislative and policy constraints, as well as in governance and institutional fragmentation, making the specific implementation of these approaches at a regional scale difficult. All strategic plans have recognized the dependency of humans on their environments and have developed promising policy goals based on sound scientific findings; while research initiatives are developing so called *"tool boxes"* which assists the practical application of the ESS approach. It would be interesting to see how its translation into operational management objectives will be achieved.

Besides the detailed analysis of strategic plans, this thesis has shown different approaches, tools, and frameworks, which consider ESS across the land-sea divide for Hamburg and San Francisco. Key ESS have been identified and the institutional settings/organization these are embedded in. The intrinsic relationship between the coastal city and the coastal zone may require a stronger planning link between both, and a stronger integration of ESS Approaches into spatial planning frameworks and legislation. Planning per se covers and influences several

ESS, while its instruments and tools can contribute to the ESS Approach. Case study comparison of particular applications of ESS Approaches and tools can foster successful implementation, by exchanging experiences, findings and knowledge.

Recommendations for the future development of coastal- and land use -management and the incorporation of an ESS Approach could comprise the following:

For Hamburg:

- Work on the establishment of a coordinating agency, which can implement ESS Approaches and which considers sectoral activities of land and sea
- Integrate River Basin Management into a spatial planning framework, building on ESS of land and sea
- Develop institutional structures, which fit to the new challenges (urban land use office may not have the capacity to manage all relevant aspects)
- Establish communicative and outreach programs such as in the US (river clean ups, tree counting and others)
- Extend current planning instruments with ESS tools which are available

For San Francisco

- Establish a coordinating agency for urban land use planning, which oversees and manages funding
- Improve vertical and horizontal integration to counteract land fragmentation
- Set some regulatory measures such as the inclusion of ESS approaches within permits

Strategic planning and policy should build on and further develop those initiatives, tools and methods already in place, that aim at including ESS.

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9. APPENDIX

1a: San Francisco General Plan (2010)

1b: San Francisco Bay Plan (2007)

2a: Flächennutzungsplan/Erläuterungsbericht (1997)

2b: Integrierter Bewirtschaftungsplan Elbeästuar Teil A/B (2010)

Author's Declaration of Originality

I hereby certify that I am the sole author of this thesis and that no part of this thesis has been published or submitted for publication.

I certify that, to the best of my knowledge, my thesis does not infringe upon anyone's copyright nor violate any proprietary rights and that any ideas, techniques, quotations, or any other material from the work of other people included in my thesis, published or otherwise, are fully acknowledged in accordance with the standard referencing practices.

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Bremen, 05 August 2013

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Sarah Wolff