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EVOLVING ECOLOGIES ACROSS THE LAND-SEA BORDER

# SETTLEMENTS

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# 04

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OF COASTAL LANDSCAPES

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## SETTLEMENTS

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Impianti per lo stoccaggio di gas liquido e cereali lungo il Margem Sul, Almada, Portogallo. Photo by S. Antoniadis © 2016



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## A REFLECTION ON THE MEDITERRANEAN COASTAL TERRITORIES

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Fig. 00\_Aerial  
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Photo by  
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### INTRODUCTION

Coastal territories form hybrids with a dynamic character. With a variety of land uses and appropriations, they constitute vital interfaces between water and land, and they are constantly in transition. Human pressure, as a result of intense human activities, and climate have been major drivers of change for the Mediterranean coastal territories, placing them under a continuous transitional stage. Even though «the Mediterranean region is home to some of the oldest human settlements in the world giving it unique cultural heritage and cultural landscapes» (UNEP/MAP 2016), currently, the coastal territories face new challenges as they are gradually under higher pressure. The inhabitation of the Mediterranean coasts has a long and rich history but is lately challenged by the climatic events in the region, such as extreme drought, flooding events and wildfires.

These extreme events have been radically increased as an impact of climate change and are unexpected, in intensity and frequency. Extreme events invade the exposed urban and rural areas, resulting in dramatic human losses and major economic and ecological damage. At the same time, the gradual sea level rise, as the major factor of spatial transformation, is setting a fragile frame for the Mediterranean coastal territories by intensifying erosion, inundation, and saline intrusion.

In the Mediterranean, around one third of the population lives in high proximity to the coast, while more than half of the population resides in the coastal hydrological basins (UNEP/MAP and Plan Bleu 2020). Densely populated settlements and scattered urban tissue spread along the coastal line and intermingle with forest, agriculture and various terrestrial and marine ecosystems. As indicated in the Cross chapter 4 of the IPCC 2022 report, «the Mediterranean region is a hotspot for highly interconnected climate risks», a statement that specifically frames the low-lying areas as the most vulnerable ones (p. 2235). River deltas, which offer favorable conditions for various species, are especially vulnerable to sea level rise (Poulos et al. 2009). Following the “One Health integrated approach” (WHO et al. 2023) which highlights that humans, animals and ecosystems are interdependent, this paper aims to open a discussion on the necessity of a balanced multi-species inhabitation on the Mediterranean deltas in the face of climate change. In order to do so, the case study of Axios delta in Northern Greece is introduced through the lens of multispecies inhabitation. Which are the relations between the different neighboring habitats? Could a multispecies approach provide a new analytical tool

### L'ABITARE MULTI-SPECIE DEL DELTA. Una riflessione sui territori costieri del Mediterraneo

*L'abitare lungo i bordi del Mediterraneo ha una storia lunga, ricca di processi naturali e antropici molto complessi ai quali oggi si aggiungono nuove sfide dettate dal cambiamento climatico e dai suoi effetti.*

*Le aree costiere sono ibridi fragili con caratteristiche proprie, dove foreste, agricoltura e insediamenti si mescolano e nidificano specie diverse. Negli ultimi decenni, i fenomeni derivanti dal clima che cambia – siccità estrema, inondazioni e incendi boschivi – sono aumentati radicalmente nella frequenza e di intensità. Il graduale innalzamento del livello del mare, quale principale fattore di trasformazione spaziale, sta esacerbando l'erosione, le inondazioni e l'intrusione salina.*

*Dentro questo scenario, i delta dei fiumi sono le aree costiere più significative per indagare l'approccio dell'insediamento multi-specie.*

*Basato sull'approccio integrato “One Health”, che evidenzia l'interdipendenza tra uomo, animali e, più in generale, tra gli ecosistemi, questo articolo si propone di riflettere sulla necessità di un'abitazione multi-specie sui delta del Mediterraneo, per rispondere alle necessità prodotte dalle mutazioni ambientali e climatiche già registrate, e quelle prospettate dalla scienza.*

*Il contributo proposto introduce il caso studio del delta dell'Axios, sito in un'importante zona umida della Grecia settentrionale. Qui, le appropriazioni umane hanno formato un paesaggio deltizio che comprende vari ecosistemi: quelli costieri, quelli interni, ripariali e agricoli che ospitano un*

*ricco patrimonio faunistico e floristico di notevole interesse e meritevole di attenzione.*

*Alcuni interrogativi sono utili come traccia per la riflessione: quali sono le relazioni tra i diversi habitat limitrofi? Un approccio multi-specie potrebbe fornire un nuovo strumento analitico per i territori costieri del Mediterraneo sottoposti ai cambiamenti climatici?*

*Per seguire questa linea di ricerca e per rispondere a queste sollecitazioni, è necessario chiamare in causa il paesaggio – con i suoi caratteri specifici, le sue risorse, i suoi drivers. Esso ricopre un ruolo cruciale per l'adattamento: può potenzialmente tessere e rappresentare una nuova tela per supportare la transizione delle zone costiere verso una condizione di maggiore sicurezza ambientale e sociale.*

for the Mediterranean coastal territories under climate change? Within this trajectory, landscape appears to hold a crucial role as it appears essential to address future climate-related challenges and can potentially create a new canvas to support the transition of the existing coastal zones into a robust condition.

## APPROACHING COASTAL INHABITATION UNDER A MULTISPECIES LENS

The broad definition of inhabitation is the act of living in a place. Perceiving inhabitation as the appropriation or domestication of the space surrounding us, of our close or distant environment in order to accommodate our needs, introduces a new dimension on our perception of the environment and on the juxtaposition of the two notions: inhabitation and protection. Heidegger in «Building Dwelling Thinking» (1952) links the essence of the human existence to the action of dwelling and to the sense of freedom when one is preserved from harm and danger, safeguarded. Thus, human inhabitation often means dwelling, which usually includes building a structure, a shelter to protect the inhabitants from the outside. But it is certainly more than that. This is eventually about building a relationship with the outside, with the natural environment, along with all the benefits and threats it brings. The landscape is being shaped by human activities, as «[...] human beings inhabit discursive worlds of culturally constructed significance, laid out upon the substrate of a continuous and undifferentiated physical terrain» (Ingold 2000, p. 172).

Reaching beyond conservation, a multispecies approach in urbanism considers «[...] human interactions with animals, plants and other life forms in what scholars once unproblematically called “nature” or “the natural world”» (Aisher and Damodaran 2016, p. 294). Wilderness no longer exist as «[...] all parts of the world, even the most remote have been adulterated to some degree» (Wilson 2016, p. 71). The notion of inhabitation is gaining a different meaning when considering the overexploitation of natural resources in a global and local scale and its impacts on wildlife. The dependency of human settlements to the landscape that supports them is illustrated in the work of Brenner et al. (2014) on planetary urbanization. By catalyzing the divisions between urban and rural at a global scale, the importance of the operational landscapes is coming into the foreground and becomes an invitation to reconsider human's relation to nature.

The appropriation of the natural environment is a key aspect in the process of human inhabitation and relates to the formation of edges, with higher or lower

levels of porosity. The intensity of human appropriation marks the contact zones, areas where human and non-human lives and habitats intertwine forming porous membranes. Seen as edges and bordering conditions, membranes are challenges for planners (Sennett 2018, p. 222) as the need to provide space for all inhabitants create conflicts. Sennett (2018) discusses porosity based on two kinds of edges: borders and boundaries. This is a distinction borrowed by natural ecologies, where the boundary is seen as a low-intensity edge and «the border is an edge where different groups interact; for instance, where the shoreline of a lake meets solid land is an active zone of exchange where organisms find and feed off other organisms» (Sennett 2018, p. 220). The balance and exchanges between neighboring habitats create different bordering conditions, especially in the interface between sea and land. «The permeability of the coastline, that is, the ability to move easily between terra firma and the sea, is influenced by environmental change and a society's ability to manipulate access to and from the sea» (Walsh 2013, p. 30).

Diverse coastal environments support a wide range of life forms, including marine life, birds, mammals, and human communities. A multispecies approach on coastal inhabitation acknowledges the interactions and dependencies between the different species by referring to the coexistence and interdependence of various species of plants, animals, and humans in coastal ecosystems. Viewing landscapes as multispecies assemblages (Aisher and Damodaran 2016, p. 298) is providing a more comprehensive scope on the notion of conviviality. These assemblages can be seen as open-ended gatherings that host patterns of unintentional coordination which can be noticed by «watching the interplay of temporal rhythms and scales in the divergent lifeways that gather» (Tsing 2015, p. 23). The interrelation between human settlements and ecosystems is complex and dynamic and has profound implications for both the environment and human well-being. The “One Health approach”, as developed by WHO, FAO & UNEP (2023), focuses on the animal-human-environmental interface to illustrate the importance of protecting all habitats and maintaining the socio-ecological balance. The multispecies inhabitation corresponds to the neighboring of multiple habitats in a fragile coexistence. «The coastline, however, is the interface between two remarkably different worlds; these are environments on the edge – not marginal per se, but zones where a change in one particular environmental parameter or process can test the resilience of any society's engagement with that landscape» (Walsh 2013, p. 31). Nevertheless, the perception of the «coastal areas as terminal parts - the extremities - of larger environmental regions» (Cavaliere

2020), allows for a further reading of the coast as a hybrid zone of multispecies inhabitation.

The coastal zone, as the transitional zone between water and land, is a vital interface (UNEP/MAP 2020) on the frontline of the climate battle. Climate change is triggering more intense transitions in less time, constituting an accelerator to the natural processes. Along with existing and intensified human pressure, the altering climatic conditions are putting coastal areas in a more vulnerable frame and the coastal zone is being compromised.

The Mediterranean is a micro-tidal region where activities take place often in close proximity to the sea as «communities have developed lifestyles adapted to non-dynamic water levels» (MedECC 2020, p. 561). The coast «usually designates wide zones involving both land and water, across which shifts the shoreline, as the active narrow zone of contact between land and sea and great forces and processes of nature are at play on a large scale» (Thomas 1956 - article by Davies, p. 504). The effort to define the coast is challenging due to its dynamic character, but important in order to better understand the common ground of land and sea interactions, not as a dividing boundary, but more as a common terrain for multispecies interaction. The coasts are becoming vibrant interaction zones where marine and coastal ecosystems are neighboring coastal human settlements.

The Mediterranean basin is both a climate change hotspot and a biodiversity hotspot (UNEP/MAP 2020). Expected higher demands in water, energy and food, are putting extra pressure on the coastal ecosystems and environments, and therefore presenting a substantial development challenge for the Mediterranean (UNEP/MAP 2016). As the coastal ecosystems are facing the threat of a great biodiversity loss, they are in danger together with their adjacent and dependent settlements. «The adaptive capacity of ecosystems and human systems is expected to encounter hard limits due to the interacting, cumulative and cascading effects of droughts, heat waves, sea level rise, ocean warming and acidification» (Ali et al. IPCC 2022, p. 2236). River deltas are presenting higher vulnerability as the «risks of erosion and flooding will be amplified with climate change, particularly in river deltas [...]» (Ali et al. IPCC 2022, p. 2245). How could a multispecies approach add value on the adaptation and mitigation efforts?

## THE AXIOS DELTA COMPLEX

The Axios delta is a major wetland area in Northern Greece. It is a low-elevation zone, as most of the area lies in less than 2m above mean sea level (Poulos et

al. 2009). It is neighboring Thessaloniki, the second biggest urban center of the country, and constitutes a fluviially-dominated delta, in the inner Thermaikos Gulf (Poulos et al. 2009). The delta complex is the discharge area of 4 different waterways, Axios, Aliakmon, Loudias and Gallikos rivers. «Major changes took place in the twentieth century resulting in heavy losses of the original size and wilderness of this complex wetland area» (Vokou et al. 2018), such as drainage of the floodplains, sand quarrying, canalization, land reclamation, and construction of levees and weirs. During the 20th century, 70% of the original wetland was destructed (Elias et al. 2020). The area is covered by perennial and intermittent marshes and swamps but also used for agriculture, as «most of this area has been reclaimed, drained by an extensive channel network» (Poulos et al. 2009). The delta complex has a critical role as a biodiversity reservoir which is challenged by the overall human pressures in the area. «The complex wetland system formed by the Axios, Aliakmon, Gallikos, and Loudias rivers, and their streams and irrigation channels, provides many services; prominent among these are water supply, rice, and mussel production» (Vokou et al. 2018). Different uses and landscape characteristics compose the whole area, a small sample of which is shown on the aerial view between Aliakmon, Loudias and Axios (fig. 01). Excluded from this view, but quite important, is the extended industrial zone which lies within the (approximately 40,000km<sup>2</sup>) catchment area of Thermaikos Gulf. In parallel, the Axios complex delta has 12 different habitat types of Annex I of the EU Habitats Directive and multiple efforts have been made lately on «changing the way that people understand, value, and use the natural resources of the protected area» (Vokou et al. 2018).

Besides human pressure, Sea Level Rise (SLR) and droughts are recognized as the main climate change related threats that will influence the hydrology of the area, its species and habitat types (Vokou et al. 2018). «Low-lying coastal urban centers, populated deltas, and coastal protected areas are key societal hotspots of coastal vulnerability in terms of relative sea level change» (Elias et al. 2020). The study of Elias et al. (2020) made a comparative analysis of three coastal areas which showed that the Axios delta complex and specifically the village of Chalastra demonstrate the most adverse conditions on relevant sea level projections. The examination of the relative SLR in 50 years in Chalastra and Kimina (villages of an altitude of approximately 5m), showed a max rate of 90cm & 53cm respectively and a minimum rate of 44cm & 25cm respectively. Poulos et al. in their study (2009) declare that «in the event of a sea-level rise, significant parts of the deltaic coasts investigated will be inundated and shoreline will retreat». Even though the



Fig. 01 \_ Intermingle of agricultural fields, natural and man-made areas. This aerial image shows the Axios — Loudias — Aliakmonas Delta National Park (ALAD) in Greece, acquired by one of the Copernicus Sentinel-2 satellites on 31 August 2022. Source: <https://www.copernicus.eu/sk/node/12185>

authors recognize the limitations of the used methods, they tested specifically for the Axios delta, two cases of SLR of 0.5m and of 1m. In the first case, all the lower part of Axios delta will be flooded and the coastline will retreat at a maximum of 2km in the southern part, while at the second case, the entire delta area will be flooded, and the maximum retreat will be around 5.5 km in the central part of the delta. «The substantial loss of deltaic land will also cause damage to the agricultural economy of the area, which may be worsened further by the process of salinization of the groundwater and, especially, of the phreatic horizon» (Poulos et al. 2009). The relevant sea level projections include a level of uncertainty but help in building local scenarios and address minor or greater changes. Mediterranean delta ecosystems are changing radically, meaning that species will need to adjust to the new conditions, migrate or become extinct as the changes are happening faster than the adaptation (fig. 02/09 in the next pages). There is «high variability in the eastern Mediterranean region, implying the need of inclusion of its coastal mapping amongst other hazard properties (like coastal erosion) as an additional feature in risk analysis processes» (Elias et al. 2020).

The human appropriations formed the current landscape which is an important wetland on all levels (national-European-global). Various ecosystems, such as coastal, inland, riparian, and agricultural, compose

this complex deltaic area that hosts a rich and important associated flora and fauna (Vokou et al. 2018). As the area lies on one of the main migratory routes for birds in Europe, it is famous for its avifauna which is changing seasonally. The area, due to its location and geomorphology, is an important resting and nesting spot for birds, but is also hosting important mammal, reptile and fish populations. «All these habitats and species are targets of the Europe-wide conservation efforts» (Vokou et al. 2018). Indeed, the area is included in various protection protocols, as it is a Ramsar Site 1975, part of the Natura 2000 network and a National Park. As illustrated in the map (fig. 10), the boundaries of the mentioned protection protocols differ, with the one of the National Park (dashed line) being the wider one, including a larger area with natural habitats, agricultural fields and mussel aquaculture. It is significant to see how these possibly contradictory land uses can coexist and influence one another especially within a regulated boundary for habitat protection. How is the relation between multispecies inhabitation and protection being formed?



Fig. 02-03 \_ The appropriation of Axios Delta, Greece, is expressed as a fragile balance between human activities and the natural landscape. Photos by E. Samara © 2023

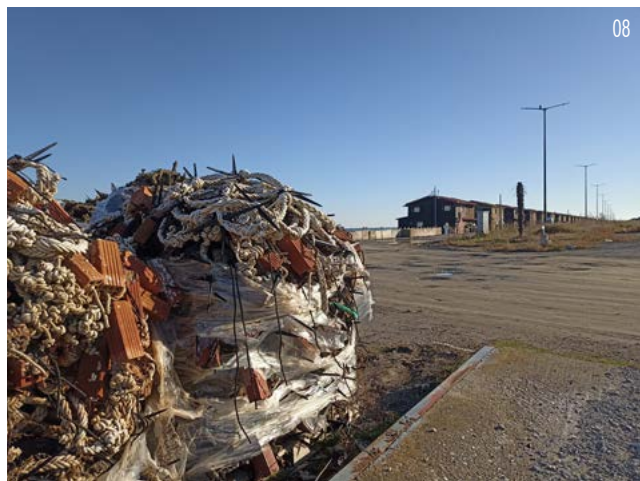
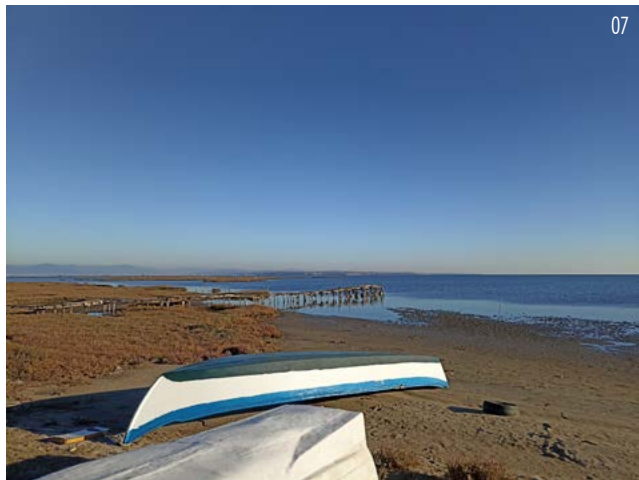
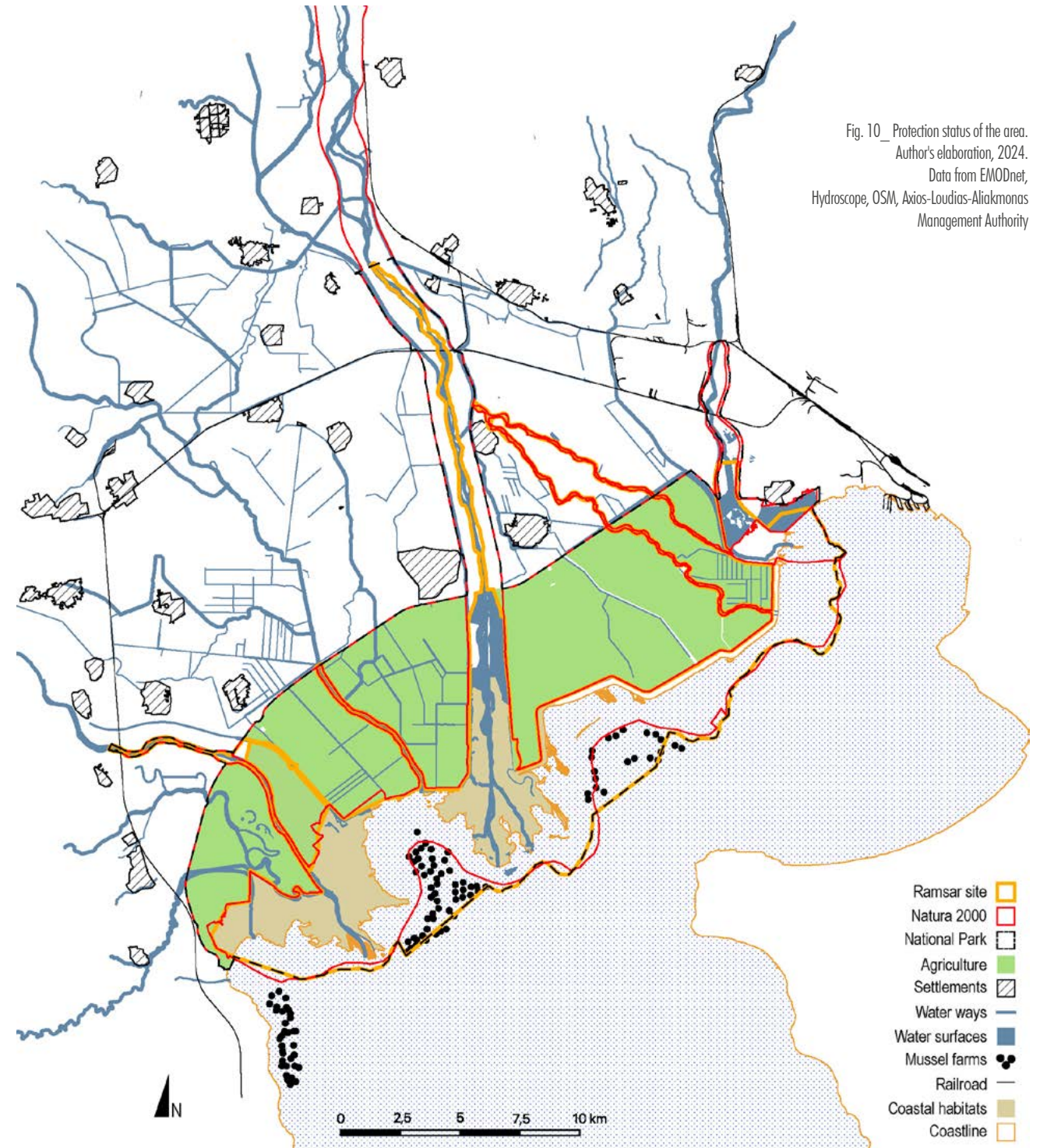


Fig. 04-09\_ The figures present examples of the various spatial modifications of smaller or bigger extent of the Axios Delta. The sense of abandonment is strong even though the territory is daily hosting a variety of human activities. Questions on the alignment to the rules of environmental protection are raised along with the water and material flow issues. Photos by E. Samara © 2023



## SYSTEM PROTECTION OR THE INVENTION OF NEW BALANCES

There is cause-and-effect relation between human inhabitation and protection: inhabit in order to be protected (from nature, weather, extremes, hostile species and environments) and protect the area of inhabitation

(responsibly cultivate the land, care for and take care of the inhabited territory). But how can we conceive a multispecies inhabitation? Under climate change, the Mediterranean biodiversity is threatened, but «habitat restoration and development in coastal systems can support biodiversity, protect communities from flooding and erosion, support the local economy and enhance the

livelihoods and well-being of coastal peoples» (Cooley et al. IPCC 2022, p 486). Further, Wilson, E. O. in «Half-earth» (2016) argues that human is part of the biosphere, not ruler of it (p. 17) and that biodiversity as a whole forms a shield protecting each of the species that together compose it, us included (p. 14). Within this framework, it is useful to reconsider which is the role of landscape in the effort of coastal human settlements and ecosystems to adapt to the changing climatic conditions, in order to be resilient.

Landscape is seen as an identity shaping element, that can be used as a model and a medium (Waldheim 2016). Under this scope, landscape plays a significant role in the Mediterranean and can be the catalyst in building future resiliency. The protection and restoration of coastal ecosystems is vital for building resilience in the face of climate change (Chausson et al. 2020). The project of ecological re-adaptation of the existing systems as urgent and pressing, while the formation of «landscape as an infrastructural field of practice» is coming into foreground (Bélanger 2016). Landscape urbanism can potentially contribute by embracing the dynamic inhabitation processes and setting the frame for a sustainable coastal inhabitation. «Landscape Urbanism could be an urbanism strategy that gives voice to the restorative and resistive social and cultural formation of territories – and the evocative power of landscapes» (De Meulder and Shannon 2010). The protection of the multispecies coastal system, under the pressure of a changing climate, relates more to the effort of inventing and establishing new balances, rather than imposing measures to maintain the existing balance. The unexpected extremes are seen as threatening events that create hostile conditions for all inhabitants, altering ecosystem balances, but what if they establish new balances on the dynamic land-sea boundary? «It is widely acknowledged that effective problem solving across the land-sea boundary, and the sustainable management of coastal and marine social ecological systems, requires terrestrial and marine spatial planning to be linked» (Morf et al. 2022). Spatial planning and design play a crucial role in this process and «it is important to highlight that most of the literature shows that no universal solution exists, and that robust planning and implementation is a prerequisite for any successful intervention» (MedECC 2020, p. 562). It is argued that «[...] what is needed is a completely new way of thinking about organisms and about their relations with their environments; in short, a new ecology» (Ingold 2000, p. 173). Therefore, the reinvention of coastal inhabitation modes is vital and arrives along with the discussion on human's relationship with nature. What does a multispecies approach offer on a contemporary redefinition of coastal inhabitation?

To better illustrate the discussion and focus on the local scale, it is useful to mention a couple of cases from tourism seen as a temporary inhabitation process. Coastal tourism is a multidimensional topic in the Mediterranean due to the variety of scales and kinds of touristic facilities and appropriations but also due to its importance as an economic activity. An interesting case study on coastal inhabitation is that of free camping. Free camping is an example of temporal human inhabitation without a permanent shelter – expressed as low-cost vacation in nature (coast-mountain-river-forest) – using the tent as an ephemeral structure, as a temporary shelter for the visitors. It is currently an illegal activity in Greece, due to environmental protection concerns. Nevertheless, free camping remains a popular activity in many places, both on island and mainland coasts, especially during the summer months. Even though the unregulated status of free camping may not guarantee the protection of the involved territories, similar nature-protection concerns are not projected on other types of tourism such as the large all-inclusive hotels located directly on the beach. Visitors in such resorts are probably disregarding the surrounding environment, as their focus is oriented to the inside of the accommodation unit and to the offered services. From the above, it is evident that one parameter that influences the balance of multispecies inhabitation is the time and intensity of human appropriation of the coast.

### CONCLUSION NOTES

The notion of conviviality is crucial in coastal inhabitation, when seen as a fragile multispecies inhabitation. It's essential to balance human activities with the needs of other co- habiting species to ensure the long-term sustainability of coastal ecosystems. Efforts to protect and conserve coastal ecosystems should take into account the needs of all species involved and spatial design in all levels need to re-establish the relation between man and nature. The effort to build resilience by maintaining healthy ecosystems that can adapt to changing conditions, is enhanced by the adaptation of a multispecies approach in coastal inhabitation. Preserving these ecosystems and the interconnections among them is fostering harmony among all species sharing these environments. Overall, multispecies inhabitation on the coast is about fostering coexistence, conservation, and sustainability to ensure that these unique and vital ecosystems thrive for both human and non-human inhabitants. When multispecies landscapes assemble and emerge, benefits and turbulences come at the same time (Aisher and Damodaran 2016, p. 294). The role of urbanism in this exchange is to negotiate

the interrelations and invent new balances of the system as a whole. To summarize, a multispecies inhabitation approach for the coast is about recognizing and respecting the intricate web of life in these environments, with the goal of achieving a sustainable coexistence of various species, including humans, in these valuable ecosystems. «It requires that we imagine ourselves as “inhabitants not just of a human lifetime or generation, but also of deep time” (Macfarlane 2016)» (Aisher and Damodaran 2016, p. 295).

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# SETTLEMENTS

## EVOLVING ECOLOGIES ACROSS THE LAND-SEA BORDER

This issue closes the first cycle of Seascope dedicated to the main phenomena affecting and shaping the coasts of the world. The journal wanted to turn the spotlight on the contribution that human actions are having with respect to the erosive phenomena accelerated by climate change, to the many forms of sustainable and unsustainable tourism, to the decommissioning and abandonment of heritage, and to legitimate or abusive margin occupation processes.

In the first four issues, critical reflections were presented often accompanied by action programs, plans and projects, drawing from the research carried out (or being carried out) by the authors, sometimes even through educational experiments useful as a test bench for testing possible innovations. Involving a plurality of different knowledge, Seascope observed these phenomena and possible approaches to mitigate or to correct them, sometimes to enhance them and operational methods to trigger processes useful for building better conditions to inhabit fragile coastal landscapes.

The selected contributions for this issue document the multiple facets of coastal settlement processes, restoring their stratified nature towards both land and water, and providing design and applied research examples to recognise and define new balances.

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