The Human Factor: Coastal Social-Ecological Systems

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Abstract

After the comprehensive description of the ecosystem processes in Chap. 4, the following paragraphs are dedicated to the philosophical, social, and economic aspects of the Baltic human-environmental systems. While in Chap. 2 the foundations of these disciplines have been discussed, those basic ideas are deepened and applied in Chap. 5. The narrative starts with aspects from economics, introducing ecosystem services and approaches to characterize them, mainly from a behavioral science perspective. The next viewpoint is environmental ethics, which provides a reflective and grounding layer for the ecosystem service approach. Thereafter systems-based aspects are applied to human environmental entities in general and the study region as a special case, which is illuminated from a socio-economic viewpoint.

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The last chapters of this book have shown potential contributions of different disciplines for interdisciplinary coastal ecosystem analysis (Chap. 2), the environmental conditions of the Baltic Sea (Chap. 3), the German coast and the terrestrial hinterlands (Chap. 3), and an analysis of the ecological structures and functions of inner coastal water bodies (Chap. 4) and the offshore ecosystems (Chap. 4). All of the respective articles have focused on ecological characteristics and societal conditions, thus the reader might meanwhile have obtained a good impression on the processes and processors of the southern Baltic coastal environment.

In order to move forward to the multiple actual environmental problems of the research area, there will be a stepwise introduction of the important elements and relations of human-environmental systems. Such widening of the scope will be advancing by integrating the viewpoints of economy (Chap. 5.2) and ethics (Chap. 5.3), in order to discuss the ethical suppositions in the ecosystem service approach (Chap. 5.4). Those constituents are integrated in Chap. 5.5 by applying the basic ideas of human-environmental systems approaches.

19.1 Introduction: Human Factors and Normative Analyses

Scientific knowledge cannot tell how humans should behave. It is impossible to derive an "ought"-statement from "is"-statements irrespectively of the number of true "is"-statements. Even if there would be such thing as perfect scientific (biological, ecological, marine) knowledge about the Southern Baltic Sea, political decision makers would clearly stand in need of normative (or: prescriptive) sources of practical knowledge. Therefore, the natural sciences must cooperate with prescriptive disciplines in order to give guidance or make suggestions for policy makers. As argued in Chap. 2, there are three disciplines with prescriptive content: legal scholarship, economics, and ethics. This study abstracts away legal topics. Economics is devoted to efficient allocation of scarce means of production with respect to given human preferences under conditions of trade-offs, risk and uncertainty. The concept of efficiency itself has an ethical meaning, as it is directed against wastefulness. The objective to maximize personal utility or societal welfare (Pigou 2002) is clearly prescriptive. The idea of consumer sovereignty also has some prescriptive force ("preferences are to count"). Both the foundations of economic modeling and legal policies are to be reflected in economic theory, political philosophy, and in ethics. This remains true, if economics, law, and ethics are applied to environmental topics. Although the methods and the conceptual frames of economics, legal scholarship, and ethics are different, they should be regarded as an interconnected cluster of normativity within the natural sciences.

Table 19.1 Different definitions of the term "Ecosystem Services"

Daily (1997)	Ecosystem services are the *conditions and processes* through which natural ecosystems, and the species that make them up, sustain, and fulfill human life
Costanza et al. (1997)	Ecosystem *goods* (such as food) and *services* (such as waste assimilation) represent the benefits human populations derive, directly or indirectly, from ecosystem functions
Boyd and Banzhaf (2007)	*(Final) Ecosystem services* are components of nature, directly enjoyed, consumed, or used to yield human well-being
Fisher and Turner (2008)	Ecosystem services are the aspects of ecosystems *utilized (actively or passively)* to produce human well-being
Millennium ecosystem assessment	– Ecosystem services are the benefits people derive from ecosystems – Ecosystem services are the benefits people obtain from ecosystems and *also the processes that produce* or support the production of ecosystem goods
TEEB (2010)	Ecosystem Services are *the direct and indirect contributions* of ecosystems to human well-being. The concept "ecosystem goods and services" is synonymous with ecosystem services
Haines-Young and Potschin (2010)	Ecosystem services are the contribution which the biotic and abiotic components of ecosystems jointly and directly make to human well-being, *an "end-product" of nature*
Burkhard et al. (2012a)	Ecosystem services are the contributions of ecosystem structure and function—*in combination with other inputs*—to human well-being

19.2 Economic Aspects of Human–Environmental Relations

Already Westman (1977) used the headline "How Much Are Nature's Services worth?" for a paper published in Science. The term "Ecosystem Services"[1] (ESS) occurred first 1981 (Ehrlich and Ehrlich 1981). However, the idea, that ecological systems are beneficial for human beings and provide contributions for their well-being is much older in academic discussions.

Taking this into account, we would like to look back on ecosystem service research and its special contributions on coastal ecosystem research. And we would like to go one step further and discuss coastal ecosystem service research from a behavioral science perspective.

19.2.1 Starting Points in Environmental Economics

"Ecosystem Services (ES) are the ecological characteristics, functions, or processes that directly or indirectly contribute to human wellbeing: that is, the benefits that people derive from functioning ecosystems" (MEA 2005, see also Table 19.1). But

[1] In several instances of the forthcoming texts, the term "Ecosystem Service" is shortened to the abbreviations ESS or ES.

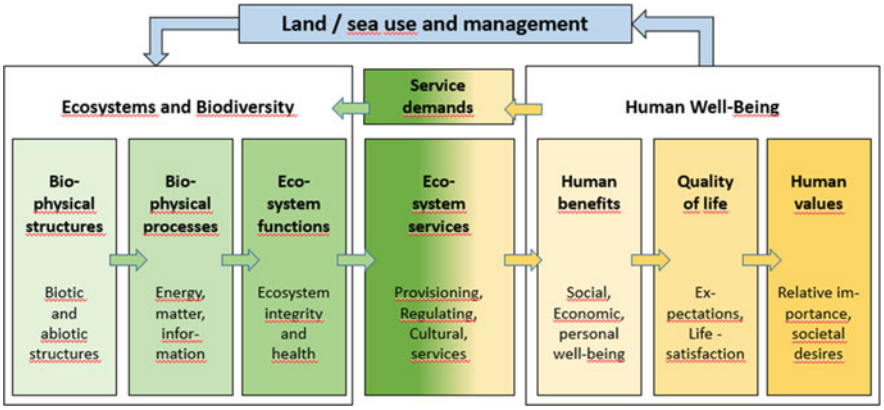

Fig. 19.1 Cascade model: Ecosystem service components from structure to functions to services to benefits to value (after Potschin and Haines-Young 2017)

how do these connections and interrelations work in specific local settings in detail? This is one of the central questions of ES research, which was intensively discussed during the past decades.

The first field of ES research that is relevant for our Southern Baltic coastal ES analysis is the discussion about the interactions between the ecological environment and the social and economic system. A result of this discussion is the "cascade" model by Potschin and Haines-Young (2017) visualized in Fig. 19.1. We can see that the chart starts with bio-physical structures or processes, goes on via functions to services and then—leaving the ecological environment and entering the social and economic system—produces benefits to human beings and creates value for single persons or for parts of society (Costanza 2008).

This cascade model was heavily discussed and extended. Especially the extension by the dynamic system model introduced by Costanza et al. (2017) is relevant for our research because—within the social and economic system—constructs were integrated that are able to explain why the services from ecosystems are able to create benefits and value. These constructs are, for example, images, needs, and preferences. We will discuss these constructs and their relevance to explain the interrelations between services and benefits or value later on in this chapter.

The second field of research relevant for us is the discussion about ecosystem service classification systems. A meta-classification was already introduced with the cascade model by MEA (2005). The authors discriminate between provisioning, regulating, cultural, and—sometimes—supporting services (Hernandez-Blanco and Costanza 2019):

- *Provisioning services*: The ecosystem provides human beings with goods such as water, timber, or food.
- *Regulating services*: The ecosystem creates value by regulations of ecosystem processes such as flood control, water purification, or climate control.
- *Cultural services*: The ecosystem creates non-material benefits such as spiritual, recreational, or aesthetic benefits.

- *Supporting services*: The ecosystem provides structures and processes that create value indirectly because they are necessary for the three other types of services. These services are also comprehended as attributes of "ecosystem integrity." The key components are ecosystem structures and ecosystem processes (Müller 2005). In order to avoid wrong accounting results, this class has been neglected in most recent classification systems for ecosystem services.

Within these categories, a lot of research was done to create classification systems for ES in general or for special regional ES, e.g., for coastal ES (Sukhdev and Kumar 2008; Böhnke-Henrichs et al. 2013; Kandziora et al. 2013; US EPA 2015; La Notte et al. 2017; Haines-Young and Potschin-Young 2018). One of the most prominent assessment concepts are so-called ES matrices conceptualized, e.g., by Burkhard et al. (2009, 2012b), Fürst et al. (2009), and Koschke et al. (2012). Through these matrices, the potential of ecosystems to supply services to human beings is calculated. Therefore, on the vertical side of the matrix ecosystem structures and processes that represent ecosystem integrity are classified. Moreover, on the horizontal side provisioning, regulating, and cultural services are categorized. In this way, experts are able to estimate for each cell of the matrix the potential of supporting services to create provisioning, regulating, or cultural services. Figure 19.2 demonstrates the layout of such an ecosystem service matrix. Within this ecosystem service matrix-structure a lot of research was done to create matrices for special regional ES, e.g., for coastal ES (e.g., Burkhard et al. 2014; Stoll et al. 2015; Müller et al. 2020; Schumacher et al. 2022). By using the ecosystem service matrix we are able to aggregate ecosystem structures and processes into land use classes and translate them into ecosystem service potentials, respectively, ecosystem service offerings. In the following, we try to answer the question how we can transform these offerings into economic value.

19.2.2 The Social-Economic and Behavioral Science Perspective

From the social-economic perspective, we have to ask how the services provided by ecosystems create value for human beings. This question is not trivial: between service offerings on the supply side and value creation on the demand side, there are a lot more than the benefit-construct from the cascade model. Behavioral science research has identified many intervening variables and constructs. These variables and constructs are responsible for the transformation of sole offerings like fish or landscape into valuable offerings like food or holidays. Variables and constructs that are responsible for this transformation are, for example, images, needs, and preferences. They "translate" sole offerings into valuable services and benefits. Let us look how this transition works.

When we try to answer the question how benefits and value occur, we have to look at research streams coming from behavioral sciences. Especially consumer- and buying behavior-research analyze why customers buy and use products and services

		Regulating Services				Provisioning Services				Cultural Services			
		Climate Regulation	Water Flow Regulation	Erosion Regulation	...	Fish	Timber	Aquaculture	...	Tourism	Cultural Heritage	Landscape Aesthetics	...
Ecosystem Structures and Processes	Sediment												
	Reaf												
	Sand Bank												
	Dike												
	Beach												
	Salt Marshes												
	Forest												
	...												

Fig. 19.2 Exemplary ecosystem service matrix: from ecosystem structures and processes via ecosystem types to ecosystem services

to create personal benefits. This research postulates—similar to ES research—system models of different drivers of benefits and value.

Figure 19.3 shows such a systems model. Starting in the left side ecosystems and their service offerings create stimuli for the potential user of that services. The stimuli initiate information processing and lead to problem recognition. At that state the decision-making process starts and ends with the decision to use or not to use the ecosystem service offerings. Moreover, the usage leads to value and satisfaction or dissatisfaction. Within the decision process during the early phases, the potential ecosystem service user takes a lot of decision-making and general motivation variables into account.

As soon as we want to interconnect the ecosystem service offerings and the value creation on the demand side, we have to look on these decision-making and general motivation variables. In the following, we will use motivation as such a variable.

One of the most relevant variables for the transition of offerings into benefits and value is motivation, because motivation creates behavior (Sheth et al. 1999). We distinguish between emotional and cognitive processes within the motivation variable. The emotional processes stimulate a behavioral response, while the cognitive process provides specific directions to that response. The terms motivation and need are often used interchangeably. The best-known and most powerful categorization is

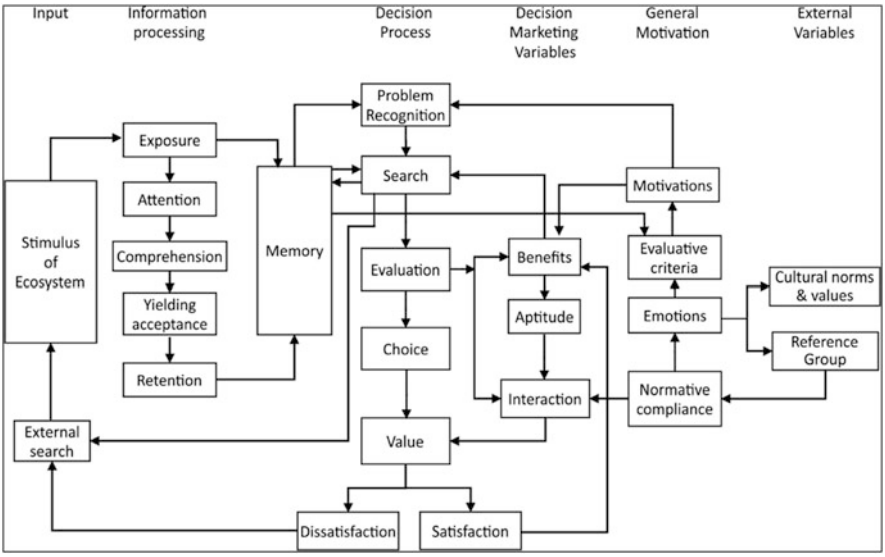

Fig. 19.3 Model of ecosystem value creation from a behavioral science perspective, following (Engel et al. 1978)

Maslow's need hierarchy (Maslow 1970), a macro theory designed to account for most human behavior in general terms (see Chap. 2).

19.2.3 Integrating ES-Research and the Behavioral Science Perspective

Maslow's theory helps to explain human behavior and therefore is able to link ecosystem service offers to benefits and value because only those offerings are valuable for human being that fulfill special needs in Maslow's pyramid and satisfy selected motivations. Therefore, we integrate Maslow's Pyramid of needs into the ecosystem service matrix. The result is shown in Fig. 19.4.

Using this extended ecosystem service matrix, we are able to translate ecosystem processes and structures into ecosystem service offerings. Furthermore, we are able to calculate to which extent these offerings are able to satisfy human needs and motivations.

When we try to assess the transformation of ecosystem service offerings into need-satisfaction, we have to take into account that the same ecosystem service offering is able to contribute to different levels of needs in Maslow's pyramid. For example, fish can—of course—fulfill physiological needs when people are hungry. But fish can also contribute to esteem and even to self-actualization if a fly fisher is able to catch a big trout.

On the other hand, an ecosystem service offer can also stimulate conflicting motivations. Let us take eel as an example. Eel is able to fulfill physiological

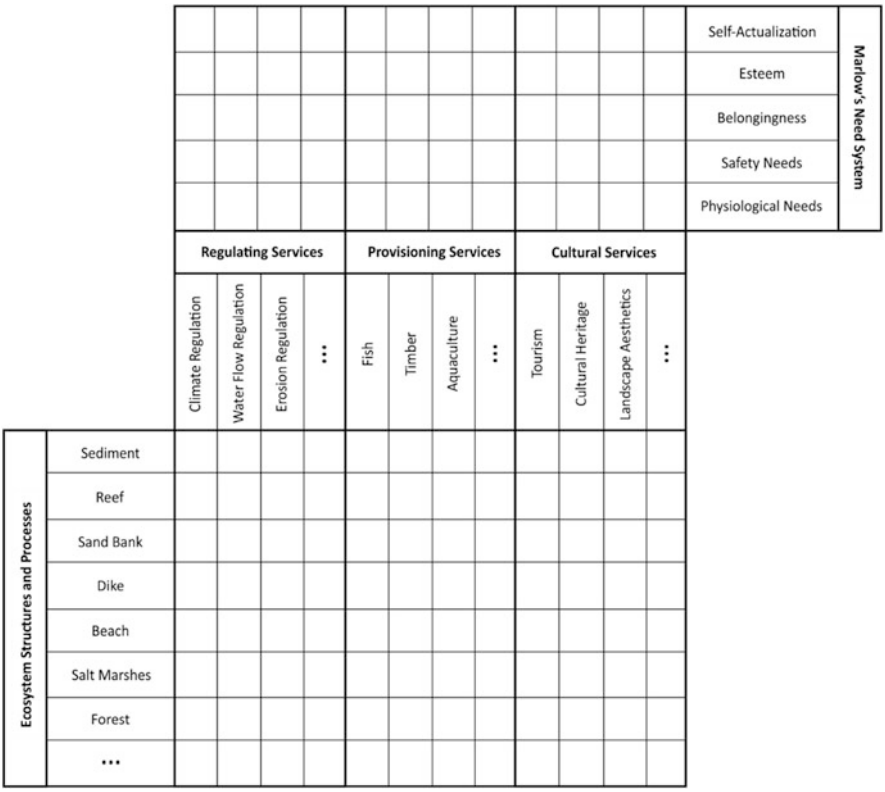

Fig. 19.4 The potential structure of an extended ecosystem service matrix

needs again when people are hungry. However, eel is a threatened species. Therefore, the desire for self-fulfillment may create a motivation not to eat the eel. These conflicts are typical in the system of motivations.

19.3 Environmental Ethics: Patterns of Reasoning

Humans perform cognitive operations as they schematize, classify, grade, judge, and type. They also do so with respect to evaluations. This subchapter argues that all conceptual schemes used for environmental evaluation are, finally, to be grounded in the universe of environmental ethical discourse (for a philosophy of environmental evaluations see Ott 2020, Ott and Reinmuth 2021 with further literature). This claim holds true for ES as well. Therefore, ecosystem service assessments should incorporate a reflective ethical layer of inquiry which is outlined in this subchapter.

Table 19.1 gives an overview on "ecosystem service" definitions. At the core of all ESA definitions are the common idea to bridge the gap between the performance of ecosystems and human welfare. This idea is expressed by the metaphor of a

"cascade." Trivial to state, that valuable benefits which humans obtain from ecosystems contribute to human welfare. Disservices diminishing welfare are abstracted away in the definitions and are not addressed here. Definitions are highly generic, and specific ESA studies must specify them with respect to geographical locations, ecologies, human stakeholders, cultural values, and trade-offs.

A terminological caveat is at place here: Author dislikes the term "service," because it stems from economics of service industries and it may transport misleading connotations. Falling prey to this "service" terminology, we may end up perceiving nature not in its ecological naturalness and its fertility, resilience, diversity, and richness, but in analogy to service industries (as pizza service, laundry, etc.). To avoid this pitfall, we should use the established term "service" as technical term referring to the many modes by which nature can be beneficial to humans. Any service has, by definition, a positive value to humans (individuals, groups, stakeholders, communities, etc.).

If one reflects service categories within ESA, one necessarily touches ethical topics. Therefore, this subchapter wishes to make the significances of such ethical reflections for ESA more explicit than this is usually being done in the literature.

Ethics rests on some basic concepts. A basic distinction is between moral and ethics. Morals is a network of emotions, intuitions, convictions, and believes that forms the characters of moral persons (= agents). Morals strongly vary across cultures and history. Ethics is reflective about moral believe systems. Ethics can be distinguished in different layers of inquiry:

1. Deontic logic and analysis of moral concepts
2. Metaethics: meaning of moral discourse
3. Ethics of "Good Life" (Aristotle: eudaimonia)
4. Normative Ethics (as Kantianism, Utilitarianism, Discourse Ethics)
5. Applied Ethics (= Practical Philosophy in Fields of Human Practices)
6. Case Studies

Environmental ethics is one field of applied ethics (layer no. 5), presupposing a set of assumptions from layers 1–4. This chapter only addresses layer no. 5, for general ethical theory, see Ott (2005a), Tugendhat (1994) and contributions in Brune et al. (2017). Ethics of good (meaningful, flourishing) human life (level 3) constitutes a reflective background for concepts of welfare, benefits, and utility being present in ESA. Normative ethics constitutes a reflective background for ideas about commitments, obligations, equity, and fairness being useful for analyzing trade-offs and conflicts about production, maintenance, and distribution of ecosystem services. It makes a difference whether agents appreciate ecosystem services (value) or whether agents are committed to maintain it (obligation). ESA focusses benefits and values but rather unspecific with regard to obligations, justice, laws, and commitments.

On level 5, one can distinguish three approaches in environmental ethics (Ott and Reinmuth 2021). The "classical" approach tries to resolve the problem of inherent moral value in nature (demarcation problem, Ott 2008, Sober 1995) and it derives

from such resolution a concept of nature conservation (Taylor 1986). This approach wishes to overcome anthropocentrism. Since ESA is an anthropocentric concept, inherent value approaches should not be ignored because the demarcation problem is often mentioned by participants of ESA studies and by students in ESA-courses. Thus, ESA should conceive its relation to the demarcation problem. It can do so by ignorance, denial, or abstraction. Environmental ethics dislikes ignorance and denial because the demarcation problem is essential for the entire discipline (Attfield 2014; Warren 1997; Krebs 1999; Sober 1995). If the demarcation problem is abstracted away for the sake of identification and measurement of ecosystem services, it remains an "open question" for ESA-scholars. It becomes a salient point for ESA being located outside of ESA. If so, it deserves attention.

A second approach is post-modern environmental ethics. In post-modern approaches, narratives, literature, pictorial representations, alternative media approaches, and criticism against Western economic rationalities play an important role (Morton 2016, Haraway 2016 for criticism see Ott 2019). Post-modern approaches take no interest in ESA (Haraway 2016) but rather regard ESA as a repugnant neo-liberal commodification of nature. Post-modern approaches are left aside.

A third approach is environmental pragmatism (Norton 2005, 2015). Environmental pragmatism exists within the tradition of philosophical pragmatism (cf. Schneider 1963, Chapters VIII and IX; Minteer 2006), as it takes its starting point in different kinds of established human practices in dealing with nature (agriculture, forestry, sailing, hiking, gardening, etc.) and explicates the many different values being involved in such practices. Environmental pragmatism aims, in a reforming and civic way, to make such practices more compatible with sustainable preservation of nature (see Sagoff 1988 for a reconciliation of environmentalism and political liberalism). Environmental pragmatism can adopt ESA without reservations. Norton (2015, pp. 179–198) argues that pragmatism explores a toolbox of schemes for environmental evaluation. Norton distinguishes conceptual-analytic and behavioral-action tools. ESA belongs to the former tools. In this subchapter, a theoretical approach is endorsed which combines the traditions of continental philosophy of discourse (Hönigswald 1937; Apel 1976; Habermas 1981) with environmental pragmatism. ESA can and should be embedded within this theoretical approach. If so, ESA is seen as a helpful tool (= device) for deliberation and reasonable choice (Hiedanpää and Bromley 2002) in environmental policy-making underpinned by a reflective ethical layer and embedded in the theoretical paradigm of discourse-oriented environmental pragmatism.

Within the general approach, six specific lines of reasoning constitute a universe of environmental ethical discourse that underlies the ESA toolbox. These six lines of reasoning go ethically beyond sociological ESA studies as they rather provide reasons why ecosystem services *should* be appreciated, preserved, and restored (O'Neil et al. 2007). They substantiate the factual appreciation of ecosystem services ethically (Jax et al. 2013).

19.3.1 Dependence and Reliance

Supporting and provisioning ecosystem services are, ultimately, grounded in reliance-arguments. Arguments from dependence and reliance claim that human beings, as embodied and precarious beings, are dependent on a continuous metabolism with nature, the maintenance of which requires a careful use of natural resources and environmental media. Reliance is common, but differentiated. Humans *should* care for nature and ecosystem services either out of prudence or out of duties against other persons being reliant on ecosystem services. Maintenance of ecosystem services can be in the prudent interest of a societal unit (household, community, state) or there can be moral obligations not to impair ecosystem services upon which other people are reliant. To impair and destroy ecosystem services needed for decent livelihoods count as ecological victimization from a justice perspective (Martinez-Alier 2002).

Supporting services point to basic structures and functions of ecological systems which make human-ecological systems productive and resilient (see Nielsen et al. 2019 for theory, Meyer 1997 for ecosystem function). Even if economists discard supporting ecosystem services from ESA studies wishing to avoid economic double-counting, reliance on life-supporting ecosystems, as fertile soils, forests, rivers, ocean waters, groundwater tables, pollination, etc. is beyond doubt. From an environmental ethics perspective, supporting services are close to so-called systemic values, as fertility (Rolston 1988, 1994, 1999). Ecosystems have systemic vital value which are of non-moral goodness (Rolston 1999, pp. 43, 360). The wording "supporting" may even underrate such basic ecosystem services. Supporting services point out that "something is at work" within ecological systems without which there will not be other ecosystem services. Supporting services make provisioning, regulating, and cultural services become possible and real.

Nature also provides specific resources for meeting basic human needs (water, food, shelter, overview in Dudley 2011, Chap. 5). Provisioning services are, however, mostly mediated by human labor: freshwater, cereals, fish, beers, etc. Therefore, ESA studies must conceive human-ecological land use systems in close correlation in order to understand provisioning services. Environmental pragmatism points to the economic side of provisioning services, as agriculture, forestry, fisheries, grazing systems. To pragmatism, the approach to provisions is Lockean: Nature must be mixed with human labor because wild nature as such contributes roughly 1% of utility to humans while cultivated systems contribute 99% (Locke 2002, p. 19). Provisioning services become manifest in yields which can be processed further to food, textiles, furniture, etc.

19.3.2 Eudaimonic Values

Arguments from cultural or eudaimonic values ("eudaimonia" = good life) claim that experiences of nature are an essential part of a rich, successful and meaningful life (Ott 2016; Chan et al. 2016; Holland 2006; Hargrove 1992). Eudaimonic values

have large overlap with cultural ecosystem services. From an environmental ethics perspective, cultural ecosystem services are not just a speculative add-on to measurable provisioning and regulating services but are essential to the overall ESA approach (Ott and Reinmuth 2021). ESA studies should not underrate them. Ethics can shed light into the deep background of eudaimonic values (Firth 2008; Benton 2008) since they are not simply "naturally given" but mediate between natural phenomena and cultural traditions (Ott 2016). While ESA can remain at the level of preference satisfaction, eudaimonic values refer to the idea of a worthwhile life with and within nature (Holland 2006).

Coastal zones are paradigm locations for eudaimonic values. The matter of fact that many humans migrate to coastal zones and coastal zones are prominent tourist destinations count as strong sociological evidence. Eudaimonic values of coastal life are, however, ambivalent with respect to nature conservation because they may imply over-tourism and, in economic parlance, provoke congestion effects. Authorities have to find a delicate balance between open access, regulation, and protected areas. This seems to be true for the Baltic. Therefore, we should take a closer look on eudaimonic values grounding cultural ecosystem services.

Eudaimonic values are divided into different ways of enjoying nature, such as promoting physical and mental health (Dudley 2011, p. 104), experiences of natural beauty (Seel 1991, Saito 2014, Sepänmaa 2014), a sense of being at home (Scruton 2012) and spiritual recuperation in nature. Eudaimonic values explain why many people are unwilling to forego contact with nature in their lives. Norton (1988) argues that experiences of nature often have a transformative effect on their attitudes toward life ("transformative values"). These transformative values point to environmental virtue ethics (see below). The same applies to the view that nature is an indispensable "sphere of resonance" for human experiences (Rosa 2014). Eudaimonic values explain why landscapes can be "therapeutic" (Gesler 1992).

The commonly shared value of human health leads to the question whether and to what extent specific natural sites (forests, coastlines, mountains) are beneficial to physical and even mental health. Healing, refreshing, and recreational effects of forests and coasts and the health-promoting activities of hiking and bathing are not denied from scientific medical points of view anymore. Since medical research gives salient focus on the neuro-immune system (Hyland 2011), new connections between natural environments, human outdoor activities, and maintenance and recovery of health might be established. At the University of Exeter (Prof. Lora Fleming), there is a center of research investigating specific health-related topics in coastal populations (life expectancy, mental disorders, suicidal rates, strokes, etc.). With some caveats in mind, there are reasons to believe that coastal populations are, on the average, in a better health condition. Bell et al. (2015) see coastal zones as paradigms of therapeutic landscapes.

Such community medicine perspective (Fleming et al. 2014) should be augmented by cultural studies since health-related and cultural motives intertwine in environmental movements as in earlier times, for example, in the lifestyle reform movement or the German "Wandervogel" movement (Wolschke-Bulmahn 1990; Wedemeyer-Kolwe 2017). Nudism became prominent in Germany since 1900 since it could point to the presumed healthiness of being naked in the outdoors, especially

on the beach (see Andritzky and Rautenberg 1989). Coastal zones became prominent locations for nudism in the German Democratic Republic also. As the example of nudism shows, concepts of bodily health are always mediated with cultural ideas about a flourishing human life. A historical-cultural investigation on the origins of tourism and recreation at the Baltic coast came to the result that health-related ideas played an important role in emerging tourism since the nineteenth century (see Chap. 6.3). This has not changed since then. At present, health care is of high cultural significance in all societies surrounding the Baltic Sea. This significance has increased since the Covid-19-pandemic (Popp and Ott 2020). Health effects of therapeutic landscapes can, in principle, be addressed by economic methods, as payments for wellness locations and travel cost analysis.

Some other cultural services, however, remain obscure and opaque to scientific and economic methods. This seems to be true for, e.g., "beauty" and "spiritual encounters with nature" (see contributions in Bergmann et al. 2013).

Generally, ESA-studies should be warned against underrating cultural services that can neither be perfectly monetized nor measured in physical terms ("How many tons of beauty?"). Many scholars fill the gaps of ESS approach with ideas of participation, stakeholder involvement, and deliberate decision-making. Therefore, cultural services are another reason to perform transdisciplinary studies (Chap. 2). With respect to deeper layers of cultural services, other approaches in the humanities, as cultural history, history of landscape painting, history of nature conservation, cultural anthropology, and religious studies (see contributions in Kearns and Keller 2007, Jenkins et al. 2017) can contribute to an in-depth understanding of cultural services, especially spiritual ones. Phenomenology of nature investigates how cultural ecosystem services reveal into mental states (Böhme 1997; Abram 2004). Understanding spiritual services must go beyond ecosystem analysis. Phenomenological expressions of how atmospheres, auras, and sacred sites are perceived and how they constitute specific mental moods may come close to aesthetic, transformative, and spiritual encounters with nature. It is fair to say that cultural ecosystem services must go far beyond economic assessment, as in contingent-valuation studies. If some persons become attuned to special places and sacred sites (see contributions in Mallarach 2012), their willingness to accept compensation for losing such sites may drop to zero.

19.3.3 Intergenerational Responsibility

The values of the first two categories of values (reliance, eudaimonic values) can and should be prolonged into an intergenerational perspective. Long-term policies for safeguarding ecosystem services must suppose some intergenerational obligations (see Düwell et al. 2018). From an ethics perspective, there must be a rationale why current generations are not entitled to consume the sources of ecosystem services away within their lifespan but should bequeath a fair intergenerational legacy in terms of ecosystem services. The ESA approach as such does not entail such rationale even if long-term thinking might be implicitly supposed. Such fair

ecological legacy should be grounded in an egalitarian standard of intergenerational equity prescribing that average members of future generations should be equipped with as least as much ecosystem services as present generations (Ott 2005b). Under such obligation, environmental evaluation becomes a matter of the prudent art of long-term thinking (Klauer et al. 2013). Ecosystem services become an asset within such legacy, which may shrink or enhance within the chain of generations.

The topic of fair legacies leads to concepts of *sustainability* (see Ott and Döring 2011). As it has been argued elsewhere, there are reasons to adopt the concept of strong sustainability (Ott 2009; Daly 1996). Within the concept of "strong" sustainability and its constant natural capital rule, nature conservation represents an essential dimension of sustainability policies (Ott 2015a, b). Strong sustainability also entails a restoration rule: If the stocks and funds of natural capitals from which ecosystem services flow have been diminished in the past, societies should invest in natural capitals by means of restoration ecology (Zerbe and Ott 2021). This rule demands to increase the flows of all kind of ecosystem services because cultural ecosystem services cannot be substituted by provisioning services (and vice versa). If an egalitarian standard is taken seriously, a fair intertemporal legacy must include all kinds of ecosystem services undiminished. If so, it would be unfair if present generations maximize provisioning services at the expense of cultural services in the future.

Since provisioning services will be crucial for meeting basic needs of future generations, the famous WECD (1987) definition of sustainable development ("(. . .) meeting the needs of the presence without compromising the ability of future generations to mee their own needs") focusses conservation of supporting and provisioning services. The WCED definition is silent on cultural and regulating services.

If there are strong reasons to increase regulating services in order to combat climate change in the twenty-first century, this might be appropriate from an intertemporal perspective. The urgency to enhance food security for a growing population and the urgency to produce negative emissions in order to keep climate change likeliness, endanger cultural ecosystem services. ESA scholars should, on reflection, keep this trade-off in mind.

Strong sustainability has been applied to coastal zones via an interpretation of SDG 14 ("Life below water") by Neumann et al. (2017). Since coastal zones provide all types of ecosystem services, unspoiled or restored coastal zones are a high-rank legacy to future generations. Depending on the definition, coastal zones reach out for many miles in the hinterland, covering many ecosystems and landscapes. Therefore, coastal zones are precious assets in the overall stock of natural capitals contributing to the sustainable wealth of a country. Coastal zones have to be defended against the imperatives of tourism, shipping routes, harbors, and even offshore-wind farms. Marine and coastal spatial planning seems mandatory for long-term sustainable development (SRU 2004).

19.3.4 Environmental Virtue Ethics and Biophilia

The values and commitments of these first three categories (reliance, eudaimonistic values, and fair intergenerational legacy) lead inevitably to the question of what kind of person one wants to be in the worrisome times of the Anthropocene. This question concerns different attitudes toward nature, including one's own biological-embodied, aging and mortal nature. Such line of reasoning leads to the realm of environmental virtue ethics (see contributions in Cafaro and Sandler 2005).

Preservation and care, curiosity, attentiveness, restraint, protection, consideration, moderation, simplicity, but also joyful devotion, humility, affirmation of life and gratitude are some of the relevant attitudes within environmental virtue ethics, but also vices as gluttony, arrogance, and greed (Cafaro 2004). It is open for further research whether there are specific virtues related to the sea, as sobriety or tranquillity of mind, but also courage. Which attitudes might be implied in the parlance that one "loves" the sea? Interesting enough, terrestrial beings, as humans are, can "fall in love" with the alien world of the sea.

Attitudes and virtues are crucial since cultural ecosystem services are composed of emotions (see Kals et al. 2000), perceptions, traditions, longings, habits, and attitudes. Environmental virtue ethics constitutes a background of relevance for weighing trade-offs between different kinds of ecosystem services. Depending on their virtues and vices person may prioritize some services at the expense of others. Virtue ethics is not directly addressed by ESA studies but belongs to the background of environmental evaluations.

Environmental virtue ethics also is of relevance to moral and environmental education. Thus, environmental virtue ethics strongly supports the idea to educate children and young adults in terms of ecological literacy in general and ocean literacy in particular. Ocean literacy would be incomplete without philosophy (Scholtz 2016) and ocean ethics (Dallmayer 2003).

Eudaimonic values and environmental virtues may have deep roots in evolutionary anthropology. As a legacy of many millennia of co-evolution, human beings may possess a biophilic inclination structure (Wilson 1984; Kellert 1997). The concept of biophilia means a profound disposition in the human mind to affiliate with living beings and living (or lifelike) processes. "Affiliation" means to have close contact. The human mind has formed by interaction and interference with nature, which clearly included foraging, and hunting but also knowledge of animals and plants, symbols and imageries (Levy-Strauss 1981).

Biophilic inclinations can serve as anthropological and evolutionary explanation why ecosystem services, including cultural and even spiritual ones, are appreciated across cultures even if there are many cultural differences as well (see contributions in Ehlers and Gethmann 2003). Reference to the biophilia-hypothesis can explain why ESA can, in principle, be applied globally even if non-Western cultures may not be familiar with the Western parlance of "service" (or may dislike them).

A comprehensive typology of biophilic values is given by Kellert (1997). Levy (2003) presents a fine-grained analysis of the biophilia-hypothesis. Levy (2003, p. 246) concludes that humans "benefit from contact with a non-human world in

ways that are reasonably called 'aesthetic' and 'spiritual'". If so, biophilic inclinations reveal itself in eudaimonistic values and environmental virtues.

Many biophilic ways of life are practical ones. Bird watching, diving, hiking, gardening, musing with pets, even going by bicycle through open landscapes are instances of modern biophilic practices. The opposition to biophilia is retirement from nature and a devotion to machines, money, factories and offices, television, etc. Fromm (1974, 1976) construed an opposition between biophilia and the virtuous attitude of "being," on the one hand, and necrophilia and the vicious attitude of "having," on the other hand. This is of relevance for ESA since one can adopt the attitude to possess the sources of ecosystem services or enjoy them with a willingness to share them with others.

19.3.5 Religion and Spiritual Services

The term "spiritual service" is uncommon to the field of religious studies (Jenkins et al. 2017), but it may serve as a purely technical term for the multitude of perception and experience that touch the sphere of the sacred within nature. From an ESA-perspective, spiritual services encompass all spiritual ecosophies and worldviews (as "pacha," Vedic wisdom, Daoism, "obuntu," Deep Ecology, etc.). Without reference to specific religious traditions, the category of spiritual values remains abstract. Any religion is a specific one. An overview of sacred sites and spiritual attitudes is given in Ramakrishnan et al. (1998) and Mallarach (2012). Environmental theologies in the spirit of the Hebrew Bible are given in Hardmeier and Ott (2015) and Vogt (2021) via a correction of the misreading of Genesis 1 as simply "subduing" nature.

In a broad sense of spirituality, also Romantic traditions may count as spiritual ones. The Romantics saw nature as "wonderland" full of bliss lifting the spirit to a "great secret." Out-reaching in this respect was Friedrich Hölderlin whose poetry reveals a spiritual reverence for nature (Mögel 1994). Romantic encounters with nature start with intense aesthetic experiences with nature, but it moves beyond beauty because aesthetic experience seems to reveal something being "more" than just beautiful (Ott 2013). As we know from the history of Romanticism, the Baltic Sea was the paradigm location of the mysteries of Northern latitudes. The paintings of Caspar David Friedrich reveal such locations. The category of cultural services should not just refer to the mundane practices of current mass tourism at the Baltic coastlines (recreation, beauty) but should keep such spiritual traditions in mind.

As Cooper et al. (2016) argue the ESA has conceptual and methodical problems to incorporate spiritual services properly. It transcends the scope of economic techniques (as contingent-valuation, willingness to pay, willingness to accept, travel costs). In a secular culture, many persons may be reluctant to talk about spiritual experiences in interviews, via questionnaire, or in public settings. Spiritual ecosystem services are a paradox for ESA: On the one hand, it must make room for spiritual services from within the ESA tool box, because they matter much to many people all around the world (contributions Jenkins et al. 2017), while, one the other hand, it

wishes to abstract away such obscure values for methodological reasons. Environmental ethics argues that this paradox should not be resolved in a way that saves the method but eliminates the spiritual dimension from ESA.

19.3.6 Inherent Moral Value

The category of *inherent (=intrinsic) moral values* points beyond anthropocentrism. Since ESA is anthropocentric, the category of inherent moral value is abstracted away. From an environmental ethics perspective, ESA should be aware of such abstraction and, moreover, should be able to say a word about inherent moral value if participants of ESA studies claim that some natural beings should be protected for their own sake and not just for the sake of services they bring about. If this category of inherent moral value is applied to specific entities, it implies respect and protection for their own sake. The idea of overcoming anthropocentrism was at the heart of environmental ethics since its origins (Routley and Routley 1979; Callicott 1980). Different non-anthropocentric solutions of the demarcation problem are subsumed in the category of "physiocentrism." Even anthropocentric approaches must give due consideration to the demarcation problem after they have harbored eudaimonic and spiritual values, intertemporal responsibility, virtues, and biophilic attitudes.

In physiocentrism, different criteria of direct moral consideration are discussed (e.g., sentience, perceptive awareness, being alive) and claimed as morally relevant characteristics or criteria.

An appropriate solution to the demarcation problem should combine the two characteristics of sentience and the ability to communicate into a gradable concept of openness to a species-specific environmental world (*Weltoffenheit*) (Ott 2015b), followed by a complex casuistry that ranges from chimpanzees and whales to fish, jellyfish, dragonflies and spiders, for some authors even to plants since plant can exchange information and, by doing so, "communicate" in a rudimentary way. The decisive factor in the characteristic of world-openness is that a natural being, due to its organic endowment (brain, nerve cells), perceives something of its environment and can respond to environmental stimuli. The more complex an organism is structured the more agency aspects are revealed in such response. Expressive behavior and intraspecies communication count as strong evidence for "world-openness." These criteria, however, do not entail ecosystems as such in the moral community.

All physiocentric positions (as sentientism, biocentrism, ecocentrism, and holism) can be either gradual or egalitarian. With high likeliness, the egalitarian-gradualism-divide is as crucial for the demarcation problem as the criteria themselves. Egalitarianism claims that all members of the moral community have the same inherent value. The rationale, however, is less clear than the claim. Neither does the moral point of view imply egalitarianism, nor is egalitarianism a conceptual truth of inherent moral value.

Gradualism claims that morally relevant traits of natural beings (sentience, consciousness, world-openness) come and go by degrees. This gradual scale of

morally relevant properties itself permits grading. Even the species-specific proliferation strategies (K- versus r-strategies) can make a difference with respect to single tokens (mice, frogs, fish). Grading is close to the ways organisms live. If less than 1% of the newborn tokens of specific species reach the adult form, a single life does not count that much. Respect for nature also means to respect evolutionary traits. This holds true for marine life. There should be leeway for grading between marine mammals, marine birds, turtles, sharks, sardines, crabs and shrimps, shellfish, molluscs, plankton, etc.

A close examination of the demarcation problem enables moral agents to distinguish between natural entities which are appreciated for the services they bring about and other entities which must be respected morally for their own sake. As Muraca (2011) shows, there are many options to combine appreciation and respect. As Norton (1991) argues such combinations of appreciation, intertemporal fairness, and moral consideration constitute practical-political convergences in nature conservation policies despite remaining ethical disagreement.

19.3.7 Conclusion

ESA is a highly useful tool for bridging the gap between ecosystems and human values. It allows for measurement, quantification, and economic evaluation of crucial ecosystem services. ESA studies bring about robust results in terms of physical or monetary units. ESA is, however, limited in scope and method. It faces methodological limits with respect to obligations and commitments, intergenerational equity, spiritual services, biophilia, virtues, and inherent moral values. If, however, ESA is connected to these six lines of environmental ethical reasoning, it can and should become an eye-opening device for the deeper layers of environmental ethics. Therefore, ESA works as a turning-table. On the one hand, it makes the contributions of ecosystems to human welfare visible and can calculate such welfare effects in economic terms. On the other hand, it can serve as an entrance gate for environmental ethics. ESA can and should be used as such turning-table between scientific support for environmental policy-making and ethical reflection.

If such turning-table function is recognized, it can help to address problems of conflicts and trade-offs. ESA, without amendments, is silent about how conflicts and trade-offs should be decided in case of conflict. A theory of environmental conflicts is suggested but not entailed in the ESA. Should humans produce more provisioning services at the expense of cultural ones or should they better reverse the trend to produce provisioning services at the expense of cultural ones? ESA seems to be neutral in this respect as it leaves the trade-offs between kinds of services to the market, to stakeholder negotiations, and to political decision-making (see Bromley and Paavola 2002). Environmental ethics might encourage ESA-scholars to defend underrated cultural services against the widespread dominance of provisioning and regulating services. A concept of conflict resolution is beyond the scope of this subchapter. It must suffice to say that ESA should take a view in the world of normative orders, as entitlements, rules, obligations, and commitments.

19.4 Systems-Based Aspects of Human–Environmental Relations

All the human factors discussed above are also strongly influencing the environment, generating solid interrelations between the human and non-human system elements. The resulting entities will be briefly and generally characterized on the following pages, guided by the question for the relations, the flows between the pools and their consequences from a system-analytical viewpoint. These constellations are applied to coastal conditions, and in the end, some concrete human elements of the Baltic human-environmental systems will be briefly identified.

Discussing these items, we are moving forward from the ecosystem conditions described in Chaps. 2, 3, and 4 into coupled human-environment systems (HES or CHANS as coupled human and natural systems, Chen 2015), which characterize the dynamical interactions between human systems and natural entities (Sheppard and McMaster 2004; Liu et al. 2007; Alberti et al. 2011; Scholz and Binder 2011). This linkage expresses the idea that the mutual evolution of humans on the one hand and environmental systems on the other—especially in the anthropocenic age or under the target of sustainable development—should not be treated as individual, isolated systems. Instead, the concept of human-environmental systems (also termed social-ecological systems, coupled human and natural systems, or coupled human-biophysical systems; see e.g., Chapin et al. 2009, Chen 2015) recognizes that the social, economic, and cultural well-being of people depends not only on their relations with other people, but with the physical and biological environment as well. These relations often describe the environment as stocks of resources as well as the capacity of the environment to function as a life support system, providing several ecosystem services.

Following Colding and Barthel (2019) human-environmental systems (HES) are complex adaptive systems (Müller and Li 2004). They provide key characteristics such as: (1) integrated biogeophysical and socio-cultural processes, (2) self-organization, (3) nonlinear and unpredictable dynamics, (4) feedback between social and ecological processes, (5) changing behavior in space (spatial thresholds) and time (time thresholds), (6) legacy behavioral effects with outcomes at very different time scales, (7) hierarchical structures and emergent properties, and (8) the impossibility to easily extrapolate the information from one SES to another" (Colding and Barthel 2019).

The basic quantifiable features of these systems are the flows of energy, water, matter, and information. These subjects can be organized in different quantities, qualities or utilities, the flows can be triggering growth and development as well as disturbance and decay, they can accelerate service provision or disservice impacts, they may be supporting the systems' integrity or provoke degradations of the human-environmental entities.

A generalized depiction of these HES can be seen in Fig. 19.5. On the one hand, the sketch demonstrates the distinction of human and environmental subsystems referring to some of their basic elements. It is easily visible that the internal components, their structures, linkages, and subsystems are extremely different.

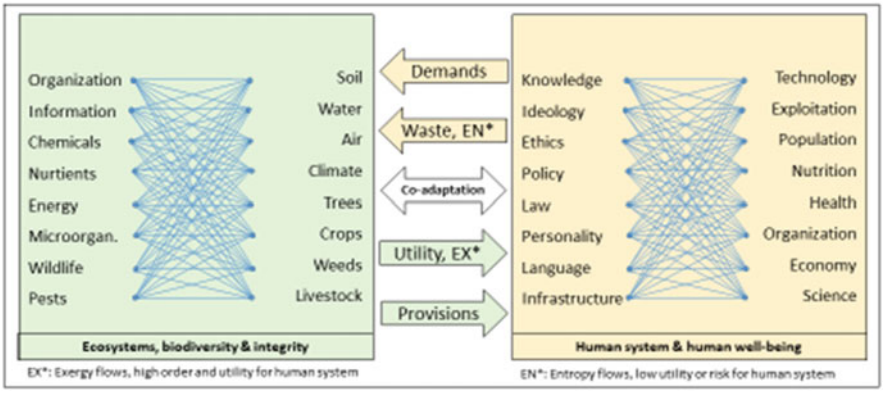

Fig. 19.5 Basic elements of human-environmental systems and fundamental characteristics of interacting flows after Marten (2001)

And on the other hand, the basic interrelations between human and natural subsystems, which can comprise an enormous complexity, are characterized here in the following scheme: Human subsystems are developing and expressing demands for ecosystem services from the natural units (see Chap. 2), including all of their classes in local intensities and sequences. Contrary, the ecological entities are able to provide the respective ESS. Most of the resulting nature-culture-flows include transfers of relatively ordered structures, which provide a relatively high capability to be transformed into mechanical work or utility, thus owing a high degree of exergy (Joergensen and Müller 2000; Nielsen et al. 2019). The opposite direction (flows culture-nature) often is accompanied by high degrees of entropy, disorder and waste which flow back to the nature side after a degradation within the human-technological networks.

In order to better relate these multiple components within a generalized sequence of causes and effects, the DPSIR approach has often been successfully used as an approved instrument of integration between human and environmental processes and structures (Smeets and Weterings 1999; Borja et al. 2006; Svarstad et al. 2008; Burkhard and Müller 2008; Gari et al. 2015). The idea is that the society implies social, demographic, and economic developments and corresponding changes in lifestyle which influence the levels of consumption and production and which strongly influence the motivations of the acting persons for specific land use strategies. These drivers (D) are responsible for the production of pressures (P), the release of substances, physical, chemical, and biological agents into the ecosystem by the resource and land use realization. As a consequence the condition or the state of the ecosystem (S, measurable by biological and ecological indicators) can be modified, and this will have potentially disturbing impacts on the ecological (I1) and human (I2) subsystems. After a reception of these disarrangements, the society can carry out actions to minimize the negative impacts imposed on the environment (response R). In Fig. 19.6 these causal hypotheses are arranged in relation to the ESS

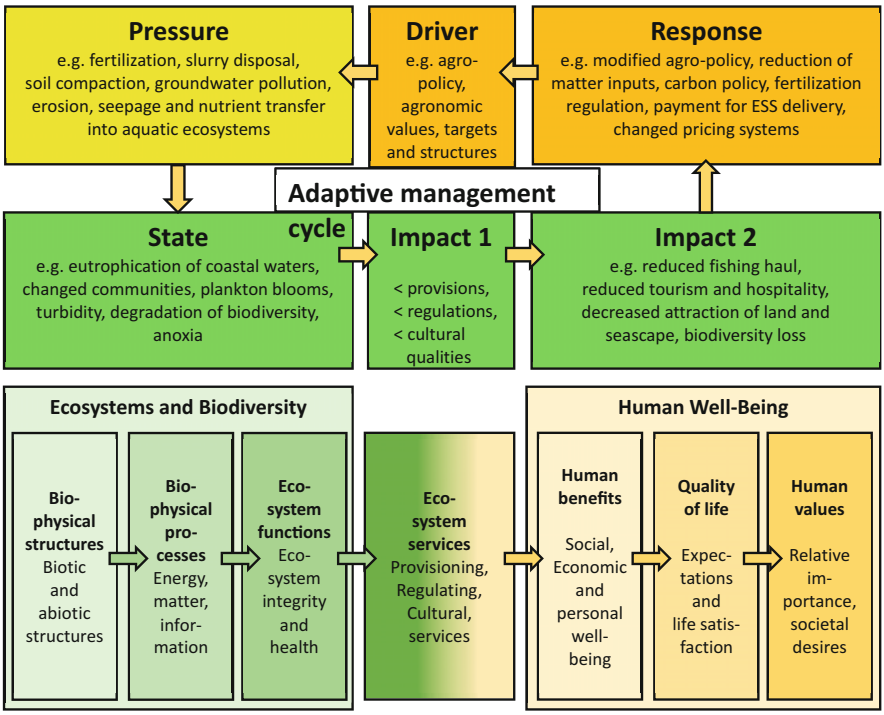

Fig. 19.6 Linking the ecosystem service cascade (see Fig. 19.1) and the DPSIR indicator approach for human-environmental systems

cascade which has been introduced in Chap. 2 of this volume. In Fig. 19.6, eutrophication has been chosen as a case study to demonstrate these human-environmental interrelations. Here the abiotic elements and the biodiversity components are producing ecosystem functions. All of these environmental activities can be observed as parts of the state function S. This situation is based on certain societal drivers (D, e.g., agro-policy), which provoke pressures that are responsible for the state dynamics (P, e.g., fertilization). The ESS flow can be understood as a first impact on the ecological element, if a modification of the functionality entails a decrease of ESS capacities. Such a new development will be recognized by the society as it leads to a decrease of human well-being (Impact 2). And consequently, there should be a political or administrative or management-based reaction, e.g., a change of the fertilization policy (R).

What we can keep in mind from the sequence of figures is that there is an extraordinary high complexity of relationships between coastal, human and ecological subsystems. While searching for sustainable pathways for future development, it is obvious that the interactions provide a certain directionality with exergetic flows to society and entropic flows transferred to the ecosystems. In order to understand these unilateral linkages, the DPSIR approach of the European Environmental Agency can be adopted to underline the interactions within the causal chain of an adapted

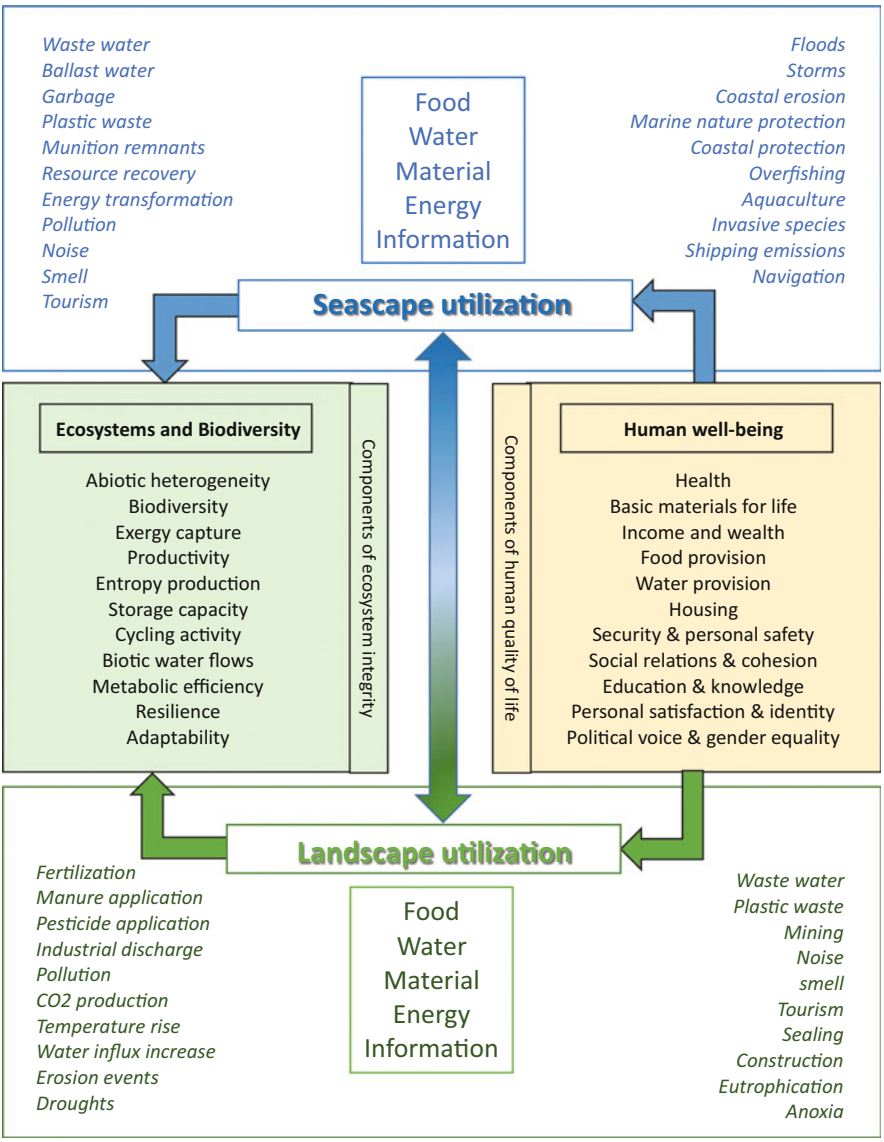

Fig. 19.7 Flows and pressures (*italic*) from land and sea toward coastal ecosystems, some of their basic parameters of systems conditions, and some resulting effects

management model. If we convey these conditions to the marine-terrestrial environments of this volume, things might move to another step of complexity, because in general two different directions of the pressure-based networks are possible, one resulting from direct seascape utilization and the other originating in landscape resource use. Figure 19.7 shows some of the many related pressures, the

focal integrity parameters of the ecosystem and some features of human well-being, which are the target values of the ecosystem service provision. We have to be aware that all of the involved interactions are active, resulting in an enormous functional network. But there might be some more significant and some less important influences in a certain study site. Therefore, it makes sense to take a look at the effectual boundary conditions of the concrete research area before the exchanges of ecosystem services are discussed.

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