A GEOETHICAL APPROACH TO THE GOVERNANCE OF SOCIAL-ECOLOGICAL SYSTEMS: THE CASE OF DELTA DEL TORDERA (CATALUNA)

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ABSTRACT

This paper presents the geoethical dilemma of the coastal zone of the Tordera Delta as a case study with the objective of showing the contribution of geoethics to the governance of coastal social-ecological systems. The Tordera Delta, located in the southern Costa Brava, Catalonia, constitutes a social-ecological system that suffers from intense anthropization mainly due to tourist pressures on the coast. The massive tourism of “sun and beach”, although it brought human well-being and economic development to the region, has caused a heavy urbanization of the coastline that altered the coastal dynamics, eroded its beaches and degraded many ecosystem services, something that is aggravated today by the climate change events in terms of rising sea level as well as the magnitude of the storms ("llevantades"), typical of the Western Mediterranean coast. Posing the problem of governance in terms of a geoethical dilemma means discerning among the values that refer to the intrinsic meaning of coastal landscapes and much more instrumental values that see beaches as goods (commodities) for tourism uses. Finally, the paper reflects if there is a way to overcome this dichotomy of values by briefly considering meaning values as elements that forge cultural identities as further research.

Keywords: deltas, geoethics, Geosphere, governance, natural resources, socio-ecological systems

1. INTRODUCTION

At the end of January 2020, Storm Gloria severely hit the Spanish Mediterranean coast resulting in substantial infrastructure and economic damage. The Tordera Delta (TD) located 80 km northeast of Barcelona (Catalonia) was especially affected. At the same time, however, the storm largely increased the amount of sediment reaching the shoreline, enlarging the beach's recreational areas. The moral of this story is that society's wellbeing increases its vulnerability with raised exposure to natural hazards, but benefits when natural ecosystem functionality is healthy and functional.

Delta areas are complex socio-ecological-technical systems (Wessenlin et al., in press) where human technology and land-sea interactions are key and socio-environmental problems emerge. Policy fragmentation often becomes an obstacle for advancing towards sustainable use of coastal areas, especially deltas that are highly vulnerable to natural forces and subject to stressful pressures by human interventions. Deltas constitute fragile habitats considering rising sea level due to climate change and the TD is a good case in point.

The general regression and disappearance of sandy beaches on Catalonia's Mediterranean coast, where the TD is located, is an issue of social and economic significance since sandy beaches support a tourist economic sector, which attracted almost 20 million tourists in 2019[1]. Coastal regression is mainly due to the accumulative impacts of upstream dams retaining sediments, marine structures blocking sediment redistribution (sport harbors and marine breakwaters), and urbanization of coastal dunes and back shores (Garcia-Lozano and Pintó, 2017; 2018), coupled with intensification of winter storms and rising sea level linked to climate change[2]. Due to these impacts, only 25% of the Catalonia's coastal habitats have a favorable conservation status[3].

During the last 60 years, the downstream of the Tordera watershed underwent drastic changes in modifying hydraulic conditions and land uses. Today, the area has high industrial, agricultural, tourist and residential competing uses, exerting unsustainable pressures on natural processes. Twenty years ago, most stakeholders of the TD recognized that cumulative effects resulting from multiple activities carried out without any comprehensive plan of action resulted in a loss of the TD's ecosystem functionality, putting the ecosystem resources and beaches in a critical state. Since then, numerous studies and researches have been carried out by the "Observatori de la

1 Institut d'Estadística de Catalunya, IDESCAT, Dades turístiques 2019.

2 According to the Laboratori d'Enginyeria Marítima & Centre d'Investigació dels Recursos Costaners de la Universitat Politècnica de Catalunya, 75% of the sandy beaches are eroding and the average values of annual erosion are calculated at 1.7 m/year.

3 Generalitat de Catalunya, Departament Territori i Sostenibilitat (2019), Avaluació de l'estat de conservació dels hàbitats d'interès europeu 2013-18.

Tordera" (ICTA-UAB), ICHN, CEAB-CISC, ACA, CREAF[4] and universities, providing large amounts of data, and even a detailed hydrogeological numerical model for the TD, allowing a sound understanding of the key environmental problems.

However, the social dimension of the TD remains a serious challenge. To implement an effective ecosystem-based management (EBM), as recommended by the EU policies, the involvement of the key stakeholders was required (Sardá et al., 2014; 2015). With this aim in mind, the *Taula del Delta i de la Baixa Tordera* (TDBT) was created in 2017 by local stakeholders, aimed to be the governance structure dealing with the issues and adopting a long-term and strategically planned approach. The purpose of the TDBT is to recover the social and ecological balances of the TD and to reduce its vulnerability to climate change by means of developing a strategic and integrated plan in a transparent and participatory manner, as explicitly indicated by the EU Water Framework Directive. However, besides knowing the problems and having the data, despite the creation of the TDBT, and also knowing the technocratic technical measures that should be implemented, difficulties exist that impede society in advancing and deciding what to do. The application of new innovative approaches and perspectives is crucial to overcome this blocked situation.

Geoethics is an emerging frontier discipline -between ethics and geosciences- that looks at the values in how humans relate to the Earth System (Di Capua and Peppoloni, 2019). Frequently, principles used in EBM and governance models, presented as neutral, do not adequately consider the intrinsic values underlying decision-making processes. Therefore, understanding the values that underpin EBM and governance principles in socio-ecological-technical systems is fundamental to reverse the unsustainable management of fragile and stressed geo-resources, such as coastal landscapes.

Climate models for the future in Catalonia (Institut d'Estudis Catalans, 2016) suggest that extreme events will become more frequent in the short, medium and long term and encouragement is needed to promote bold adaptations, which imply changing our relation with Nature as soon as possible. This paper contributes to highlighting this societal challenge in the TD, as a paradigmatic case study that can serve as an example for similar territories. Several cases of success show the gains of this innovative approach, applying geoethics in governance processes (Bellaubi and Bustamante, 2018; Groenfeldt and Schmidt, 2013; Glenna, 2010) that have the potential to unblock the current governance situation in the TD and will contribute to validate a methodology that is able to be replicated in other deltas along the Mediterranean and Atlantic coasts.

4 Institute of Environmental Science and Technology (ICTA-UAB); Catalan Institution of Natural History (ICHN); Blanes Centre for Advanced Studies (CEAB) - Higher Council of Scientific Investigations (CSIC); Catalan Water Agency (ACA); Ecological and Forestry Applications Center (CREAF).

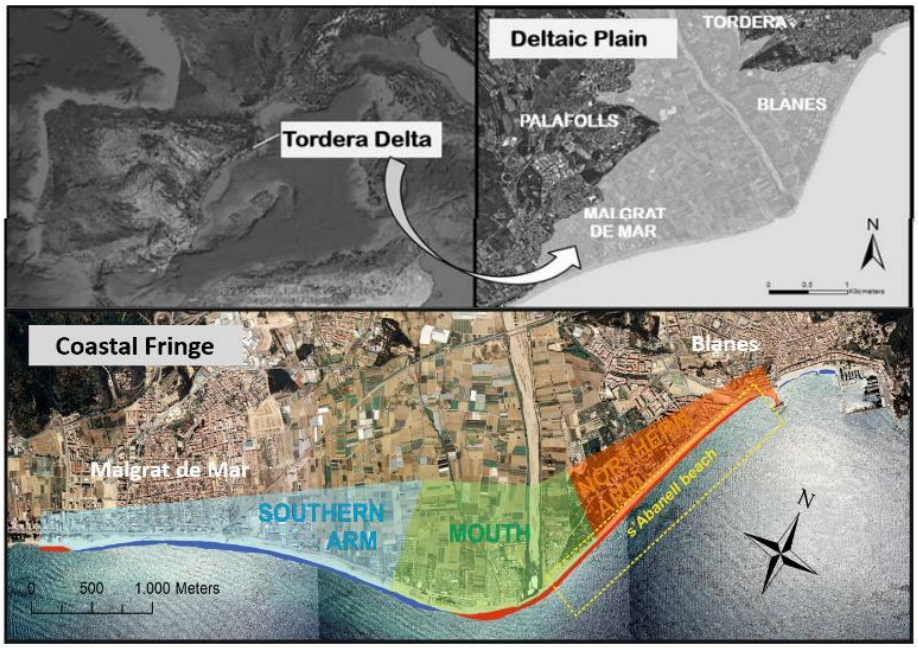

Fig. 1. Location of the Tordera Delta (Sardá et al., 2015)

2. METHODOLOGY

Environmental and social challenges rely on technological based solutions, but technology is not enough to tackle ecological problems because ecological problems involve Human-Nature[5] relationships and, so, values[6]. Even when it has been proved that changes in production technology will not be sufficient to achieve sustainability (Daly, 1987), the scientism fallacy makes us believe that technology is the solution to Human-Nature challenges regardless of the values behind it. Addressing values is key in solving social and environmental-related challenges (Glenna, 2010). In the relationship between Humans and Nature, the abiotic entity of Nature, or the Geosphere, is of special interest when referring to the management of natural resources and

5 By Nature, we refer to the natural environment that encompasses biotic and abiotic entities and, by extension, to the Earth's system.

6 If the main objective of ethics is justice, then not only environmental and social justice is enough, but also a more global ecological justice is at stake.

their governance, because these geo-resources under utilitarian values sustain our current development patterns. However, the concept of the Geosphere introduces a conceptual change so, rather than talking about the water, the soil and the rocks and minerals under natural resource management and governance, the Geosphere refers to the geodynamic processes of the water, the soil and the subsoil and the expression of its multiple manifestations in terms of rivers, lakes, mountains... as common beings (Bellaubi and Bustamante, 2018), thus introducing their intrinsic value. Whilst instrumental value refers to the value in the use of an object to accomplish something , and clearly refers to the utilitarian values of the geo-resources, intrinsic value is the value within an object itself (Álvarez, 2019), in this case the value of the Geosphere manifestation. Geosphere manifestations, as common beings support communities of life not only in the biological sense but also in the spiritual sense. The communion of human communities with the land as meaningful wholes (Simon, 2019) is at the base of historic memories and cultural identity values that overcomes the dichotomy between instrumental and intrinsic values (Rolston, 1988).

Values are at the core of the technocratic artifacts in which humans relate to the Geosphere and embedded in cultural geographic identities. Under this approach, the territory is seen not only as a mere political social construct or a "passive" space of power where social actors interact but also as having power in itself or the power of the space (Rodriguez, 2006). The Human-Geosphere relationship is a continuous social production of space (Lefebvre, 1991), where the physical environment becomes an agent itself (Voiron, 2012), shaping humans' social relationships which, in turn, affect the Geosphere's dynamic processes. This social production is a result of a dialogue between intrinsic and instrumental values at the different levels of social space: the day-to-day psychical perceived space, the conceived spaces (or the territorial representation of space) and the land understood as a lived space. The land becomes a representational space holding the cultural identity values that bring together the intrinsic and instrumental values, a place of spatial justice (Soja, 2010) and a space of ecological justice (Kortetmäki, 2017). How cultural identity values evolve and how they are transmitted are key to understanding the complex interrelations between human societies and the physical space they inhabit, frequently involving social inequalities and negative impacts and, so, land use conflicts (Tàbara and Ilhan, 2008).

The interaction of these Geosphere manifestations with the human agency, through technocratic artifacts and their enabling technocracies, result from institutional governance frameworks, technical-hardware and software-knowledge and capacities, as well as the dynamics of power between the different social actors, in turn, characterize specific organizational management practices around these artifacts. These terms define Geosphere governability (Bellaubi and Bustamante, 2018), a concept associated to the Noosphere (Vernadsky, 1945) that Moiseev (1989) interpreted as Earth system governance. However, the term as defined by Vernadsky emphasizes the development of human consciousness in its relation with the Geosphere. Geosphere governability outcomes result from the alteration (impact) of the biogeochemical cycles of the Geosphere and their feedback on the human

activities in terms of socioeconomic vulnerability, both map-able features and suitable for exploring geoprospective scenarios (Bellaubi and Arasa, 2020), which allow defining the Noosphere as the social-natural coevolution production of space.

3. RESULTS

In considering the described methodology, a potential way forward to unblock the governance of the socio-ecological-technical systems of the TD means exploring the value relationship dimension under the concept of Geosphere governability by using a geoethical dilemma. In this paper, geoethical dilemmas are defined as the ethical attitude when instrumental and intrinsic values are confronted in the Human-Geosphere relationship. Geoethical dilemmas help us to discern the meaning values that define the relationship of humans with the Geosphere, putting low impact and vulnerability Geosphere governability scenarios with spatial ecological justice situations in perspective. In turn, geoethical dilemmas unfold as a pedagogy process involving social actors building a values-based ecological dialogue based on solidarity, integrating different views and creating consensus aiming at ecological justice.

According to Bellaubi and Arasa (2020), a geoethical dilemma is presented as a double-entry matrix representing the two possible technocratic alternatives under instrumental or intrinsic values for the two main stakeholders involved in the dilemma. Each alternative is crossed producing four scenarios. Each scenario can be considered as a Noosphere space, as it relates material and spiritual dimensions of the Human-Geosphere relationship, and may be expressed in terms of Geosphere governability; meaning it has an impact on the Geosphere and, oppositely, there is a derived socioeconomic vulnerability on human activities. Furthermore, for each scenario, the credibility of the social actors is evaluated. Credibility is key in fostering cultural changed (Knott et al., 2008) by shifting scenarios and it is based on cultural capital (Bourdieu and Passeron, 1978). In turn, solidarity as a consciousness for the other (Tischner, 2005) may be understood as the created cultural capital within the pedagogic process of a values based ecologic dialogue. In this way, qualitative scenarios in terms of impact and vulnerability may be qualitatively evaluated by a binary scoring system of credibility. The credibility of a stakeholder results from his/her attitude for a value and the associated social cost/ gain from the observer. The actor’s attitude scores 1, otherwise it scores 0. Social costs or gains score 1 or 0, and subtracted (if the actor's attitude is 1) or added (if the actor's attitude is 0), respectively, to the stakeholder’s attitude according to the perception of the observer over the generated scenario. The rationale for such scoring can be found in Bellaubi and Pahl-Wostl (2017).

The geoethical dilemma of the TD refers to the urbanization of the coastal landscapes and an increase in sport harbors, as a result of a mass tourism, and the overexploitation of ground water, disrupting the morphologic coastal dynamics and transport of the sediment that results in coastal regression. The involved stakeholders are the Catalan regional and local administration

vs. the tourism sector, whilst the local inhabitants are the «observers». The objectives of the geoethical dilemma of the TD are: 1) to understand the current situation of mass tourism, which brings considerable income to the region but has an associated negative environmental impact on the coastal system, considering the values related to the governance, and 2) to open a participatory dialogue under a geoprospective (Voiron, 2012) approach to ask: what are the alternatives to the current tourism model? The geoethical dilemma matrix with the different outcomes' scenarios and credibilities is shown in Table 1.

Table 1 Geoethical dilemma matrix in the Tordera Delta

Disruption of the coastal system due to mass tourism Observer: local population	Tourism follows the same model but addresses environmental impacts	New tourism model: degrowing + proximity tourism
Public administration follows a low term vision where economic benefit prevails	Scenario 1	Scenario2
	Impact: coastal dynamic disruption Vulnerability: social and economic impoverishment Credibility administration = 1 - 1 = 0 Credibility tourism sector = 1 - 1 = 0 Credibility scenario = 0	Impact: small impact on the coastal system Vulnerability: Possible bankruptcy of the sector Credibility administration = 1 - 1 = 0 Credibility tourism sector = 0 + 1 = 1 Credibility scenario = 1
Public administration follows a strategic prospective development strategy	Scenario 3	Scenario4
	Impact: sustained environmental degradation Vulnerability: Improvement of social and political image of the region Credibility administration = 0 + 1 = 1 Credibility tourism sector = 1 – 1 = 0 Credibility scenario = 1	Impact: recovery of a socio-environmental model Vulnerability: Political cost and slow economic growth in short term Credibility administration = 0 + 1 = 1 Credibility tourism sector = 0 + 1 = 1 Credibility scenario = 2
Credibility stakeholder = attitude ± social cost/social gain		

4. DISCUSSION

The result of the geoethical dilemma of the TD was presented in the CEAB-CSIC centre, Blanes, at a two-day conference event on March 5 and 6, organized by the Campus of Natural and Cultural Heritage of the University of Girona, CEAB-CSIC and the platform SOS Costa Brava. In advance of the conference, a group of scientists had subscribed to the 'Manifesto for the

Tordera'[7], which proposes a number of detailed management actions to be put in place in order to improve river and coastal management. During the conference, attended by over fifty public officials, municipal technicians, and researchers and experts from different fields, six scientists discussed how geoethics could invigorate the table of the TD and the lower Tordera river. For the first time in this context, the contributions under a geoethics perspective were openly discussed, both theoretically and in practice, during a participatory workshop with some of the main local stakeholders.

The values that define our relationship with the Geosphere relate significantly on how we relate to others under a principle of Solidarity. Bearing solidarity in mind, we can engage in a values based ecologic dialog that allows us to commit on a shared value to develop a common future for the land. This represents another way forward for complex governance problems, overcoming participatory processes that have become technocratic tools of "consumption" without being able to modify the current unsustainable socio-environmental trends s (Bellaubi, 2019).

In Table 1, scenario one represents the current situation in terms of Geosphere governability in the TD, whilst scenario four would be the best outcome in terms of impacts and vulnerability. Scenario four is also the most credible, and overcomes a possible "ecological tragedy" in the TD. The paradox remains how to shift from scenario one to four when the latter is the most credible. As reaching scenario four involves a change of stakeholders' attitudes, it is perhaps more feasible to look for other possible scenarios that avoid the ecological tragedy. Hereby, we suggest politically articulating the dialogue in order to increase the credibility of scenarios three and two, looking at a way to avoid the social cost of administration or tourism sector by posing the following questions:

1) to improve the credibility of scenario three: How can "investors'" benefits have a positive effect on improving social services (living conditions) and environmental services (coastal landscapes)? This question may trigger an increase in the credibility of scenario three because the locals see the sharing of the benefits of tourism as an act of solidarity. (Table 2)

Table 2 Enhancing credibility of scenario 3

scenario 3 before: credibility scenario 1	scenario 3 after: credibility scenario 2
Administration = attitude 0 + social gain 1 = 1 Tourism sector = attitude 1 – social cost 1 = 0	Administration = attitude 0 + social gain 1 = 1 Tourism sector = attitude 1 - social cost 0 = 1

7 Tordera is a small river flowing to the Mediterranean, 80 km northeast of Barcelona. It is one of the few rivers in Catalonia without dams. The Tordera ground water feeds the heavily populated coastal areas of Maresma.

2) to improve the credibility of scenario two: How can public administration commit to the proposals of the population and environmental groups, not only in urban planning (beyond consultation and empowerment)? In this situation, the solidarity comes from the administration as «an offer» to include the local views on the tourism sector development. (Table 3)

Table 2 Enhancing credibility of scenario 2

scenario 2 before: credibility scenario 1	scenario 2 after: credibility scenario 2
Administration = attitude 1 – social cost 1 = 0 Tourism sector = attitude 0 + social gain 1 = 1	Administration = attitude 1 - social cost 0 = 1 Tourism sector = attitude 0 - social gain 1 = 1

However, the dialogue can also be “spiritually” driven by suggesting, as exposed above, a change in attitudes and exploring the meaning identity values at stake in the dilemma. Undoubtedly, the mass tourism industry is part of the locals’ way of living. Not only has the tourism development created jobs and boosted the regional economy, but from a sociocultural point of view, visitors and tourists exposed the locals to new ways of living and thinking. In turn, many locals felt their traditions and the local beaches and calm villages were lost in favor of economic growth. Taking this “spiritual way” in the dialogue means to question not only the kind of tourism development model itself, but also if tourism is necessary and convenient at all. Therefore, it is an invitation to reflect on how tourism may be articulated together with auto-sustainable local economies based on degrowing theories (Higgins-Desbiolles et al., 2019) to find an “equilibrium solidarity point”, which accepts the benefits of tourism under certain premises and conditions acknowledging a total preservation of the environment is perhaps not possible. A “small, slow and local” spiritual entrepreneurship tourism (Ramis-Pujol et al., 2015) that respects people and biodiversity, a proximity tourism that promotes cultural and natural heritage (Llurdes et al., 2016). This solution of compromise can be seen as an attempt to overcome the underlying tension of stakeholder attitudes of intrinsic vs. instrumental values and closer to ecological justice as it tries to reconcile both social and environmental issues. In the end, the values that shape the identity of the people with their environment are the overlapping interacting layers producing a living space.

5. CONCLUSIONS

This paper has exposed the importance of geoethics as a possible way forward to unblock governance processes focusing on a values approach. This perspective involves a different way of managing the geo-resources, such as water, soil and minerals, not only from a utilitarian view, but also taking into account the interaction between water, soil and atmospheric cycles, as a whole that generates the biosphere. Thus, our rivers, mountains, our beaches, and our lakes sustain human communities, which highlight the intrinsic value of the Geosphere in an

inseparable relationship that generates cultural identities. I can remember that particular place, that bend in the river where I was fishing in my childhood, that forest where I walked with my partner, or that summit that I climbed in my youth. These forests and meadows, the rivers or the beaches are permeated with experiences of ourselves and our ancestors, and constitute part of our identities. Those places are a living part of our history and ourselves, they were there when we were born and raised and will eventually see us die and return to the Earth. Geoethics opens a door to consider there are deeper spiritual meaningful values that link us with the land we inhabit, which is not inert, but alive and dynamic and, as such, never ceases to interact with us.

Geoethical dilemmas cause us to become stuck in the endless debates on what should be done or not. Beyond that, however, there is the delicate question of governance: who decides to do what and how decisions are taken, how are rules framed and legitimized? A fair governance involves more transparent and participatory institutions, as well as more truthful, clear and accessible information for decision making, which refers to ethical or moral principles. Indeed, principles guide us in what we should do, but they do not tell us why. The profoundest reasons must be discovered in ourselves, at the core of our relationship with Nature, which is never independent of our relationship with the other fellows.

The global environmental crisis we are immersed in is also a social crisis strongly related to a type of development that fosters unsustainable - destructive - rhythms of exploitation of the natural resources on which we all depend. The same values that inspire the relationship with ourselves and our human fellows define our relationship with the Geosphere.

Any significant intervention on the Geosphere has effects at different levels and timescales on other humans. Thereby, to activate the desalination plant of the Tordera Delta to improve aquifer dynamics related to water extraction, to replenish sand extracted from adjacent sandy marine bottoms for tourist use as it done in the past in the Tordera Delta beaches (Sagristà et al, 2019, Sagristà and Sardá, 2020), or to protect coastal dunes as recently happened in the area, it is guided by certain values that are rarely explained. Often an attitude in line with the shared values involves a social cost, i.e. a "price to be paid". The social cost is the “price” of the responsibility by sharing the burdens when we make decisions, a kind of social and environmental solidarity: the extent to which we are willing to sacrifice our 'consumerist' economic model for the sake of the common good, of present and future generations.

How can we promote this shared responsibility? How can we foster a dialogue of values that helps identify those of us who agree, to jointly build a social and environmental fair vision of the future that is adapted to the reality of natural cycles and rhythms? How do we imagine the landscapes, deltas, beaches, rivers, meadows or forests of our land for our children and grandchildren, for generations to come? How should we pass on to our young generations the testimony of the wisest and most inspiring values and memories we have received from our ancestors? Beyond the dialectics of winners or losers, a dialogic dialogue may reconcile us to others and to our land when we recognized them. It is about our roots, with the conviction that

our values are not absolute, but only a part of the truth, which can be enriched by the truth (or values) of others, and thus foster the growth, as a society, in order to respond to increasingly complex and difficult environmental challenges we are facing.

Finding the fragile balance between utilitarian and intrinsic values, and those that give meaning to who we are, as a person or as a people, usually is a complex challenge. When the ethical dilemma arises, how can we move towards environmental and social justice, with a deeply humble attitude of appreciation for what has been bestowed on us? Geoethics invites us to have a more humble and respectful attitude towards the Earth and to life: to look around and to be amazed, to wonder, because everything is a wonder (as the medieval Catalan philosopher Ramon Llull taught): appreciating everything we have received, with an attitude of reverence and deep gratitude.

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