

Seaport ecology in seaport ecologization: yesterday's concern, today's footnote?

Mathilde Fernandes^{1*}, Eric Foulquier², and Gaëlle Guéguen-Hallouët¹

¹ UMR AMURE – IUEM – UBO, Plouzané, France

² UMR LETG – IUEM – UBO, Plouzané, France

Abstract. Ecologization refers to taking environmental issues into account in human activities in order to reduce their footprint. In the context of the energy transition, decarbonisation now seems to be prioritised over all other considerations. From this point of view, a paradigm shift seems to have taken place. Ports, which are by nature subject to very high anthropogenic pressure, have seen their footprints expand to meet the contingencies of their time (industrial port areas, gigantism, poldering). Ports have had to comply with these new environmental requirements for all their adaptation and modernisation projects (e.g. dykes or dredging). However, the emergence of ecological and energy transitions has led to a conceptual ambiguity between ecologization and decarbonization. Building on a semantic and analytical framework, the paper defines port ecologization et port ecology and provides a theoretical model for observing the phenomenon of ecologization in these areas. An exploratory analysis of French decentralized ports, based on their websites, tend to reveal their ecologization trajectories. The reflections presented below are part of the work carried out within the framework of the Chaire Transitions Portuaires et Maritimes hosted by the University of Brest Foundation.

Keywords: Greening ; Port ecology ; Decarbonization ; Ecological transition ; Energetical transition ; Ports ; Biodiversity ; Environmental impacts ; Decentralized ports ; Regional ports ; French ports

Main text

While it is widely accepted that commercial ports play an essential role in globalization—first in trade and then in the broader economic integration of the world—the issue of reducing their impact on the global ecosystem remains a problem that requires further study, both in terms of the impacts themselves and the solutions needed to address them. Thus, since the early 1990s, the process of port ecologization appears to have taken center stage in the development of port strategies. From rhetoric to action, is port ecologization a verifiable reality?

Like many other human activities, commercial ports are not immune to the wider debate on the environmental impacts of industrial societies. This growing environmental awareness, driven in part by the work of Rachel Carson (Carson, 1962), as well as the Meadows (1972) and Brundtland (1987) reports, found a global resonance at the Earth Summit in Rio in 1992, which marked a turning point in the implementation of public environmental policies. In 1992, Europe adopted the Habitats Directive, a flagship piece of legislation for the protection of biodiversity, which led to the establishment of the Natura 2000 network (Directive 92/43 EEC of the Council of 21 May 1992). The Water Framework Directive was adopted eight years later (Directive 2000/60/EC of the European Parliament and the Council of 23 October 2000). The environmental awareness that had begun twenty years earlier was given a solid and mature legal framework in the early 1990s. In ports, this development resulted in growing concern about the conditions under which activities were established in the host regions (Carter et al, 2023).

The emergence of the concept of ecological transition in the early 2010s marked a new turning point in this process. At the same time, the concept of energy transition entered the political discourse. It is interesting to note that, in legal terms, one of the first instances of the term ‘ecological transition’ appears in the 2012 Act on Energy Transition for Green Growth. Whilst one might think that the ecological transition encompasses the energy transition, the legislator deemed it necessary to distinguish between them (Audrain-Demey, 2018; Guéguen-Hallouët, 2018). Almost 15 years later, the energy transition seems to have readily taken precedence over the overarching concept. Its corollary, decarbonisation, is understood as the policies and practices aimed at mitigating the effects of climate change; in other words, the set of measures or policies designed to reduce or even eliminate greenhouse gas emissions and phase out fossil fuels. In ports, it targets activities related to improving energy efficiency, producing renewable energy, accommodating new energy sources, creating energy hubs, and developing intermodal transport modes that consume less hydrocarbons per tonne transported (inland waterways, rail). To achieve this, quays must be reinforced, and space must be made available to store the large volumes of equipment required by this new industry. Land reclamation and encroachment on waterways are often the only solutions. The greening of regions and the greening of ports follow a trajectory that is paradoxical in many respects.

Two concepts must therefore be distinguished when considering the relationship between ports and the environment. The ecologization of port operations is not limited to port ecology. Whilst port ecology can be understood as the identification of the specific ecosystem characteristics of these highly artificialised coastal areas, the ecologization of port operations involves integrating environmental issues into the port’s economic and decision-making model. Thus, port greening concerns both the preservation of the port ecosystem and the development of new functions linked to mitigating the environmental impacts of human activities, such as recycling, decarbonisation, business ethics, challenging extractivism, offsetting, restoration, and certification and risk management.

However, port decarbonisation appears to have its own priorities. In a port economic model based on the growth of technical solutions and the economic return on investment, the preservation of biodiversity and pollution issues seem to have been completely overshadowed by the imperatives of decarbonisation. In this sense, the European Sea Ports Organisation (ESPO) framework document on the environmental priorities of European ports illustrates this unambiguously. For thirty years, ESPO has been listing the environmental priorities of ports. Whilst these priorities cannot constitute a ‘ecologization trajectory’ as such, they nevertheless provide insight into the major shifts in the port-environment relationship (Montouroy et al, 2023). In 1996, issues relating to the expansion of port

footprints driven by changes in the maritime sector topped the list of priorities. A shift occurred in 2013, with air quality taking the top spot. Ten years later, air quality still occupies the same position, a place it shares with climate change and energy consumption. Over the past thirty years, there has been a genuine reconfiguration of port paradigms in environmental matters.

In this context, can decarbonisation be regarded as the building block leading to the ecologization of port operations? Or is it merely yet another iteration of the model, without the model itself ever being fundamentally challenged? In other words, does the energy transition lead to an ecological transition, or is it ultimately nothing more than the development sector's response to the constraints of climate change? Answering this question requires us to examine port practices in the areas of environmental management, conservation and ecological remediation.

1. The Semantics of the Port Environmental Issue

Although less widely accepted among decision-makers, the concept of port ecologization is one that deserves closer attention, as it is currently discussed primarily within academic circles (Foulquier et al., 2025).

From the perspective of meaning and origin, ecologization stems directly from the political objective of ecological transition. In this sense, ecologization is the implementation of ecological transition at the level of a given space or object. More specifically, "ecologization refers to the processes through which the environment is taken into account in public policies, organizations, and even professional practices" (Mormont, 2013). Ecologization processes thus aim to reduce the ecological footprint of the targeted activities.

From the perspective of industrial ecology, ecologization refers to practices aimed at reducing environmental impacts while contributing to local development through the circular economy or the development of innovative activities. In this context, reducing ecological impact boils down to the efficient use of natural resources, particularly energy (Beyer & Lacoste, 2017). Other environmental impacts—those affecting biodiversity or forms of pollution other than air pollution—are excluded from such a definition. This aligns with Léo Magnin's analysis, for whom "ecologization is neither a structured nor a uniform movement" because "not all actors agree on its content or its application" (Magnin, 2024).

According to Foulquier, Guéguen and Fernandes (2025), ecologization is a process that enables environmental issues to be integrated, to varying degrees - that is, in line with priorities - into strategies for establishing business activities within a region. This interpretation aligns with the proposition put forward by Jean-Paul Deléage (2018), for whom the question is indeed whether a greening of capitalism is possible. For Deléage, this evolution of capitalism must be assessed in terms of "its ability or inability to extend its production-consumption model to all of humanity whilst internalising ecological costs" (Deléage, 2018, p.20).

Its connection to the concept of ecology is far from obvious. To put it succinctly, we could say that ecology focuses on describing an environment or an object, whereas ecologization—a more fluid concept—refers to a renewed form of management (and remuneration within the framework of a cost-benefit analysis), comprising a set of practices aimed at integrating the principles of sustainability.

In accordance with the original definition given by Haeckel in 1866, port ecology in its primary sense would focus on the characteristics and functioning of an environment that is, by nature, anthropized. A new proposal comes from human ecology, a movement that emerged in the 1930s with the Chicago School, which analyzes urban metabolism; this approach was revived in the 2000s to assess the environmental impact of the city-port relationship, with the aim of providing a systemic analysis of material flows and their implications in terms of secondary flows, logistics, transportation, and data (Duval, 2025). This broad definition of port ecology allows us to consider all the factors that shape this socio-ecosystem. Four major components structure port ecology: the site and its geographical space; the port functions deployed; the footprints and their infrastructural materiality; and the geopolitical footprint of the governance mechanisms employed (Foulquier et al., 2025). It is understood that these four components result from a geo-historical process and cannot propose a uniform model. In other words, “to each port its own ecology.”

1.1 The descriptors of port ecology

Site and Geographic Space

Ports can be classified according to eight geographical configurations: from bay ports to roadstead ports, from estuary ports to delta ports, from waterfront ports protected or unprotected by barrier islands, to river ports (Rodrigue, 2024). Added to these configurations are specific bioclimatic conditions, such as current dynamics or microclimates. Each port is also situated within a specific watershed, whose inputs will influence the composition of its ecology. The human impact on its watershed, as well as the type, duration, and intensity of activities taking place or having taken place there, affect ecological patterns. For example, in the bay of Brest, traces of lead, silver, and zinc are found in varying quantities. These are the result of a former lead-silver mine operated in the 18th and 19th centuries in Huelgoat-Poullaouen. More recently, the use of nitrogen fertilizers and manure for industrial crops has encouraged the proliferation of green algae in this same harbor and along the french brittany coast.

Port Functions

Port functions will inevitably have an impact on the ecology of this area. These impacts vary notably depending on the nature of the goods handled, the equipment used to process or move them, and the storage sites. The varying degrees of volatility and toxicity of certain bulk materials, as well as the duration of these activities, will result in impacts of varying severity and duration on ecosystems. Whether or not certain equipment is used—such as a dust-collection system when storing highly volatile bulk materials—and the storage location (open air or warehouse) must be considered when assessing the intensity of these impacts. Finally, the intensity of port activities and traffic are important variables. They result in impacts on air quality, noise levels, the volume of discharges, the introduction of non-native species, etc.

Port Areas and Their Infrastructure

Port areas will, of course, have a significant effect on the ecological regime of ports. The extent of port activities determines the area occupied by the port, whether a simple dock or a massive port. According to Sengupta & Lazarus (2023), the coastal footprint of the world's sixty largest ports has grown by approximately 20% over the past thirty years. These artificial structures replace natural marine and terrestrial habitats. The physical nature of infrastructure, particularly in terms of submerged materials, design, and the age of

infrastructure structures, plays a role in port ecology. Concrete has dominated since the early 20th century. This material is known to be “more homogeneous and less complex, resulting in a net loss of habitat for many marine species” (Bouchoucha & Pioch, 2025, p. 105). Furthermore, breakwaters and dikes alter or reduce hydrodynamics and contribute to the retention of microbiological or chemical contaminants.

Governance

Finally, port ecology cannot be separated from its political and legal dimensions. Legally, this involves regulations at the international, national, or local levels that govern various port activities, particularly regarding environmental matters. The political context is also of great importance. The port sector operates in a globalized sphere, where a distant event can have direct effects on the decisions that will be made, and consequently on the level of investment in environmental issues. The choices made by the port authority, the financial resources available, as well as the skills and awareness of employees regarding port ecology are determining factors for the protection of the environment in all its dimensions (Carter et al., 2023).

Port ecology, understood in a broad sense, stems from each of these four components. Port ecologization, a concept that is by nature elusive, can also be understood through a set of descriptors.

1.2 The descriptors of port ecologization

Ecologization is a process, and as such involves decision-making, which is itself driven by strategies. With ecologization, it is not a matter of a “given,” but of a construction—more or less collective—based on choices, more or less imposed. Two possible paths govern these choices. It may involve “endogenous ecologization,” driven by regulations and compliance requirements to which the Port Authority must adhere. This internal momentum can also stem from a logic of competitiveness when it comes to asserting a unique identity within a competitive landscape. But the port is not alone; it is part of an ecosystem. It is therefore also a matter of “exogenous (or sectoral) ecologization,” when the port is embedded within logistics networks driven by users seeking to reduce the impact of their activities, or constrained by sector-specific regulations (Bouleau et al., 2020).

Ecologization is the application of sustainability principles in the areas of biodiversity conservation, pollution control, and decarbonization within the industrial-port area in the form of policies or practices. These practices may stem either from regulatory requirements or from voluntary initiatives.

To be identified, the ecologization process must be observable. From this perspective, a theoretical model can be conceived around six descriptors. A descriptor should be understood as a set of markers. These markers are designed as indicators of presence or absence for the port in question : does this port undertake a specific action or implement a specific measure, yes or no? Each marker can then be broken down into indicators, this time capable of evaluating the action or mechanism in question, along a gradient ranging from best to least favorable, or from most to least significant (Fig. 1).

According to Foulquier et al. (2025), the trajectory of a port’s ecologization rests on five descriptors : city-port interactions, changes in the nature of traffic handled, new port

functionalities, changes in operating conditions, and the evolution of governance. We will add a sixth category to these five: ecological action (Fig. 2).

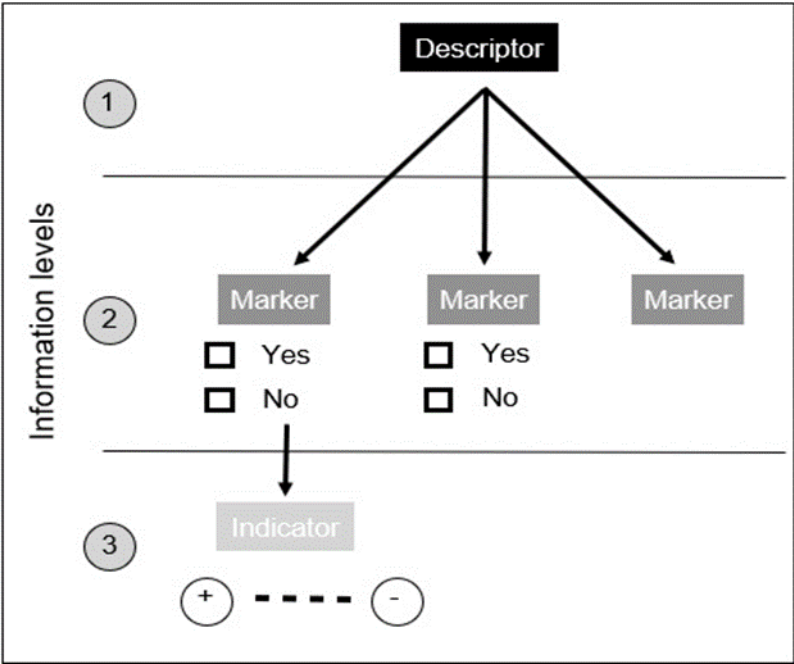


Fig. 1. Information levels

City-port or territory-port relations

A port is not an autonomous entity; it operates within a region and in close proximity to its host city. The nuisances caused by port activities can strain relations between residents, public authorities, and port authorities. But the port also generates positive externalities, such as the jobs it creates. In Brest, the commercial port is estimated to provide nearly 2,500 direct jobs. In this space between positive and negative externalities, ecologization measures are taking shape. The main tools for managing conflict—and thereby acceptability—are mediation (fostering public understanding of port operations), monitoring of nuisances (set up of a « nose » observatory in Brest to identify the odours coming from the seaport), and, in the best-case scenario, a voluntary reduction of pollution and nuisances.

Nature of Traffic

There is a spectrum ranging from the extractive port focused on mass-scale operations and the flow of hydrocarbons, minerals, and industrial agricultural products, to the ethical, green port based on organic and conventional goods, sensitive to ethical issues such as product origin, recyclability, and the nature and origin of carbon. Currently, port activities remain largely tied to those of the surrounding region. Thus, many French ports continue to depend on traffic involving hydrocarbons, bulk cargo linked to industrial agriculture, or products from extractive industries.

New functionalities

Driven by the ecological transition, new, “more sustainable” functions are emerging, particularly in connection with the energy transition. Projects range from the integration of new marine energy sources to energy production (such as hydrogen and solar power) and the use of carbon-free fuel for ship bunkering. To a lesser extent, the development of sailing remains an industry in search of a sustainable business model, as demonstrated by the recent bankruptcy filing of the French company Twot, a pioneer in sailing-based freight transport.

Operating Conditions

There are two types of operating conditions: those arising from day-to-day port management, and those related to structural measures.

Ports are committed at their level to strategies aimed at limiting their own impact. These measures are diverse: management plans for waste reduction and recycling, the use of eco-design in the construction or renovation of buildings, environmental upgrades of certain equipment, and reductions in energy consumption (shore power, electric vehicle fleets). Port authorities can also engage in certification processes, such as ISO 14001 for environmental management.

In the context of ecological changes, structural measures must also be promoted. River or rail intermodality contributes to this momentum and features in many major projects at French ports. The circular economy is also widely embraced. It is based on the creation of substitution flows (Company A’s waste becomes Company B’s raw material) and sharing flows (for example, through the joint recovery of waste) (Boutillier et al., 2024). In Brest, a project to create an industrial boiler plant for the local production of energy from solid recovered fuels supplied by Guyot Environnement to provide steam to the company Bunge is one such example.

Environmental Governance

The conditions for implementing environmental governance depend on both regulations and policies at the national and supranational levels. Following these guidelines grants access to a number of subsidies. However, to be effective in these areas, the port itself must be proactive in implementing the ecological transition through dedicated resources and staff trained in these matters (Carter et al., 2023).

Environmental Action

Regarding the sixth descriptor discussed here, it can be broken down into seven distinct indicators: 1. Does the port state its intentions regarding the ecological management of its surrounding area in its strategic plan or communications, demonstrating a commitment to the environment?; 2. Does the port have a natural terrestrial area within its port domain that it manages? 3. Is the port engaged in monitoring species, whether fauna or flora? 4. Has the port initiated a process of restoration, renaturation, or ecological compensation? 5. Is the port involved in the governance or management plan of a designated natural area (Marine Park, ZNIEFF, Natura 2000, etc.)? 6. Has the port carried out one or more voluntary, one-off actions to benefit wildlife or plant life (planting programs, installation of species-hosting structures, etc.)? 7. Is the port involved in raising awareness about ecological issues among professional users or the general public?

This descriptor ultimately corresponds to port ecology in its strictest sense; it must contribute to preserving the good ecological status of the port environment. It follows that ecologization would encompass port ecology.

Furthermore, it is clear that whilst decarbonisation contributes to port ecologization, particularly when new functionalities are introduced (3rd descriptor), it is only one part of this process. Given that ecologization is a cumulative process, each descriptor is essential. The task now is to analyse the role played by the sixth descriptor in environmental action within port practices, particularly in relation to decarbonisation, which currently appears to account for a large part of the effort to make ports more environmentally friendly.

Descriptor	1. Port territory insertion						
Markers	Port center	Dry port & hinterland logistics	Density of road access infrastructure	Port city connectivity	Waterfront occupational density	Expansion project	
Descriptor	2. Nature of traffic						
Markers	Oil and hydrocarbon	Extractive dry bulks	Exps	Breakbulk	RoPax	Recycled materials	Cumulative deadweight tonnage of ships calling at the port
Descriptor	3. New features						
Markers	Biofuel production	Renewable energy production	Supply of new energies	Wind ship cargo terminal			
Descriptor	4. Operating conditions						
Markers	Superstructures decarbonation plan	Shore electric power	Label & certification	Professional training plan	Digital monitoring & numeric optimization	Management of dredged sediment	Management of ballast water
Descriptor	5. Governance						
Markers	Environmental department	Environmental strategy	Ethic strategy	Innovation efforts	Regulations compliance		
Descriptor	6. Ecological action						
Markers	Natural domain	Environmental communication effort	Ecological monitoring system and scientific partnership	Restoration, compensation, renaturation	Involvement in a management plan for a classified natural area	Ad hoc ecological actions	Mediation efforts

Fig. 2. Descriptors of port ecologization

2. The Decentralized Ports website, a marker of ecologization trajectories

Unlike decentralised ports, major seaports are legally required to establish specific management arrangements for port areas where nature conservation is a concern (Article R 312-63(4) of the Transport Code). These issues are, in fact, extensively covered on their websites. As such, relying solely on websites as a source for observing the greening trajectory of major seaports is unsatisfactory, hence the selection of decentralised ports for our sample. Our highly exploratory approach involved examining the stated environmental strategies of French decentralised ports, based on what they communicated on their websites.

The idea here is to try to identify the prominence given to the sixth descriptor of greening – environmental action – in the projects hosted and highlighted on the ports’ websites. There are around thirty decentralised ports in France[†]. Of these, seven do not have a website[‡].

The vast majority of ports showcase their ecologization initiatives on their websites. However, it is important to keep in mind that the content of these websites is not always exhaustive; some initiatives or projects may not have been listed. During an interview with a member of the management team at a decentralized port on the Atlantic coast, we learned of their commitment to the Green Ports Alliance (label). Yet this initiative does not appear anywhere on their website, despite the content being updated regularly. Lorient, for its part, presents itself as “the 1st port of french brittany for hydrocarbons,” and makes no mention whatsoever of its activities related to renewable energy, even though they are part of its development strategy (Regional Port Strategy 2023–2033—The Region’s Ports in the Service of Sustainable Development in Brittany and Its Maritime Vocation). In this regard, this analysis of port websites should be viewed as an indicator, an initial marker of what truly constitutes the concerns of port authorities in this area. Before examining the nature of the projects supported in this context, it is worth addressing the ports that do not follow the general trend.

2.1 Each Port Has Its Own Ecology and ecologization Approach

The Impact of Port Functions on Port Ecologization

In our findings, we observe an initial variable related to the nature of certain ports’ functions. Ecologization is absent from the websites of ports whose activity relies either primarily on the seafood market, such as Boulogne-sur-Mer, or on cruise tourism, as is the case with Corsican ports. The less industrial nature of these ports’ economic fabric could explain this absence. Furthermore, the fishing industry is subject to fairly extensive environmental regulations, so concerns related to ecologization would likely lie elsewhere in the supply chain. Regarding the Corsican ports, one might hypothesize that in the public imagination, an industrial port is perceived as polluting more than a port dedicated to cruises. The sites of the five Corsican ports—Ajaccio, Bastia, Port de l’Île Rousse, Porto-Vecchio, and Propriano—are all built according to the same layout. With limited amenities and clearly intended for passenger transit, various information is available there, such as boat schedules, tourist sites “to discover,” and on-site services (parking, access). Two issues seem to be of particular concern to these port authorities: ensuring a high level of safety for the cruise lines and their passengers, and promoting cruises commercially.

In contrast, ports that host critical industries within their territory—producing volatile substances harmful to health and the environment—generally pay closer attention to environmental issues. For example, the port of Bayonne operates in a context where the risk of industrial pollution is heightened due to the nature of the industries present on-site. The metallurgy sector accounts for nearly half of the port’s tonnage; the fertilizer sector represents 20% of the port’s activity, and the chemical sector 10%. These activities cause various nuisances and are a source of concern for the local population. Consequently, as early as 1995, a collaborative framework was established to ensure the prevention of industrial

[†] Ajaccio, Bastia, Bayonne, Bonifacio, Boulogne-sur-Mer, Brest, Caen, Ouistreham, Cherbourg, Dieppe, Calais, Concarneau, Fécamp, Port de l’Île-Rousse, Le Légué, Le Tréport, Les Sables d’Olonne, Lorient, Nice, Port-Vendres, Port La Nouvelle, Porto-Vecchio, Propriano, Rochefort, Tonnay-Charente, Saint-Malo, Sète, Toulon, Tréguier. Atlas des ports décentralisés, Cerema, 2021.

[‡] Concarneau, Fécamp, Le Légué, Le Tréport, Les Sables d’Olonne, Nice, Tréguier

pollution in the estuary: the SPPPI Estuaire de l'Adour association, which brings together associations, government agencies, industrial, and local authorities. Its areas of focus include water quality, industrial risks, air quality, and noise pollution. For all these reasons, it is not surprising that environmental protection receives such attention on the website.

The Link Between Port Morphology and ecologization

"Every port has its own ecology," we wrote previously. A port's path toward ecologization cannot ignore the specifics of its location or site conditions. Estuary ports—such as Bayonne, for example—depend on dredging. This issue is readily accessible on the port's website, proof if ever there was any that the subject is a priority. There, one notices the omnipresence of Hondarra (Basque for "sand"), the dredging vessel attached to the port. A banner at the bottom of the homepage displays the port's projected figures for 2023. It states that "100% of the dredged sand is deposited in coastal areas." Bayonne is naturally subject to sedimentation that leads to shoals at the mouth of the river; coupled with strong ebb currents, this contributes to the formation of a bar, making access to the port difficult and sometimes dangerous. As in most European and global ports, dredging is an essential activity for the port's continued existence. At Le Légué (Saint Briec), it takes place almost daily. In Bayonne, the operation occurs several times a year. Spillway operations are now carried out mainly in the coastal zone to compensate for the erosion of the beaches at Anglet. In 1974, the State, then the owner of the port, was found liable for coastal erosion caused by dredging. The issue is of great importance to the port. It is equally important for the nature of the relationship the port maintains with its surrounding area. This dual necessity explains the emphasis placed on communication regarding the subject and the prominence of measures related to the environmental management of dredging operations in the public communication of port activities.

The Website as a Tool for Communication Between the Port and Its City

We start from the premise that port websites tend to highlight elements of dialogue with the region where the city and the port coexist. In Bayonne, controversies have arisen with the local population, either due to dredging or the risks of industrial pollution. In this sense, the website serves as a medium, enabling the defusing of conflict through communication or the cultivation of a reassuring image based on the idea of relative transparency. It is through this lens that we assess the significance of the information, insofar as this communication reveals strategies—and, consequently, priorities for action.

This is why, in Bayonne, decarbonization is less prominent on the website, even though this concern appears in the news and, above all, completely overshadows other environmental issues when one examines the port's strategy. Out of 30 actions, only one concerns biodiversity, compared to 10 for decarbonization. There is a disconnect between the environmental concerns displayed on the website and those contained in the port's development strategy.

It is clear that the port's environmental approach is deeply rooted in the local context in which the organization operates. Depending on the sites and their specific environments, each port implements actions tailored to its unique context and primarily addressing local constraints. This is an interesting point that underscores how port ecologization is inherently dual-natured, balancing compliance with standards set at national and supranational levels with local engagement with decision-makers in the surrounding community. Beyond these specific cases, and when it comes to ecologization port sites, the general trend is indeed to prioritize projects related to decarbonization.

2.2 Decarbonization: The Focus of Attention

An overrepresentation of decarbonization projects

Of all the ports with a website (20), only 8 do not highlight decarbonization (Ajaccio, Bastia, Bayonne, Bonifacio, Boulogne-sur-Mer, Port de l'Île-Rousse, Lorient, Port-Vendres), including 5 that do not address environmental issues at all (Corsican ports). The vast majority of ports that highlight their ecologization initiatives do so through decarbonization projects. This priority is evident from the “About Us” section, where port authorities seek to introduce themselves. Ports de Normandie state their ambition to become “a major player in the MRE (marine renewable energies) sector”; Brest sees itself as a “pioneer of the energy transition”; Port-la-Nouvelle describes itself as “a port of the future between land, sea, and the energy transition”; Calais and Sète share this same desire to play a decisive role in the energy transition of their operations. This communicative language is revealing. Decarbonization is less an act of ecological remediation than a lever for development. In other words, ecologization through the lens of decarbonization is intended more as a transformation of an economic model than a shift toward an ecological trajectory.

Port La Nouvelle, for example, likes to define itself as a port in transition whose ambition is to become a major port—a “grand port,” if you will—of the energy transition. Backed by an investment of over 600 million euros, it has equipped itself with new infrastructure, such as a terminal dedicated to green hydrogen and another to MRE, particularly floating wind power. On its homepage, a “key port figures” section highlights key data for the facility. Of the six key figures, three relate to the energy transition: 7 hectares for assembling floating wind turbines, 6,000 metric tons of certified hydrogen produced per year (this figure does not actually correspond to actual hydrogen production, but to the production target), and the first energy-positive region. Projects include, for example, the establishment of a hydrogen production plant at the port in 2024, a project led by the company Hyd'Occ. Among the port's key infrastructure projects, we also find initiatives related to wind power and others focused on multimodality (rail-port zone).

In Bretagne, the Region has allocated some 500 million euros to its 21 ports over the next seven years, or 80 millions euros per year, the vast majority of which will be distributed among the region's three main ports—namely Brest, Lorient, and Saint-Malo. The President of the Region does not hesitate to invoke the image of a “financial wall” to describe the scale of the investment in the ports. In Brest, this sum is intended in particular to finance the development of a multimodal terminal, create an MRE hub, and install electrical connections for ships at the docks. In 2012, 220 millions euros had already been allocated to create a dedicated area for new energy sources.

Compared to such sums, projects related to ecological action seem rather insignificant.

Unambitious ecological projects

Apart from the websites of the ports of Corsica and Boulogne-sur-Mer, most address the issue of ecological action from the perspective of biodiversity protection or pollution reduction to varying degrees. As we mentioned, this sixth descriptor can be broken down into six indicators: 1. strategic communication; 2. Presence of a managed terrestrial natural area?; 3. Implementation of species monitoring (fauna or flora)?; 4. Engagement in a process of restoration, renaturation, or ecological compensation?; 5. Involvement in the governance or management plan of a designated natural area?; 6. Implementation of ad hoc voluntary

actions in the form of “ ” in support of wildlife or plant life; 7. Involvement in awareness-raising initiatives on ecological issues targeting professional users or the general public.

Most ports at least check the least restrictive box, which involves mentioning the protection of their natural areas in their values or principles, some with greater care than others[§]. However, unlike the GPMs, decentralized ports rarely manage any natural land areas. A natural area is an unspoiled zone, defined as “an area that is either natural, bare or covered with water, or vegetated, constituting a natural habitat [...]” (Article L 101-2-1 of the Urban Planning Code). Dieppe, which is one such port, has implemented eco-grazing to manage its green (semi-artificial) and natural spaces. In reality, few ports implement this type of voluntary, ad hoc environmental initiative. Lorient mentions planting honey-producing trees to support its beehives, while Sète and Toulon have a plastic waste collection project.

In terms of monitoring, studies, or research, Ports de Normandie is one of the few to highlight initiatives of this kind. Dieppe is participating in the development of an environmental assessment. The study covers 10 ports and focuses on sediments, waste, water quality, invasive species, and ecological continuity within its territory^{**}. Also at this port, a study is being conducted to ensure ecological continuity—that is, sufficient sediment transport and the movement of migratory fish on the Arques River^{††}.

When it comes to raising awareness among its professional and private users, Port-Vendres stands out. Since 2024, the Compagnie Port-Vendraise has been the company managing the Port-Vendres port concession. A “port management” tab outlines the company’s vision for its port. Social and environmental issues are at the heart of this vision: a “resource-efficient and sustainable port at every stage of operation” and a “model port” in its commitment to ecological transformation. Port-Vendres also presents itself as a “responsible port”; a tab is dedicated to these commitments, emphasizing “uncompromising compliance with regulations” regarding the protection of the marine and coastal environment. One page is devoted to “best practices during port calls” (wastewater, waste, invasive species, freshwater conservation, etc.), and another to “the port’s commitments and actions.” Also highlighted are awareness-raising initiatives (the “local biodiversity” tab) and port protection efforts (compliance with the Gulf of Lion Natural Park specifications, or monitoring juvenile fish via an app). The scope of these actions is relatively limited; complying with the regulations in force within the natural park should go without saying. The port does not go beyond the legal requirements regarding environmental protection, but makes genuine efforts in terms of raising awareness. Port-Vendres is one of the few ports to give equal prominence to decarbonization and biodiversity. Nevertheless, it should be noted that it is still difficult to obtain details of the actions taken—and especially the results of monitoring these actions—from the port’s website.

The Port Charente Atlantique, comprising the ports of Tonnay-Charente and Rochefort, is located at the heart of the Gironde Estuary and Pertuis Sea Marine Nature Park and Natura

[§] Port-la-Nouvelle defines itself as a “responsible port” and, as such, outlines its commitments to sustainable development. To this end, the port devotes a page to its sustainable development goals, which are aligned with the UN’s SDGs. The lack of care taken in drafting this page is perplexing; incorrect syntax, numerous spelling and typos pepper the entire text. In substance, the commitments remain vague, to say the least. <https://www.port-la-nouvelle.com/sdgs/>

^{**} The environmental assessment cost €76,000, 50% of which was funded by the Seine-Normandy Water Agency, with the remainder shared among the 10 ports.

^{††} The total projected budget for this study is €100,000 (excluding tax), 90% of which is covered by a grant.

2000 sites. As part of the management of activities carried out within the park, a plan outlines the actions to be implemented in various areas of intervention, particularly port activities that have a direct impact on coastal and marine ecosystems. The management plan also requires that the port's various practices—dredging, ship maintenance, waste management, pollution control, etc.—take the natural marine environment into account.

Effective, large-scale actions—that is, those requiring significant time and resources from the port—are quite rare and are always initiated as compensation for environmental damage caused by development projects. The expansion of the Ouistreham Ferry Terminal in 2010 led to the implementation of compensatory measures, including the restoration of the François lands—agricultural polders—to their original water status. Monitored by the Coastal Conservation Agency, this project is estimated to cost just under 250,000 euros. The creation of a 4.5-hectare mudflat is another example of compensatory measures resulting from a 3-hectare expansion of the Caen-Ouistreham outer harbor to build the maintenance base for the Calvados wind farm (Courseulles-sur-Mer).

Ultimately, projects related to decarbonization are the most prevalent in ports and the ones most prominently highlighted. Initiatives dedicated to ecological action are more varied. The port's involvement in this area is very often mentioned in the “port values” section, though this does not necessarily translate into a set of concrete actions.

Conclusion

Ecologization is a cumulative process aimed at integrating environmental concerns into all practices within a given sector or target area—in this case, ports. To assess this phenomenon, we have developed six criteria that allow us to determine whether or not sustainability principles are being applied in the actions or initiatives undertaken. For a comprehensive assessment, all descriptors must be considered equally. However, it has been evident for several years that the sixth descriptor, relating to ecological action, is often neglected in favor of descriptors promoting the decarbonization of activities. This observation is all the more apparent when examining the ecologization initiatives of ports as presented on their websites. A prioritization of environmental goals appears to be deeply ingrained in how ecologization is practiced in French ports. This trend is also evident in policies at the national and supranational levels. In the European Union's latest port strategy, decarbonization is presented as an economic opportunity to be seized, while ecological action is perceived more than ever as a constraint (Eu Ports strategy, COM (2026) 112, 4.03.2026). To boost competitiveness, the EU promises, under the environmental sustainability pillar, greater “flexibility,” to “simplify the regulatory burden,” to accelerate environmental assessments, and even to tacitly approve decarbonization projects of strategic interest! The environment is becoming a constraint to be circumvented in order to remain competitive. It is clear that as long as this narrative prevails, port ecologization cannot be fully realized. To use the vocabulary of European policies, it is more necessary than ever to recognize the interdependence of environmental issues and to apply an integrated approach to the implementation of ecologization in ports. The goal of the energy transition is to lower CO₂ levels and halt global warming, which is harmful to all living things. In this regard, it makes no sense to assume that the solutions proposed to achieve the transition could mask other environmental emergencies or even harm the environment (Carter & Drouaud, 2024).

References

Books

1. S. Abbes, J. Guillaume, Ports de commerce et économie portuaire, (Presses universitaires de Rennes, Mare economicum: Enjeux et avenir de la France maritime et littorale, 2008).
2. G. Audrain-Demey, Une Méthode contemporaine pour un concept vieillissant : transition écologique et développement durable, (Mare & Martin, Droit, sciences & environnement, Penser et mettre en œuvre les transitions écologiques, 2018).
3. S. Boutillier, B. Laperche, B., S.T.K. Le, (L'Harmattan, Ports industriels en transition, 2024).
4. R. Carson, Printemps silencieux, (Houghton Mifflin, Boston, 1962).
5. C. Carter, T. Joltreau, L. Schewe, E. Foulquier & Y. Montouroy, Un élan portuaire vers une transition écologique territoriale ? Défis de gouvernance autour du Grand Port Maritime de Guadeloupe, (Presses universitaires des Antilles, Les transitions écologiques ultra-marine au concret, 2023).
6. A. Curd, E. Foulquier, Au-delà des quais : de la mondialisation aux invasions biologiques?, (Synthèses. Editions Quae, Les ports, un nouvel enjeu en écologie marine, 2025).
7. E. Foulquier, G. Guéguen Hallouët, M. Fernandes, Le fait portuaire face à la question écologique, (Fondation Sefacil, Ems, Coll. Les Océanides, Les Ports Territoriaux : Ambition, Action, Anticipation, 2025).
8. G. Guéguen-Hallouët, Les nouveaux instruments du droit de la transition énergétique, (Mare & Martin, Droit, sciences & environnement, Penser et mettre en œuvre les transitions écologiques, 2018).
9. B. Laperche, Le rôle des ports dans l'économie circulaire : Construction d'un tableau de bord d'indicateurs, (Centre de Recherche sur l'Innovation et les Stratégies Industrielles - ULCO, 2023).
10. L. Magnin, La vie sociale des haies : Enquête sur l'écologisation des mœurs (La Découverte, 2024).
11. Y. Montouroy, E. Foulquier, C. Gérard, La transition écologique des infrastructures : Compensation environnementale et débat public dans le cas du dragage du chenal portuaire en Guadeloupe, (Presses universitaires des Antilles, Les transitions écologiques ultra-marine au concret, 2023).
12. M. Bouchoucha, S. Pioch, S., Ingénierie écologique en zone portuaire, (Synthèses. Editions Quae, Les ports, un nouvel enjeu en écologie marine, 2025).
13. J-P. Rodrigue, The Geography of Transport Systems, (Routledge, 6e edition, New York, 2024).
14. F. Valideu, J-M. Farenc, F. Da Perimony, Atlas des ports décentralisés, (Cerema, 2021).
15. F. Viard, H. Rey Valette, M. Bouchoucha, Pourquoi un ouvrage sur les écosystèmes portuaires ?, (Synthèses. Editions Quae, Les ports, un nouvel enjeu en écologie marine, 2025).

Thesis

16. A. Duval, Gouverner le métabolisme portuaire : les relations socio-matérielles entre port et territoire à l'heure des transitions écologiques, Ph.D thesis, Nantes Université, 2025.

Journal articles

17. A. Beyer, R. Lacoste, La transition écologique des territoires urbano-portuaires : Les enseignements de la démarche de reconnexion énergétique engagée entre la ville et le port de Strasbourg, *Rev. d'Éco. Rég. & Urb.* **5**, 857–880 (2017).
18. G. Bouleau, C. Carter, A. Sergent, Y. Fournis, Quels territoires pertinents pour écologiser les industries qui misent sur le renouvelable ?, *Dév. durable et territoires.* **11.1**, 1-24 (2020).
19. C. Carter, F. Drouaud, Territory, ecological transition and the changing governance of ports, *Territory Pol., Gov.* **12.3**, 374-394 (2024)
20. J.-P. Deléage, L'écologie politique, vingt-cinq ans plus tard, *Écol. & Pol.* **Vol.56, n°1**, 17-34. (2018).
21. M. Mormont, Écologisation : entre sciences, conventions et pratiques. *Nat. Sc. Sociétés.* **21.2**, 159-160. (2013).
22. S. Pioch,, L'artificialisation du littoral : Comment l'éviter, la réduire ou la compenser ?, *Futuribles.* **442.3**, 63–78 (2021).
23. D. Sengupta, E.D. Lazarus, Rapid seaward expansion of seaport footprints worldwide. *Communications Earth & Environment.* **4**, 440 (2023).