

Understanding social acceptability in coastal wetland restoration. A socio-ecological perspective of the Danube Delta Biosphere Reserve

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Received: 21 November 2025; Revised: 18 December 2025; Accepted: 20 December 2025;
Published online: 22 December 2025

ABSTRACT: In this study, the Danube Delta Biosphere Reserve (DDBR) provides the geographical context for applying an interdisciplinary socio-ecological approach to the analysis of wetland restoration based on the analytical lens of social acceptability (SA). Especially in large-scale interventions, social acceptability emerges as an underrated multidimensional concept influencing both the viability and the success of the restoration. As the Horizon RESTORE4Cs project shows, social acceptability reflects how the local community perceives and supports the decision to restore. Even technically and ecologically sound actions may face resistance if local perceptions and expectations are neglected. However, these aspects are multifaceted, depending on place-specific factors. In this study, the socio-economic, cultural and environmental features of the DDBR are examined according to the eight components of SA, which include the territorial conditions of the local context and the presence of specific values and beliefs, environmental and societal impacts, risks, and local levels of knowledge, trust, and participation. The objective is to provide a novel, socio-ecological reading of the Danube Delta system, filtered through the factors that shape the local acceptance of wetland restoration and management. Via a mixed-method approach, the SA reading of the Danube Delta reserve confirms that, even in a mostly natural socio-ecological system, the factors influencing acceptability also include some relevant institutional and cultural aspects. The assessment of these aspects, however, remains ambiguous, since DDBR experts identify trust as the weakest cultural component that locally supports the acceptability of restoration. In RESTORE4Cs, this underestimation of the cultural determinants of SA is likewise confirmed by the views of local stakeholders. This result is taken as evidence of the validity of the SA lens as a filter for an ex-ante reading of the territorial aspects that characterize a wetland socio-ecological system and its restoration management.

KEYWORDS: Danube Delta, coastal wetlands, social acceptability, socio-ecological systems, nature restoration, transdisciplinary environmental management.

TO CITE THIS ARTICLE: Sella, L., Rota, F.S., Pollo, N., & Giuca, R.C. (2025). Understanding social acceptability in coastal wetland restoration. A socio-ecological perspective of the Danube Delta Biosphere Reserve. *Central European Journal of Geography and Sustainable Development*, 7(2), 23-43. <https://doi.org/10.51865/CEJGSD.2025.7.2.3>

1. INTRODUCTION

Within the European Union, coastal wetlands (Figure 1) constitute crucial habitats that deliver a wide range of ecosystem services, including biodiversity conservation, carbon sequestration, nutrient cycling,

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and climate regulation. In addition to these benefits, which extend far beyond their immediate geographical boundaries, European coastal wetlands also contribute significantly to the well-being and economic prosperity of local communities (European Union, 2024; Kampa et al., 2025; Tegetmeyer et al., 2025), while safeguarding them from coastal erosion, floods, and extreme weather events (Isaac et al., 2025). They also function as natural filters, improving air and water quality for both ecosystems and human populations (Lee et al., 2006; Robbe et al., 2024). Moreover, in many wetland regions, protection and research functions coexist with economic activities such as rice cultivation, salt extraction, fishing, hunting, harvesting, and tourism which support local livelihoods and household incomes (Tănăsescu & Constantinescu, 2020). In this sense, coastal wetlands can also be regarded as cultural landscapes reflecting the complex and dynamic interactions between society and the natural environment. To maintain their multifunctional benefits, wetlands must remain ecologically healthy and well preserved. However, this objective is becoming increasingly difficult to achieve due to the combined pressures of urbanisation, overtourism, and climate change, which threaten habitat integrity and disrupt the delicate hydrological balance between freshwater and saltwater (Babaniyi et al., 2025a; Saito et al., 2025; Lee et al., 2006). Consequently, an increasing number of coastal wetlands require restoration interventions to re-establish ecological equilibrium.

In some cases, such interventions are low-impact and small-scale, including the construction of temporary fencing or barriers, the planting of native vegetation, or the removal of invasive species. When interventions are particularly low-intensity, they may scarcely be recognized as restoration efforts. Instead, they are considered routine preservation and management measures. In other cases, restoration takes the form of large-scale projects that substantially affect local land uses, livelihoods, and identities, often generating social tensions and opposition (Skrimizea et al., 2025). This is the case, for instance, when wetlands are restored after having been converted to other uses or when habitats have been ecologically degraded by human activities or natural processes.

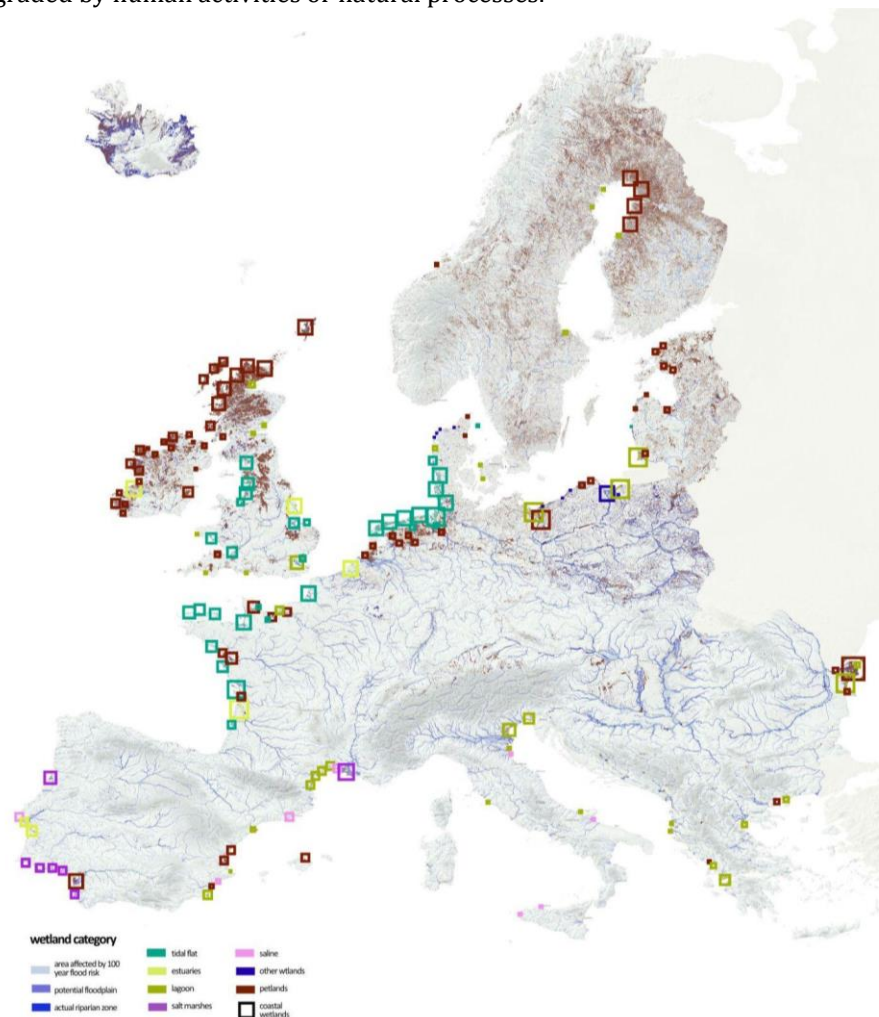


Figure 1. European wetlands, with a focus on coastal wetlands.

Source: modified from Tegetmeyer et al., 2025; squares indicating coastal wetlands added by the authors.

In this context, public acceptance of restoration decisions - here referred to as social acceptability - emerges as a key condition for effective wetland governance and for securing benefits at all scales. Within the European Union (EU), the relevance of this perspective has increased following the adoption of the Nature Restoration Law (European Commission, 2024), which positions nature restoration and management at the core of policy action across Member States, promotes a more active and integrated approach to the management of degraded ecosystems, and considers local stakeholders as pivotal actors to the success of restoration initiatives (Kampa et al., 2025). As shown in Figure 1, coastal wetlands (including tidal flats, estuaries, lagoons, salt marshes, and salines) are widely distributed across Europe and are frequently located in close proximity to areas of human settlement and activity. Relevant changes in the management of European wetlands, such as restoration decisions, may therefore affect a wide range of stakeholders and generate dissatisfaction and local opposition (Holmgaard, 2024). Accordingly, the perceptions and preferences of local stakeholders emerge as key prerequisites shaping the feasibility and effectiveness of restoration initiatives (Garcia et al., 2020).

Literature across several natural and social science disciplines recognizes that a fundamental challenge in nature restoration lies in how land-use changes are perceived and accepted within local territorial systems (Picon et al., 2025; Pearce et al., 2023). Encompassing local priorities and assessing the opinions and values of stakeholders through an inclusive and holistic territorial approach (socio-economic, cultural and environmental) is therefore essential (Sella et al., 2024). In this context, the notion of social acceptability provides a valuable interpretive lens for managers and policymakers seeking to implement effective restoration strategies (Rota et al., 2025).

However, a single, universally accepted conceptualisation of SA has not yet been established, and definitions remain tentative and heterogeneous (Sella et al., 2024). To address this gap, this study discusses an innovative multidimensional analytical framework - developed within the Horizon Europe project RESTORE4Cs to assess the social acceptability (SA) of wetland restoration strategies - and applies it to an ex-ante analysis of the Danube Delta Biosphere Reserve (DDBR).

Section 2 outlines the main premises and methodological foundations of the RESTORE4Cs project and explains how social acceptability (SA) can be used as a framework for the ex-ante interpretation of the territorial systems in which targeted wetlands are embedded. Section 3 introduces the SA concept and identifies the eight key elements - also referred to as the “petals” of the social acceptability “flower” - proposed in this study to interpret the socio-economic, cultural, and environmental features of wetland systems that may shape restoration decisions. Section 4 illustrates the SA flower of the DDBR socio-ecological system (i.e., context, knowledge, values, risks, environmental impacts, societal impacts, participation, and trust). Section 5 summarises and discusses the findings of the study from both scientific and practical perspectives, also reflecting on the strengths and limitations of the proposed approach.

2. THE ASSESSMENT OF COASTAL WETLANDS RESTORATION: PROPOSALS FROM THE PROJECT RESTORE4Cs

This study discusses selected results of the socio-economic analysis carried out within the Horizon Europe project RESTORE4Cs “Modelling restoration of wetlands for carbon pathways, climate change mitigation and adaptation, ecosystem services, and biodiversity co-benefits” to reflect on the methodologies currently available to assess the acceptability of restoration decisions in coastal wetland contexts.

RESTORE4Cs aims to provide standardized tools to assess the pressures and impacts on coastal wetland ecosystems at multiple scales, linking them to climate change mitigation, biodiversity, and other related co-benefits. To this end, six pilot sites were selected across six European countries, each representing a distinct type of threatened coastal wetland habitat (Figure 2).

Specifically, hydrolittoral mud/sand beds in the Curonian Lagoon, intertidal salt marshes in the Dutch Delta, intertidal seagrass belts in Ria de Aveiro Lagoon, brackish marshes in Marjal dels Moros, freshwater ponds and marshes in Camargue, and freshwater ponds in the Danube Delta were selected to assess the ecosystem services and co-benefits of restored areas in comparison with altered and well-preserved ones.



Figure 2. RESTORE4Cs case pilots.
Source: <https://www.restore4cs.eu/>

At the core of the project is the recognition that healthy coastal wetlands provide crucial regulatory functions related to climate regulation and biodiversity protection. Beyond the ecological functions, RESTORE4Cs also recognises that coastal wetlands support local communities by delivering material goods, such as food, water, and income, as well as intangible co-benefits including cultural identity, education, and well-being.

RESTORE4Cs conceptualises wetlands as complex socio-ecological assets (Gobster et al., 2007) and adopts an integrated transdisciplinary approach based on the direct involvement of scientific experts and local stakeholders across the selected pilot sites. Within this framework, a fundamental role is attributed to the assessment of the socio-economic and cultural aspects that shape the decision to undertake restoration actions.

Within RESTORE4Cs, this study introduces an innovative overarching methodology designed to assess the relative relevance of the constituent components of social acceptability (SA) in restoration decision-making through a participatory Multi-Criteria Analysis (MCA). The SA analytical framework applied here to the analysis of the DDBR represents a key element of this broader assessment approach. The general idea is to combine experts' identification of the most relevant environmental, socio-economic, and cultural impacts of restoration with local stakeholders' preferences through a novel MCA-SAA procedural approach that translates MCA results into the SA assessment (Sella et al., 2025).

Further investigation of the MCA-SAA approach is beyond the scope of this paper, which instead focuses on presenting and discussing an innovative analytical framework to assess social acceptability in ecosystem restoration management. Building on this premise, the paper identifies eight main components that shape social acceptability (see Section 3) and applies the SA lens to interpret the socio-ecological dynamics shaping restoration decisions in the Danube Delta case study (see Section 4). As the conceptual scheme in Figure 3 shows, the eight SA dimensions can serve both ex-ante, to provide a preliminary interpretation of the relevant SA dimensions in the territorial socio-ecological system, and ex-post, to translate the outcomes of the direct elicitation of local experts and stakeholders into a prioritisation of the SA components.

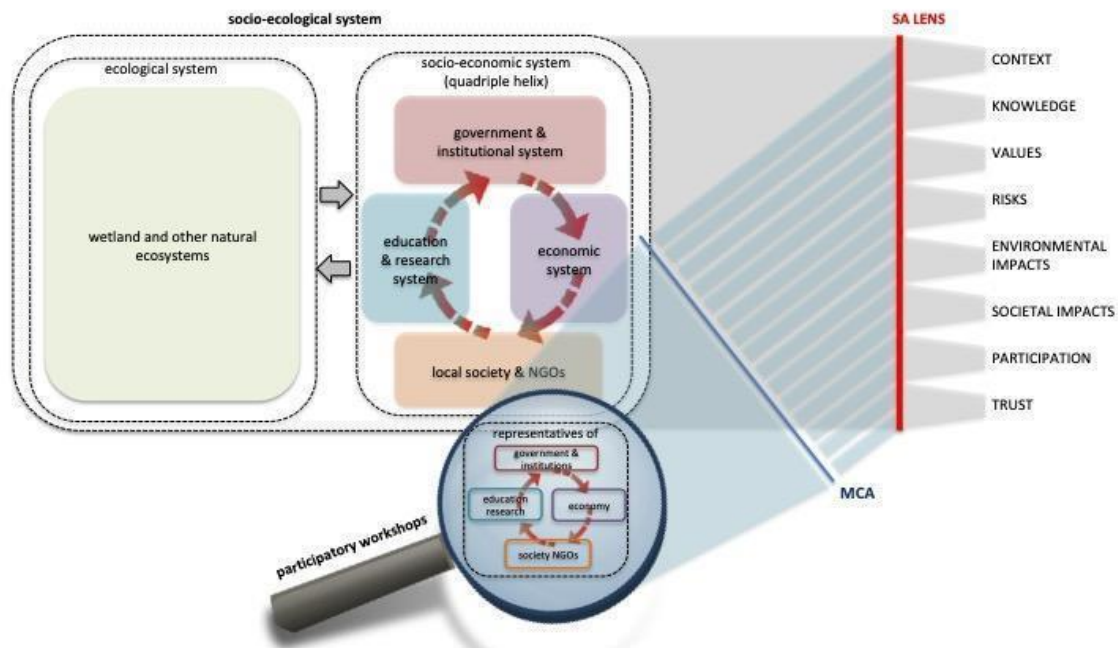


Figure 3. The SA analytical framework used in RESTORE4Cs for both analysing socio-ecological contexts and interpreting the results of the multi-criteria analysis.
Source: authors' elaboration.

Given the heterogeneity of restoration impacts on local communities and the unpredictability of long-term outcomes arising from complex socio-ecological dynamics, local stakeholders' engagement in co-designing appropriate solutions emerges as a pragmatic approach. Moreover, assessing the varying degrees of SA across different solutions (ranging from 'business as usual' to high-impact and extensive actions) provides a practical foundation for informed decision-making and for building trust, local commitment, and acceptance.

The starting point of the territorial investigation proposed in RESTORE4Cs is therefore the identification of the SA components that account for different levels of social acceptance and the clarification of their relationships with the socio-economic, cultural, and environmental aspects of the socio-ecological system. The next section explains the choice proposed in RESTORE4Cs to operationalise the SA concept.

3. THE SOCIAL ACCEPTABILITY OF RESTORATION DECISIONS: A REFERENCE FRAMEWORK

Social acceptability (SA) can be defined as "the outcome of a collective judgment or collective opinion of a project, plan or policy" which often emerges at the local or regional level (Gouvernement du Québec, 2025). The concept of social acceptability has been operationalised through several analytical and operational tools that emphasize stakeholders' involvement to foster consensus, commitment, and conflict prevention (Santaoja et al., 2025; Wang et al., 2025; International Union for Conservation of Nature, 2020). However, most of these studies are qualitative and descriptive (Ellis et al., 2023). Studies proposing a structured approach to investigate the SA of restoration decisions are rare, often tailored to specific case studies (Sella et al., 2024), and characterised by limited transferability.

In this study, we aim to fill this gap by operationalising the theoretical understanding of SA in the form of an analytical framework suited to investigate ecosystem management issues. We build our approach upon the classification used by the Ministère de l'Énergie et des Ressources Naturelles of Québec (MERN). This framework, which draws on a conceptualisation proposed by Stankey and Shindler (2006), modified by Yelle (2013), and subsequently elaborated by MERN, is currently adopted by the Gouvernement du Québec to ensure broad consideration of SA in its projects and policies, fostering long-term sustainability (MERN, 2017). The MERN classification identifies eight factors driving social acceptability: i. The social, economic, territorial and geographic contexts; ii. Local knowledge; iii. Values, beliefs, and expectations; iv. Real or perceived risks and uncertainties; v. Impacts on the living environment and the environment; vi. Benefits and repercussions for local communities; vii. Participation in decision-making; viii. Trust in the promoters and institutions.

Compared with other proposals, the MERN classification offers several strengths that motivated our attention. These can be summarised as follows:

- It is consistent with a socio-ecological approach and integrates socio-economic, cultural, and environmental factors;
- It accounts for both tangible and intangible elements, considering directly observable phenomena as well as values and other non-material dimensions;
- It places emphasis on the components of the local system that reflect perceptions;
- It considers the assessment of SA (SAA) as a process that helps ensure a stronger relationship with the community;
- It considers that SAA must accompany all phases of the project.

At the same time, this approach reflects the mission of the Québec government, which is focused on “financial and social risk management” (MERN, 2018), and marked by a strong managerial perspective.

In this study, we reformulated and consolidated the categories proposed by the MERN framework to improve conceptual clarity and operational applicability, and to align more closely with the specific characteristics of wetland habitats in need of restoration. The SA dimensions here adopted - namely context, knowledge, values, risks, environmental impacts, societal impacts, participation, and trust - are referred to as the “petals” of a flower-shaped representation, hereafter referred to as the “social acceptability flower” (Figure 4).



Figure 4. The social acceptability flower.

Authors' elaboration, adapted from MERN, 2018 (see also Rota et al., 2025).

The MERN classification already covers most of the issues that environmental land-use management literature identifies as relevant in shaping social acceptability (Shindler et al., 2002). However, the MERN dimensions are defined too broadly, limiting their usefulness for classification and analytical purposes. For example, the component described as “the social, economic, territorial and geographic contexts” includes a collection of information on various cultural, historical, and governance background aspects (MERN, 2018), which overlaps significantly with the components “local knowledge” and “participation in policy-making”.

SA drivers are inherently complex, hybrid, and multifaceted. Nonetheless, we aim to define the SA petals as precisely as possible, while assuming that the assessment methodology is applied at the broadest geographical scale at which wetlands influence the socio-ecological system, i.e. typically the aquifer or, as in the case of the Danube Delta, the Biosphere Reserve scale.

As a result, this study develops a multidimensional, comprehensive, flower-shaped analytical framework to investigate social acceptability and its underlying socio-ecological dynamics. The proposed framework is operationally useful both in ex-ante desk analysis of socio-ecological systems, which is carried out before involving local stakeholders, and in ex-post elaboration of participatory MCA co-design activities. In the text that follows, the multiple drivers characterising each petal of the SA flower are explained and discussed in comparison with the MERN approach.

3.1. The *Context* petal

Compared to the MERN approach, our analysis redefines this petal to focus on tangible aspects such as the local economy, the settlement system, and the territorial characteristics of the natural environment. The literature shows that the social acceptability (SA) of coastal wetland restoration depends on how economic, social, and ecological contexts shape community perceptions - both regarding individual interests (e.g., traditional activities like agriculture, livestock rearing, fishing, salt extraction, or industrial, harbour, and energy sectors) and collective interests, including slow or green tourism and nature conservation (Babaniyi et al., 2025b). Economic factors often prevail, as local communities are frequently not fully aware of wetlands' multifunctional services (see Section 1) and tend to assess restoration mainly in terms of its direct economic impacts (see the societal impacts petal).

Furthermore, wetlands' geographic and ecological specificity makes one-size-fits-all approaches unsuitable (Shindler et al., 2002). For instance, Atlantic wetlands differ substantially from Mediterranean or Central European ones, not only in terms of ecosystem conditions (e.g., pollution, eutrophication, fragmentation, sea-level rise, or salinisation), but also in the scale and scope of ecosystem services (e.g., flood and erosion protection, water regulation, and biodiversity support). Thus, analysing wetlands within their socio-ecological systems requires considering all relevant factors and their interconnections.

The context petal also includes material conditions related to land use and accessibility, participatory initiatives, local networks, and policy projects shaping the community. Understanding these ex-ante contextual factors is complex (MERN, 2017), especially at the aquifer or biosphere scale, but essential for strategies that ensure both ecological integrity and community well-being.

3.2. The *Knowledge* petal

This petal addresses the role of different forms of knowledge in shaping the social acceptability of wetland restoration. Unlike MERN, which emphasizes local expertise to improve projects and secure local stakeholders' commitment, this petal encompasses a wider range of knowledge, including both scientific knowledge related to ecological processes, environmental management, and local knowledge rooted in traditional practices, historical processes, everyday activities, and long-term observations.

In the context of wetland management, these forms of knowledge are essential and mutually complementary (Shindler et al., 2002). Scientific knowledge supports restoration decisions, clarifies risks (erosion, runoff, and flooding), and highlights the 'hidden' benefits of restoration (nutrient cycling, climate-change mitigation, water quality). Educational knowledge also contributes to shaping social acceptability, since scientific research, participatory environmental monitoring, and educational programmes raise citizens' awareness, promote appreciation for wetland ecosystems, strengthen public legitimacy and trust in decision-making.

Local knowledge is closely linked to traditional practices and cultural heritage. In wetlands, it represents an experiential memory of traditional activities (agriculture, fishing, hunting, salt extraction, and nature conservation practices), together with lived experiences of landscape management. This knowledge provides insight into the effects of restoration on livelihoods and captures site-specific dynamics that scientific models generally overlook.

With regard to social acceptability, local knowledge quality and circulation influence community perceptions of restoration projects. Since SA judgments integrate cognitive information with socially shared norms (Stankey and Shindler, 2006), a better understanding of ecological processes and restoration rationales tends to encourage support, while limited, fragmented, or contradictory information increases mistrust and opposition. Despite differing epistemic assumptions and communicative styles, the effective integration of scientific and local knowledge enhances context-sensitive interventions while reinforcing credibility, legitimacy, and relevance. Strengthening knowledge exchange reduces uncertainty, builds trust, and improves social acceptance of restoration initiatives (Gamborg et al., 2019).

3.3. The *Values* petal

This petal concerns individual and community beliefs, priorities, and expectations regarding the human-nature relationship, which significantly shape perceptions about restoration and its legitimacy (Dai et al., 2024; Schultz et al., 2022). While MERN highlights the importance of values in shaping community expectations after restoration, we understand values as influencing individual identity, the relationship with the natural environment, and views on natural resource management (Lengieza et al., 2025), including the balance between community needs and ecological systems (Shindler et al., 1996).

Values include aesthetic and cultural attachment, ecological worldviews, recreational preferences, physical and mental well-being, commitment to nature conservation, support for sustainable tourism, and trust in institutions. In particular, acceptability is value-dependent when restoration alters landscape aesthetic or symbolic qualities. In this sense, values reflect socially shared meanings, collective identities, and long-standing relationships between communities and their environments.

Furthermore, values vary considerably across social groups. For example, economic actors may value wetlands for fisheries or tourism opportunities, while conservation-oriented stakeholders may prioritize habitat quality, biodiversity, and landscape integrity. Understanding this heterogeneity is essential to anticipate conflicts, and to design widely supported interventions. Since greater value heterogeneity complicates agreement on restoration strategies, institutional capacity to facilitate dialogue and negotiation becomes key. For this reason, a comprehensive mapping of local stakeholders aimed at distinguishing their interests and influence on restoration emerges as critical. Hence, a thorough understanding of the “values” petal enables decision-makers to align restoration strategies with the cultural identity of local communities, strengthening legitimacy and long-term social acceptance.

3.4. The *Risks* petal

Public and individual perceptions of risk are among the strongest predictors of social acceptability (Anderson et al., 2021). This petal addresses both real and perceived risks and uncertainties associated with wetland restoration, including ecological, socio-economic, and health-related aspects. This dimension is fundamental, since wetland restoration operates under high uncertainty regarding ecosystem responses and intervention outcomes (Shindler et al., 2002; Brunson, 1996).

Risk perception - shaped by experience, cultural norms, information, and trust - plays a critical role in determining communities' attitudes toward restoration, often more than objective risk. Understanding the full range of economic, ecological, hydrological, and health-related risks allows project promoters to address community concerns, design targeted communication strategies, and develop mitigation or compensation measures. Clear communication about uncertainties and potentially negative outcomes builds trust and reduces conflict. Hence, effective management of perceived and objective risks is key for local community support.

Common concerns in wetland restoration include flooding, land-use restrictions, job or economic losses, habitat alteration, invasive species, health and safety issues. Restoration can also pose operational risks, such as disturbance during implementation, maintenance costs, or technical failures.

Risk perception varies significantly both across individuals and contexts (Garcia et al., 2020). A measure perceived as protective by pro-environment groups may be viewed as threatening by farmers or fishers. Furthermore, socio-demographic factors, such as gender, influence perceptions of risk and vulnerability (Bauer et al., 2015).

Transparency and stakeholder inclusion are essential: lack of information or exclusion increases scepticism and resistance (MERN, 2017; Pueyo-Ros et al., 2018).

3.5. The *Environmental impacts* petal

This petal concerns how wetland restoration affects ecosystem and functional characteristics of the natural environment. Environmental impacts are among the strongest drivers of social acceptability (MERN, 2018). These impacts can be either positive or negative, direct or indirect, and include changes in habitat quality, biodiversity, hydrological regulation, and ecosystem services. Common positive effects often include improved water quality, flood regulation, erosion control, and biodiversity recovery, which may support recreational and economic opportunities (Suren et al., 2010; Lovelock et al., 2022). However, ecological recovery often unfolds slowly, and ecosystem services may remain partially compromised (Browne et al., 2018). Transparent communication about short- and long-term impacts is therefore essential.

The assessment of wetland-related environmental impacts concerns both the ecological dynamics, such as documenting the condition of aquatic and terrestrial habitats and species (including the presence of invasive species), and hydrological dynamics (including climate regulation functions, flood control, coastal protection, and groundwater recharge) (Suren et al., 2010; Lovelock et al., 2022).

Broader environmental impacts include cultural connections, landscape modifications, noise, and pollution. These are often underestimated, yet they can generate immediate concern and opposition. Finally, environmental impacts that extend beyond the boundaries of the socio-ecological system also shape social acceptability.

In conclusion, environmental impacts shape expectations and social acceptance. Clear explanations of benefits and potential drawbacks increase social acceptability, while uncertainty, delays, or negative

impacts foster scepticism (Breber et al., 2008). Once again, effective communication and continuous ecological assessment are crucial elements to ensure sustained long-term community support (Browne et al., 2018; MERN, 2018).

3.6. The *Societal impacts* petal

This petal concerns how wetland restoration affects communities' livelihoods, cultural practices, land accessibility, connectivity, and well-being. Communities assess restoration not only in terms of its ecological benefits, but also in terms of its consequences on everyday life, cultural identity, and economic conditions. Social acceptability increases when benefits are clear, losses are mitigated, and restoration aligns with local priorities.

Societal impacts include economic opportunities or losses, changes in traditional activities, land-use restrictions, costs, and effects on competitiveness (Breber et al., 2008). Benefits may include job creation, recreational opportunities, cultural revitalisation, and cleaner and more attractive landscapes.

Since societal impacts are often unevenly distributed across groups, conflicts may arise. Long-term support requires early and clear communication. Consistent with this interpretation, key elements of the "societal impacts" petal include: i. Foreseeable economic repercussions of restoration, ii. Environmental-social linkages influenced by restoration (flood protection, water quality); iii. Cultural and spatial aspects (heritage, accessibility, disturbances); iv. Well-being concerns (physical and mental health). Together, these elements shape how communities experience the social consequences of restoration and, ultimately, the degree of social acceptability.

3.7. The *Participation* petal

This petal refers to the involvement of local stakeholders in planning, decision-making, and implementation, as participation shapes perceptions of fairness, legitimacy, and shared ownership, all of which are key to social acceptability. In the MERN framework, participation is considered a SA driver since communities want to take part in decisions affecting the quality of life and the environment (MERN, 2018). This aspect is particularly relevant in the case of wetland restoration, which impacts local well-being while serving global climate regulation goals. Consistent with this, government agencies often justify restoration decisions based on broader policy frameworks (e.g., the EU Water Framework Directive and the Nature Restoration Law), which are often poorly known to the general public, and communities often feel overruled and excluded from decision-making processes (Schumacher et al., 2021).

In coastal wetland and ecosystem management, continuous engagement of local communities builds trust and ensures support, preventing conflicts and aligning restoration outcomes with local needs (Reed et al., 2017). Active participation also fosters a sense of ownership and long-term cooperation.

In the social acceptability assessment of wetland management, the participation petal addresses the level of involvement of key local actors - e.g., fishers, farmers, livestock holders, industrial actors, municipalities, pro-environmental activists, and residents - in governance and planning initiatives. This information is often difficult to capture, as it depends on the mapping of participatory initiatives or institutionalised inclusive decision-making, as well as on the cultural indirect aspects of participation, such as place attachment, sense of place, community identity, and local engagement or activism, which are even harder to measure. Another participation indicator concerns knowledge-sharing activities in research, education, and recreation, measured through the degree of local involvement.

Across all participation facets, transparency and fairness emerge as crucial enablers of acceptability. Communities support restoration interventions when they feel genuinely involved (Schumacher et al., 2021). Continuous and inclusive engagement prevents resistance and supports collaborative governance, essential for overcoming scepticism and ensuring long-term success (Reed et al., 2017).

3.8. The *Trust* petal

This petal addresses stakeholders' trust in institutions, scientists, and organisations promoting restoration. Trust strongly influences how risks and benefits are perceived and is considered a key predictor of SA (Reed et al., 2017; Scholte et al., 2016). In wetland restoration, trust is critical because interventions often involve costly land-use changes immediately affecting private interests, while promising long-term collective benefits (such as ecosystem services) that are frequently unclear, uncertain, and slow to emerge (Prasanya et al., 2024). As a result, risk perception often outweighs benefit perception.

Low trust in wetland policymakers and planners, combined with poor understanding of restoration motivations and lack of consultation, often leads to opposition to (even ecologically sound) projects,

particularly when they are perceived as top-down impositions threatening traditional rights and practices (Scholte et al., 2016). For example, some degraded wetland areas have traditionally been used for harvesting, which is generally restricted under nature protection regulations, thereby causing conflicts. Conversely, institutional transparency, accountability, and engagement with local knowledge build trust (Gupta et al., 2011, Sibley et al., 2024). Early stakeholder engagement in decision-making processes is among the most effective trust-building measures, fostering acceptance (Benson et al., 2017).

Operationally, trust as a component of SA in restoration encompasses governance quality, economic transparency, clarity on job impacts, and costs - including maintenance. These aspects are crucial in fostering long-term support and legitimacy.

4. THE SOCIO-ECOLOGICAL SYSTEM OF THE DANUBE DELTA BIOSHERE RESERVE

Based on the methodology discussed in Section 3, the text that follows illustrates the main features of the socio-ecological system of the Danube Delta Biosphere Reserve (DDBR) through the lens of social acceptability. More specifically, Section 4.1 provides a preliminary presentation of the case study, while Section 4.2 contains a layered analysis of the DDBR based on the eight components (petals) of the flower-shaped social acceptability framework.

The analysed information derives mainly from a review of studies and reports offering specific investigations into the socio-economic, cultural, and environmental features of the Danube Delta region (among the most relevant: Misteli et al., 2024; ECOPOTENTIAL project, 2019; Văidianu et al., 2014). In addition, the analysis has benefited from the expertise of the researchers from the University of Bucharest (i.e., the RESTORE4Cs partner responsible for the Romanian case study), who were directly involved in the construction of a fact sheet dedicated to the DDBR, as well as in the validation of the collected evidence. A limited number of interviews were also conducted with scientific experts, local managers, and administrators (Table 1), primarily from Tulcea County, where most of the Danube Delta wetlands are located.

Table 1. The interviewed experts, local managers, and administrators. All interviews were conducted online in September 2024, as a joint activity of different work packages within RESTORE4Cs.

ID	Profession	Role	Position
1	Researcher	Public	Danube Delta National Institute for Research and Development
2	Researcher	Public	Danube Delta National Institute for Research and Development
3	Fisherman	Private	Local Entrepreneur (Somova region)
4	Activist	Private	WWF Representative (Manager)
5	Administrator	Public	Danube Delta Biosphere Reserve Administration (Governor)
6	Researcher	Public	University of Bucharest
7	Researcher	Public	Tulcea Environmental Protection Agency, DDBRA Department

Source: authors' elaboration.

4.1. The geographical and institutional contextualisation of the Danube Delta Biosphere Reserve

The Danube Delta was designated as a Biosphere Reserve in 1990 under the UNESCO Man and the Biosphere (MAB) Programme. Its protection and management are regulated at the national level by Romanian Law No. 82/1993, which established the institutional framework for its administration. The Danube Delta Biosphere Reserve (DDBR) is located at the confluence of the Danube River and the Black Sea, covering approximately 5,800 km². This area, shared between Romania (82% of the DDBR) and Ukraine (18%), hosts the second largest delta in Europe (around 580,000 ha) and the third richest biosphere in the world. Its highly dynamic socio-ecological system is composed of river channels, lakes, reed beds, marshes, alluvial forests, sand dunes, and coastal lagoons. The DDBR hosts exceptional biodiversity, with over 5,500 recorded species of flora and fauna and internationally important populations of migratory birds and fish. Its ecological significance is reflected in multiple international designations, including UNESCO Biosphere Reserve, Ramsar Wetland of International Importance, World Natural Heritage Site, and Natura 2000 site. The current landscape of the DDBR has been strongly shaped by land use and land cover transformations implemented during the communist period (approximately 1950–1989). Large-scale hydrotechnical and land reclamation projects were carried out with the objective of increasing agricultural, forestry, and fish production. Extensive areas of natural wetlands were drained and embanked, creating polders for intensive agriculture, fish farms, and poplar and willow plantations. These interventions altered natural hydrological regimes, sediment dynamics, and ecological connectivity, leading to habitat loss, reduced biodiversity, and changes in ecosystem functioning. Although

some polders were abandoned or partially restored after 1990, the legacy of these transformations continues to influence present-day ecological processes and management challenges.

As the maps in Figure 5 show, in the region, zones under different levels of protection (protected zones, deltaic and marine buffer zones) are intermingled with areas of economic activities (Figure 5a). The region is also the object of numerous wetland restoration interventions (Figure 5b), making it an insightful case to study the decision-making process for the management of the natural ecosystems.

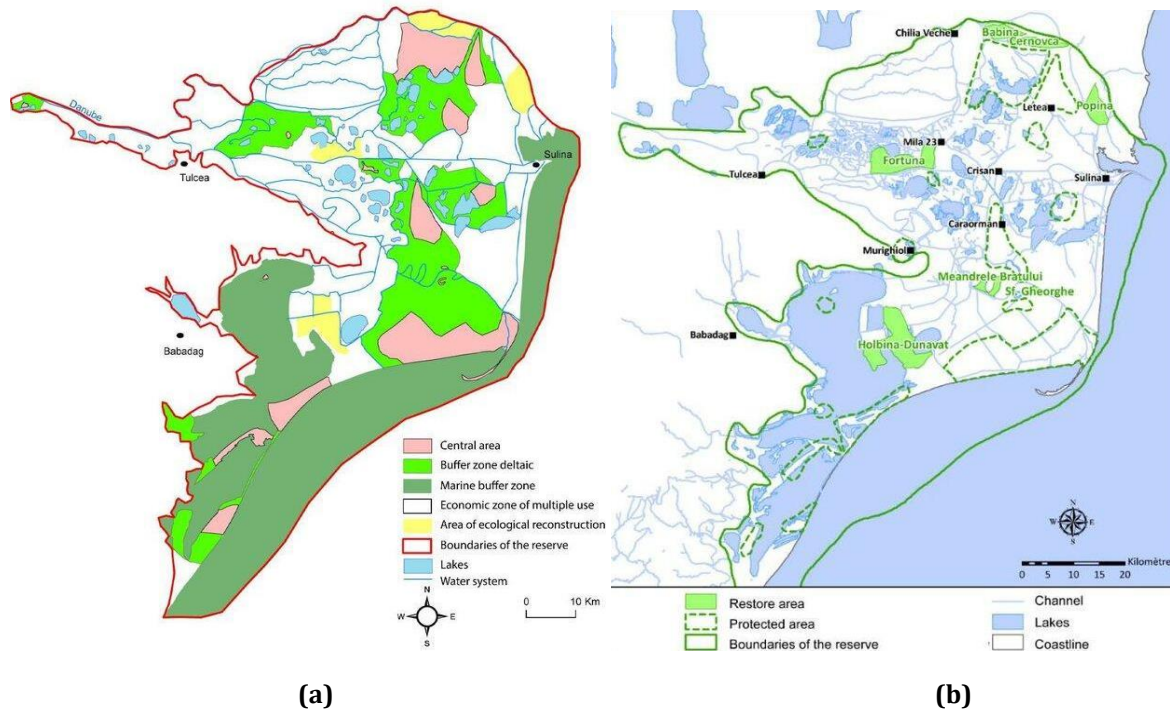


Figure 5. Danube Delta Biosphere Reserve: (a) protected zones, deltaic and marine buffer zones, economic zones; (b) protected and restored areas within the boundaries of the reserve.

Source: Niculescu et al., 2017: 35 (a); Niculescu et al., 2017: 32 (b).

The area has undergone numerous restoration projects aimed at recovering altered habitats. Since the 1990s, a major ecological reconstruction initiative has been underway to restore wetlands and the original hydrological regime in Babina (12,000 ha) and Cernovca (1,580 ha). In 2015, the Mahmudia area (900 ha) was converted from agricultural land into a wetland rich in biodiversity thanks to an EU-funded project. More recently, between 2019 and 2023, a plan supported by the Endangered Landscapes Programme sought to redevelop the wetlands of the Danube Delta, which had been primarily degraded by climate change, eutrophication, tourism, and alterations to the river's natural hydrological regime.

Socially, the Danube Delta is sparsely populated, with small and often isolated settlements primarily accessible by water. Local communities are ethnically diverse, including Romanians, Lipovans, Ukrainians, and other groups, whose livelihoods and cultural practices are closely linked to the deltaic environment. Traditional activities such as fishing, reed harvesting, and small-scale agriculture have declined due to environmental regulations, economic restructuring, and demographic aging. Economically, the region remains one of the least developed in Romania. Following the fall of communism, the centralized economic activities shifted toward subsistence and semi-subsistence practices, with nature-based tourism emerging as a key economic sector, offering alternative income opportunities while generating new pressures on fragile ecosystems. The site is managed by the Danube Delta Biosphere Reserve Administration, a public body that also regulates access. Admission is generally granted, except in strictly protected areas, but there is a fee of approximately €3, valid for one week; specific rates also apply for access by boat or private vehicle. According to official data reported by Bașcău et al. (2023), the site receives approximately 115,000 visitors each year. Within the DDBR, economic activities are subject to strict conservation regulations, requiring an ongoing balance between ecosystem protection, restoration of altered landscapes, and the socio-economic needs of local communities.

4.2. The social acceptability flower of the Danube Delta

4.2.1. Context

The socio-economic and territorial profile of the Danube Delta that we see today is the product of a long, uneven history, shaped by changes that never really happened all at once but accumulated over time. These layers of change still influence how people living in the Delta interpret restoration initiatives, sometimes cautiously and sometimes with hope. To understand why reactions differ so much, it is useful to consider the mixture of economic constraints, demographic patterns, ecological pressures, and institutional arrangements that frame everyday life in the region.

The legacy of the communist period is still noticeable, even if not always openly discussed. Forced industrialisation went on for decades, and when it suddenly collapsed in the early 1990s, it left behind unemployment, an ageing population, and fewer opportunities for younger generations (Stan & Hărmănescu, 2021). These historical and economic dynamics shape not only individual interests linked to traditional activities, but also broader collective expectations regarding tourism, conservation, and future development opportunities.

Today the economy revolves mostly around fishing, tourism, and agriculture (Lazar et al., 2022). Yet traditional fishing and reed harvesting, which were once taken for granted, have become more difficult to sustain, partly because of environmental change and partly because of new regulations. Agriculture itself often depends on European subsidies (Interview 6). In this setting, economic considerations tend to dominate how local communities assess restoration measures, particularly when their immediate livelihood prospects appear uncertain.

Demographically, the Delta remains a sparsely populated and relatively isolated place. About 11,500 inhabitants live across small villages that are scattered over a wide and sometimes difficult terrain (Bașcău et al., 2023). A few settlements, such as Sulina or Murighiol, function as small local centres, but Tulcea, the nearest urban hub, sits outside the protected area. Geography plays a major role here. Limited accessibility and long distances shape daily routines and influence how people perceive new policies. The steady outmigration of young residents, who leave for larger cities, interrupts the transmission of traditional knowledge and weakens the networks that once supported local forms of territorial management (Interviews 1 and 2).

Ecological and territorial transformations further complicate this context. During the communist period, drainage projects, land reclamation, and embankment works altered the hydrological functioning of the Delta, reshaping canals and influencing water circulation (Constantinescu et al., 2015). These interventions affected fish stocks, which in turn influenced the activities tied to them. Meanwhile, tourism has grown quickly. Many see it as the most promising economic alternative, but unregulated practices such as high-speed boating create environmental pressure and disturb wildlife (Interview 5). These transformations highlight the highly specific ecological and hydrological features of the Delta, which make generalised restoration models unsuitable and require context-sensitive approaches. For this reason, the ecological setting is not merely a natural backdrop; it is a key factor in shaping how risks are perceived and how conservation is discussed locally.

Institutional conditions, too, play an important part in shaping local perceptions. Romania adopted a National Wetlands Strategy in 1996, but it has been implemented only partially because of administrative and financial limitations (Ramsar Secretariat, 2014; 2020). Another complication comes from the lack of a clear legal definition for brackish and estuarine habitats, which creates uncertainty for local authorities (Gogaladze et al., 2022). These ambiguities sometimes translate into disputes on the ground, for example regarding land use, fishing rights or tourism development (Interview 6). Attempts to improve coordination exist, such as the Integrated Territorial Investment programme, although many actors consider the results incomplete (Interview 4).

Territorial and land-use conditions reinforce some of these attitudes. Industrialisation and landscape changes have altered the relationship between people and the river, reducing familiarity with environmental management and reshaping how communities relate to the landscape (Stan & Hărmănescu, 2021). When traditional activities become harder or less viable, support for further change may weaken.

Taken together, these elements form the lens through which restoration projects are usually interpreted. The context does not dictate reactions in a mechanical way, but it definitely influences how people position themselves. Interventions that appear aligned with local needs and identities tend to receive more support, whereas uncertainty and vulnerability often lead to hesitation or resistance.

4.2.2. Knowledge

In the Danube Delta, the social acceptability of restoration is shaped by the interaction between different forms of knowledge, including scientific, institutional, and local ecological knowledge. These

knowledge types play complementary roles in how communities understand ecological change, evaluate restoration measures, and interpret their implications for everyday life.

Local ecological knowledge represents one of the most distinctive assets of the region. For generations, fishing communities have cultivated place-based expertise related to fish migration and reproduction periods, preferred habitats, reed bed dynamics, and the use of wetland resources, forming a system of ecological understanding embedded in cultural heritage and expressed through architecture, fishing practices, cuisine, music, dances, and clothing (Interview 7; Van Assche et al., 2012; 2025). However, this heritage is increasingly fragile. Younger residents show declining interest in traditional activities, while regulatory changes and the decline of fishing and reed harvesting have weakened opportunities to maintain and transmit customary ecological knowledge (Interview 3; Morris and Polese, 2015). Historical land-use transformations and hydrological interventions have further disrupted these relationships, reshaping canals and wetlands and constraining the practical conditions required to sustain traditional practices (Tănăsescu and Constantinescu, 2020).

Institutional and scientific knowledge have also become important in shaping public understanding of restoration. The Tulcea Environmental Protection Agency works to raise awareness of the benefits of protected areas, while WWF Romania has engaged local stakeholders to better align restoration projects with specific territorial needs, demonstrating the potential of integrating scientific assessments and locally grounded observations (Interviews 4 and 7). Yet these efforts also reveal persistent barriers. Many economic actors express scepticism toward institutional procedures and scientific expertise, partly due to perceptions of insufficient transparency and the distance between institutional actors and everyday realities (Interview 6).

The circulation, accessibility, and perceived credibility of information, therefore shape how restoration is interpreted. While scientific and institutional actors underline the ecological rationale for restoration, limited or uneven dissemination of information contributes to misunderstandings and mistrust, complicating the integration of knowledge systems. At the same time, community perceptions remain influenced by lived experiences of environmental change, regulatory constraints, and livelihood uncertainties. These dynamics confirm the theoretical insight that social acceptability depends not only on the availability of knowledge, but also on its legitimacy, its perceived relevance to local conditions, and the degree to which different knowledge forms are integrated into decision-making (Stankey and Shindler, 2006).

In conclusion, the knowledge landscape of the Danube Delta is characterised by strong traditional ecological expertise, increasing scientific engagement, and evolving institutional efforts to support awareness. Strengthening connections among these knowledge systems, and recognising the socio-historical processes that have weakened traditional practices, appears essential for building long-term support for restoration and enhancing the socio-ecological resilience of the region.

4.2.3. Values

In the Danube Delta, the values that guide the relationship between local communities and the environment reflect a complex set of beliefs, priorities, and expectations that influence perceptions of resource management and the legitimacy of conservation measures. The area is widely recognized for its high ecological, cultural, and identity value, as it is home to extraordinary biodiversity, with numerous aquatic and terrestrial species, important colonies of pelicans and cormorants, and a significant number of fish species that have both economic and ecological value (Interview 7; ECOPOTENTIAL project, 2019). At the same time, culinary traditions, multicultural heritage, and ecotourism potential contribute to building a strong cultural attachment to the territory, in line with the aesthetic and symbolic dimension of values described in the theoretical framework.

Alongside these ecological and cultural values, values linked to livelihoods and the daily use of natural resources emerge strongly. Many residents recall with nostalgia a past perceived as richer in opportunities and environmental abundance, a reference that becomes a point of comparison with contemporary economic difficulties (Interview 3).

In this context, practices such as fishing and hunting play a central role not only in material terms but also as components of the historical relationship between communities and the environment, consistent with the theoretical idea that values influence identities and visions of resource management.

The plurality of values present in the Delta translates into divergent perceptions of conservation measures. Restrictions on specific traditional practices, such as fishing with certain types of nets or hunting wild boar, are often perceived as penalising and as tools that benefit external actors rather than protecting local communities, generating friction between residents and authorities (Morris and Polese 2015). This heterogeneity of values, which includes more conservationist orientations on the part of

institutions and NGOs and priorities more related to livelihoods on the part of residents, reflects what is highlighted in the theoretical framework with regard to the need to recognize value differences in order to understand the emergence of conflicts and the difficulty in building consensus.

Values also influence perceptions of the legitimacy of conservation policies, as residents express resistance when regulations are perceived as inconsistent with local needs or traditional knowledge (Interview 3). Furthermore, difficult socioeconomic conditions, linked to geographical isolation and the high cost of living in the Delta, contribute to shaping expectations and priorities, as highlighted by WWF Romania (Interview 4).

Despite these tensions, there are signs of transformation in the values attributed to the territory. Some residents show a growing awareness of the importance of sustainable resource management, while recognizing that the transition requires time, education, and adequate institutional support (Interviews 1 and 2). In line with the theoretical framework, these changes suggest that values are not static but evolve in relation to the socio-economic conditions and institutional dynamics that influence how communities imagine the future of the Delta.

Overall, the values observed in the Danube Delta include ecological, cultural, and identity elements, along with economic and livelihood values. This heterogeneity reflects the complexity of the relationships between communities and the environment and is fundamental to interpreting how local actors perceive restoration policies and to designing conservation interventions that are more consistent with the priorities, meanings, and expectations of resident populations.

4.2.4. Risks

In the Danube Delta, the risks associated with wetland management and restoration initiatives arise from a combination of ecological, economic, and institutional factors, and are perceived differently by various local groups.

From an ecological perspective, the area is exposed to risks related to climate change, such as increased droughts and reduced water levels, which affect ecosystem functionality and the availability of natural resources (ICPDR, 2015). The variability of the Danube's flow, influenced by both climate and hydroelectric infrastructure and navigation systems, is an additional source of uncertainty for water management. Added to these factors are salinisation and sedimentation processes that can reduce agricultural productivity and compromise fish habitats (Interview 6).

Alongside ecological risks, there are economic risks perceived mainly by traditional operators. Fishers fear that the decline in fish stocks could permanently compromise the sector, putting their livelihoods at risk (Interview 3). For farmers, flooding of land and the collapse of weakened embankments are interpreted as negative consequences of the conversion processes, to the point of prompting legal action and requests for the conversion of restored areas back to agricultural use (Interview 6). These episodes show how uncertainties about the effects of restoration can fuel perceptions of economic vulnerability.

Institutional and governance risks are also relevant. Disputes over land use, the need for compensation for leaseholders, and the initiation of legal proceedings highlight a context in which rules, competences, and responsibilities are not always clear to local actors. In this context, WWF Romania has also reported the problem of water extraction for irrigation as an additional pressure factor, which can exacerbate the effects of drought and accentuate the sense of uncertainty regarding resource management (Interview 4).

These risks, as perceived by different categories of actors, influence the way citizens and economic operators evaluate conservation initiatives. Concerns about loss of income, disputes over water management, and fears related to land use changes can reduce support for restoration measures, especially when such interventions are perceived as potentially harmful or when their effects are not fully understood. In this sense, risk perception is a key element in interpreting the dynamics of social acceptance in the Danube Delta.

4.2.5. Environmental impacts

As described in Section 4.1, the Danube Delta in Romania is an example of altered and progressively restored coastal wetlands. In this region, "human intervention has manifested itself in more than one-quarter of the entire Danube surface. This intervention was brutal and has rendered ecosystem restoration very difficult. Studies for rehabilitation/re-vegetation were begun immediately after the Danube Delta was declared a Biosphere Reserve in 1990" (Niculescu et al., 2017, p. 513).

These wetland restoration initiatives produced notable ecological improvements. Particularly, the reconversion to wetland enhanced biodiversity and attracted migratory birds (Interview 6). Past restoration processes were also associated with the conservation of species and habitats, greater ecological functionality, and a healthier environment, as well as hydrological improvement, such as enhanced water circulation and improved water quality (Interview 6). One of the key ecological actions

involved reconverting a large abandoned agricultural area into wetland and reconnecting it to the Danube River through a channel (Interview 6). Environmental impacts may therefore play a key role in increasing local acceptance of restoration interventions in the Danube Delta. However, as discussed in Section 4.2.2, awareness and understanding of these positive outcomes remain partial. Monitoring activities are also lacking, particularly following restoration (Interviews 1 and 2), making it difficult to fully assess ecological changes over time. Remote sensing, in particular, now provides accurate methods for detecting changes in vegetative cover and using them as indicators of restoration success (Niculescu et al., 2017). Yet the dissemination of these assessments largely occurs within academic or research-driven initiatives (including EU-funded projects such as RESTORE4Cs), with limited reach to the general public. In addition, the Governor of the DDBR notes that fish population recovery initiatives require funding that the EU currently does not provide, limiting the scope of conservation efforts (Interview 5).

4.2.6. Societal impacts

In addition to the ecological benefits, past restoration initiatives in the Danube Delta produced notable social and economic benefits for local communities. A relevant example is the 2015 EU-funded project in Mahmudia, implemented by WWF Romania and the local council, which reconverted a large abandoned agricultural area into wetland. The initiative gained support from the local population, largely due to its anticipated positive effects on tourism and fishing-related activities (Interview 6). According to a survey conducted by WWF Romania, 67% of residents perceived economic gains associated with the intervention, particularly as a result of increased ecotourism (Interview 4).

Land ownership patterns also influence the social dynamics of restoration. Environmental management is facilitated by the predominance of public land, held by municipalities and the state, but the presence of privately owned parcels can give rise to compensation claims and local tensions (Interview 6). Despite earlier successes, financial constraints continue to hinder the implementation and long-term maintenance of restoration activities. Since previous interventions relied primarily on EU structural funds, the DDBR Authority faces significant limitations in sustaining existing restoration work and requires additional external financing (Interview 6). Moreover, stakeholders have expressed concerns about the distribution of funds. For example, local fishers reported that financial resources allocated to their associations are not reaching individual members (Interview 3).

These issues highlight the broader governance challenges shaping social outcomes in the region. While attitudes toward conservation are gradually shifting, with an increasing awareness of its long-term advantages, effective sustainable management depends on addressing economic pressures, integrating local knowledge, and strengthening trust between institutions and communities (Interviews 1 and 2).

4.2.7. Participation

The governance and management of the Danube Delta Biosphere Reserve (DDBR) provide a particularly useful context for analyzing the role of participation in the social acceptability (SA) of conservation and ecological restoration interventions. Consistent with what is discussed in the participation petal of the MERN model, participation is a key driver of acceptability, as it influences perceptions of fairness, legitimacy, transparency, and shared ownership (MERN, 2018; Reed et al., 2017). In the Delta, as in many environmental management contexts, the involvement, or lack thereof, of local actors significantly influences the social response to restoration projects.

The reserve is administered by the Danube Delta Biosphere Reserve Authority, under the Ministry of Environment, which is responsible for implementing the management plan (Interview 6). This places most decisions at a higher institutional level, a dynamic that the literature associates with perceptions of distance and limited inclusion of local communities in decision-making processes (Schumacher et al., 2021). As observed for other environmental policies, such as the Water Framework Directive (WFD) or the more recent Nature Restoration Law (2024), the public's lack of knowledge of the regulatory frameworks that guide environmental choices can weaken the perception of procedural legitimacy and fuel forms of local resistance (Schumacher et al., 2021).

This institutional backdrop provides the context for the long-standing conflict between two models of landscape management: the Conservative Model, which favors maintaining agricultural activities despite low soil productivity, and the Ecological Model, which advocates removing the hydraulic infrastructure built during the communist period in order to restore the natural water regime (Constantinescu et al., 2015). This contrast reflects the tension, widely discussed in the literature on SA, between immediate local interests and broader environmental and climate objectives (Reed et al., 2017; MERN, 2018), showing how the quality of participation becomes crucial to ensuring procedural fairness and mitigating perceptions of top-down imposition.

The plurality of actors involved in the Delta further underscores the importance of inclusive participatory mechanisms. These include: fishers calling for restrictions on tourism to reduce disturbance, and pollution; landowners discouraged by low soil productivity; municipalities and the state in favor of converting agricultural land into wetlands; tourists and residents attracted by new economic opportunities but often disrespectful of the rules; NGOs and research institutes engaged in conservation (Interview 6; Prelz & Tanasescu, 2019). This diversity of interests highlights the need for participation that can generate transparency, trust, and collective ownership.

Although forms of engagement are provided for, institutions such as the Tulcea Environmental Protection Agency face a widespread trust deficit, as many residents perceive protected areas as constraints rather than opportunities (Interview 7). This phenomenon is consistent with the findings of Schumacher et al. (2021), according to whom the lack of meaningful participatory processes reduces the social legitimacy of conservation policies, especially when regulations are complex, poorly enforced, or difficult to interpret. Burdensome administrative procedures—such as obtaining licenses—reinforce this perception, contributing to participation that is more formal than substantive (Prelz & Tanasescu, 2019).

Similar to what was discussed in the participation petal, difficulties also arise in the Delta in assessing the more intangible aspects of participation, such as attachment to place, community identity, forms of local activism, or knowledge sharing (MERN, 2018). Furthermore, the memory of the profound hydrological transformations carried out during the communist period continues to influence the way communities interpret current restoration proposals (Constantinescu et al., 2015), showing how cultural and historical dimensions contribute to social acceptability.

A case study that clearly demonstrates the potential of meaningful participation is the Mahmudia restoration project. Here, WWF Romania engaged the local community from the earliest planning and implementation stages, securing strong long-term acceptance and support (Interview 4). The project provides empirical confirmation of Reed et al. (2017): ongoing, transparent, and inclusive participatory processes help align local expectations with ecological objectives, mitigate conflicts, and reinforce social legitimacy and community ownership.

4.2.8. Trust

Trust plays an important role in how communities in the Danube Delta evaluate conservation and restoration initiatives. The theoretical framework shows that it shapes perceptions of risks and benefits, influences how legitimate institutions appear, and affects whether residents are willing to support measures whose ecological outcomes may take years to materialise. On the ground, however, trust does not present itself as a single, stable attitude. It shifts depending on personal histories, regulatory experiences, and encounters with authorities.

Many residents associate protected areas with constraints rather than opportunities. This view is strongly linked to earlier development projects that were introduced with minimal consultation and that disrupted familiar livelihoods (Interview 7). Such memories remain present and help explain a general caution toward institutional decision-making. Regulatory frameworks can also feel distant or uneven. Even when European directives are regarded positively, their implementation locally is not always convincing for residents, partly because procedures have been inconsistent or difficult to interpret (Interview 5).

Tensions among stakeholder groups contribute to this picture. Tourism has grown quickly, creating opportunities but also sharpening disagreements over how tightly activities should be regulated. Fishers ask for stricter controls to protect fish stocks and reduce disturbance, while tourism operators prefer a more flexible approach that supports mobility and expansion (Prelz & Tănăsescu, 2019). These contrasting demands make it difficult for institutions to appear neutral, and they influence how fairness and credibility are assessed.

Trust, though, can change. Recent restoration projects supported by WWF Romania indicate that attitudes improve when interventions produce visible benefits or align with local expectations. A survey reports that 97% of residents viewed recent efforts favourably (Interview 4). This suggests that ecological improvements, coupled with engagement, can build trust. Yet the opposite is also possible. Conflicts over compensation for submerged land show how quickly trust can erode when economic effects are unclear or perceived as unfair, especially for those already facing precarious livelihoods.

Overall, trust in the Delta emerges from a combination of historical experience, institutional performance, economic pressures, and the ways in which information is communicated and followed up. Rebuilding trust is less a matter of one-off transparency than of continuity, responsiveness, and the capacity to remain present in community life. Without this, support for restoration can weaken, even where ecological benefits are widely recognised.

5. CONCLUDING REMARKS

The analytical perspective adopted in this study is the first part of a two-phase methodological approach developed within the RESTORE4Cs project to assess the social acceptability (SA) of wetland restoration (see Figure 3). This first phase consists of an ex-ante socio-ecological reading of the territorial system of the Danube Delta, aimed at identifying the contextual factors that shape the social acceptability of wetland restoration initiatives. Before engaging local stakeholders, this phase uses the eight dimensions (petals) of a flower-shaped SA framework revised from MERN (2018) as an interpretive lens to describe the ecological, socio-economic, cultural, and institutional features of the area. The second phase, to be implemented in subsequent research, consists of a participatory assessment that integrates stakeholders' opinions through a Multi-Criteria Analysis (MCA) with the aim of prioritising SA dimensions.

As the RESTORE4Cs project deliverables presenting the results of the MCA-SA analysis (Sella et al., 2025) have not yet been released, a definitive and fully comparative assessment between the SA reading of the DDBR and the evaluation of stakeholder preferences is not possible at this stage. Nevertheless, preliminary results from the MCA indicate that most of the narratives identified through the eight SA petals are also present in local perceptions. In particular, they highlight the coexistence of different, sometimes competing, interests within the local context represented by the traditional economic activities of agriculture and fishing, and the rapidly expanding sectors of tourism and recreation (see Section 4.2.1).

Moreover, local preferences in the Danube Delta appear to be relatively evenly distributed across the different SA dimensions, pointing to a high degree of heterogeneity in stakeholder priorities. This pattern is consistent with the SA profile emerging from the analysis of the petals Risks (Section 4.2.4), Environmental impacts (Section 4.2.5), and Societal impacts (Section 4.2.6), which reveals a distinctive combination of concerns when restoration decisions are considered. Societal concerns, in particular, are deeply embedded in Romania's post-communist economic history (Section 4.2.1), while environmental concerns are rooted in the exceptional ecological value of the area and its long-standing tradition of environmental protection (Section 4.2.3).

In parallel, this shared awareness contributes to a common understanding of the complexity of the DDBR and to a collective commitment among local actors to preserving biodiversity, habitats, hydrological regimes, and water quality, while also addressing climate change challenges. At the same time, the Delta hosts multiple forms of knowledge—practical, experiential, and scientific—which currently coexist with limited integration and persistent mutual distrust, as highlighted by the SA petals. Overall, the case of the DDBR is characterised by strong values and environmental awareness, but comparatively weaker levels of trust and participation, which hinder effective knowledge integration.

These results can be interpreted as the proof that the proposed approach provides both conceptual clarity and operational guidance, outlining a scalable methodology that can be replicated across different wetlands and territorial contexts. More specifically, the study of DDBR contributes to the growing body of literature that highlights the multidimensionality of social acceptability (SA) in environmental management (Shindler et al., 2002; MERN, 2017; 2018; Stankey & Shindler, 2006), showing that understanding the social, cultural, and institutional dimensions of restoration is as crucial as assessing its biophysical feasibility. Inspired by socio-ecological perspectives emphasising the continuous negotiation among actors within territorial systems (Rota, 2024), the paper advances a comprehensive analytical lens for interpreting restoration decisions in coastal wetlands.

This approach is innovative, as it both embeds existing SA framework within a broader methodological effort which integrates it into participatory Multi-Criteria Analysis (MCA) and adapts to the specific characteristics of wetland socio-ecological systems. Applied to the Danube Delta Biosphere Reserve, the framework reveals how social acceptability emerges from the intersection of ecological pressures, socio-economic vulnerabilities, cultural values, and institutional conditions. Despite the local specificity of the case, the results echo broader observations in the literature on wetland governance, where social acceptance depends on how interventions align with place-based knowledge, identities, and expectations (Gamborg et al., 2019; Ellis et al., 2023; Schultz et al., 2022). The findings confirm that affective and cultural attachments - often underestimated in policy debates - play a fundamental role in shaping support or resistance to restoration (Dai et al., 2024; Van Assche et al., 2012, 2025). In the DDBR, values linked to traditional fishing, hunting, and landscape identity strongly influence how communities interpret regulatory changes, echoing concerns raised in other socio-ecological contexts where restoration may alter symbolic or livelihood-related dimensions of local life (Pearce et al., 2023).

The study also demonstrates that risk perception - long recognised as a key determinant of SA (Anderson et al., 2021) - is shaped not only by biophysical uncertainties, such as hydrological change or climate variability, but also by socio-economic fragilities, unclear compensation mechanisms, and institutional ambiguities. As other authors have noted (Scholte et al., 2016; Reed et al., 2017), perceived

risks often weigh more heavily than scientifically estimated risks, and mismatches between institutional narratives and local experiences can generate resistance even when restoration is ecologically justified. In the DDBR, for instance, environmental improvements following past restoration efforts remain insufficiently communicated or monitored, limiting their potential to strengthen public trust and support.

Trust and participation emerge as pivotal components of social acceptability, in line with a vast body of research on restoration governance (Reed et al., 2017; Schumacher et al., 2021; MERN, 2018). The Danube Delta case confirms that limited transparency, administrative complexity, and insufficient involvement of local actors undermine confidence in institutions and weaken restoration legitimacy. Conversely, RESTORE4Cs promotes early engagement, shared decision-making, and clear communication as effective means to foster acceptance and community ownership. The existence of an EU project explicitly dedicated to promoting stakeholder involvement and registering local views on restoration in the Mahmudia region has been perceived as a positive element, helping rebuild confidence and commitment. This aligns with the international literature emphasising participatory approaches and co-design as essential conditions for successful nature-based solutions (IUCN, 2020). These experiences underscore the importance of designing governance structures that promote fairness, inclusiveness, and continuity in institutional-community relations.

From a methodological standpoint, the analytical framework proposed complements existing works that call for more systematic, transferable tools to study social acceptance in nature restoration (Sella et al., 2024) and provides a twofold added value. First, it offers a structured tool for conducting ex-ante territorial analyses, helping researchers and practitioners anticipate which SA dimensions are likely to be most sensitive in a given socio-ecological context. Second, by being compatible with ex-post participatory assessments through its integration into the MCA-SAA approach (Sella et al., 2025), it facilitates a more holistic understanding of how expert knowledge and stakeholder preferences interact. The dual ex-ante/ex-post usability enhances the operational relevance of the framework, making it a practical contribution to restoration planning and environmental governance debates.

Although the single-case nature of the study limits the generalisability of its conclusions, it simultaneously represents one of its strengths: the depth of the socio-ecological reading enabled by the eight-petal SA framework demonstrates how context-specific insights can meaningfully inform wider conceptual and policy discussions. The Danube Delta, with its hybrid ecology, cultural richness, and institutional complexity, exemplifies the types of socio-ecological systems where restoration must balance environmental goals, economic needs, and community expectations. As stressed in international literature, wetland restoration under climate change demands integrated approaches capable of addressing such complexity (Kampa et al., 2025; Saito et al., 2025; Prasanya et al., 2024). This study contributes to such integration by bridging qualitative socio-ecological interpretation with a structured analytical modelling of acceptability.

In conclusion, the findings suggest that the success of wetland restoration initiatives in the DDBR - and more broadly in European coastal wetlands - will depend on the capacity of institutions to enhance trust, integrate local and scientific knowledge, and design participatory processes that reflect community values and priorities. Social acceptability thus emerges not merely as a condition for implementation but as a diagnostic and interpretive tool for governance, guiding the alignment between restoration objectives and the lived reality of socio-ecological systems. By demonstrating how a refined SA framework can reveal hidden dynamics, anticipate conflict, and inform participatory decision-making, the study offers both conceptual and operational contributions to restoration science. Strengthening these dimensions will be key for advancing sustainable wetland governance and ensuring the long-term resilience of ecosystems whose benefits extend well beyond their geographical boundaries. Finally, the added value of the proposed methodology also lies in its procedural nature: it actively involves local stakeholders in the construction of a shared narrative and a common knowledge base, which can then serve as a foundation for the co-development of restoration options.

Acknowledgments

The authors wish to express their sincere gratitude to Dr. Nicoleta Geamana for her invaluable contributions to advancing research on nature conservation and restoration practices in the Danube Delta. Her expertise and dedication significantly enriched the development of this study. Regrettably, she is no longer with us. This article is also published in recognition of her enduring commitment to the conservation of the unique ecosystem of the Danube Delta Biosphere Reserve.

Use of AI tools declaration

The authors declare limited use of Artificial Intelligence (AI) tools for English proofreading.

Author contributions

All authors contributed equally to this work, integrating perspectives from their respective disciplinary backgrounds in economics, geography, sociology, and environmental studies. All authors read and approved the final manuscript.

Consent to participate to the study

The study draws upon interviews collected by the RESTORE4Cs project consortium as part of the tasks dedicated to producing a video documentary series and building a Community of Practice. Prior to participation, all interviewees were informed of the investigative purpose of the study and notified of their right to withdraw at any time, and they provided their consent. In accordance with the Guidelines for Research Integrity (2019) issued by the Italian National Research Council (CNR), because the interviews address non-sensitive content, refer to publicly known facts, involve minimal risk, contain no identifiable data, and serve exclusively scientific purposes, they are exempt from formal ethics committee review.

Conflicts of interest

The authors declare no conflict of interest.

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