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Complementary Approaches to Planning a Restored Coastal Wetland and Assessing the Role of Agriculture and Biodiversity: An Applied Case Study in Southern Italy

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Abstract: The European Parliament has recently passed the "Nature Recovery" law to restore degraded ecosystems and prevent natural disasters as part of its "Biodiversity Strategy 2030" and "Green Deal". In this respect, wetlands can provide a wide range of ecosystem services such as biodiversity conservation, hydrological land protection, provision of products, cultural and recreational benefits, and many others. However, they are still threatened by the expansion of agricultural land, overexploitation of water resources, water pollution, climate change, etc. Wetland conservation, however, is essential and requires coordinated action by managers, policymakers, stakeholders, and scientists. A systemic planning and design process is required to address these complex challenges. This research aims to outline an integrated, comprehensive, and well-structured planning framework for wetland systems that can be applied to different wetland types, in line with institutional wetland policy, governance, and management. The methodological approach developed in this study aims to integrate a longer-term strategy plan with a shorter-term action plan by combining the Yeomans scale of permanence and the Driver–Pressure–State–Impact–Response model. This innovative approach was applied to a specific case study and may guide further wetland planning in the future. The Nominal Group Technique was used, a consensus method aimed at achieving a general agreement and convergence of opinion. An expert group of seven members with different technical backgrounds was engaged and expert consultation was found to be a simple and rapid technique for carrying out wetland planning. The expert judgements were sound, consistent, and did not overlap (i.e., were not redundant). "Pressures" and "Impacts" were identified by the experts and clustered according to corresponding "States" and "Drivers". Expert scoring allowed the resulting "Responses" to be ranked in terms of their relevance and influence on the development of the wetland strategy and action plan, while a priority order for their implementation was assessed according to the Yeomans scale of permanence. Agriculture was the highest rated 'Driver'; similarly, Biodiversity (habitats and species) was the 'State' with the highest score. Therefore, their combination (agriculture and biodiversity) should be considered as the strategic cornerstone of the whole planning framework. This means designing and implementing a system in which agriculture and nature (in our case a wetland) are allied ecological systems in mutual compensation, according to the way natural elements are embedded in the agricultural system. A collection of factsheets containing the full list of responses considered in the Wetlands Action Plan, with detailed operational actions, is provided in the Appendixes.

Keywords: land planning; restoration design; nature conservation; agroecology; permaculture; ecosystem services

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1. Introduction

The 12th of July 2023 should be considered a historic date for the European Union (EU), as the Parliament passed the "Nature Recovery" Law [1]. This is a fundamental,

continent-wide, and comprehensive piece of legislation as part of the EU's *Biodiversity Strategy 2030* [2] and the even broader EU *Green Deal* [3]. It calls for binding targets to restore degraded ecosystems, especially those with the greatest potential for carbon sequestration and storage, and to prevent and mitigate the impacts of anthropogenic "natural" disasters. Europe's nature is in alarming decline, with more than 80% of habitats in poor condition [1]. Restoring natural or semi-natural ecosystems and the species they support will help to increase biodiversity and secure the wide range of ecosystem services that nature can provide [1].

In this respect, wetlands are an essential reference ecosystem in the implementation of this new EU regulation and must be the target areas of extensive and significant restoration processes to be carried out in the coming years according to guidelines based on knowledge, experience, and adequate preparation in planning and design. Wetland planning and design is therefore the specific focus of this work.

In very simple terms, wetlands are natural or semi-natural areas periodically flooded or permanently covered by shallow water. However, this apparently simple definition covers an extremely large number of possible conditions [4]. The hydrology and morphology of the land, together with the variety of associated water sources and vegetation, have shaped different types of wetlands, although the common feature of all wetlands is that they always represent a "transition zone" between dry land and deep water [5]. Transitional environmental conditions create the synergistic result known as the "edge effect". This means that wetlands can sustain a broad range of species which move between permanently flooded and dry areas, thus offering ecosystems with a very high biodiversity level [6]. Today, wetland ecosystems are marginal, fragile, vulnerable, and subject to intense anthropogenic impacts. Although many of the world's most important wetlands are protected nature reserves, they still face a range of pressure. Intense water abstraction, up to overexploitation, and water pollution have caused severe degradation of several important wetland ecosystems. In addition to these local threats, climate change is widely expected to increase the stress on remaining wetlands [7]. Infrastructure development, land-use conversion, and difficult-to-manage tourist flows are other important influencing factors [8–10]. As a result, the ecological problems of wetlands have intensified, including water eutrophication together with biodiversity loss [11–17]. Excessive and inappropriate use of fertilizers and pesticides, the leaching of livestock slurry and poultry manure, and excessive agricultural non-point source pollution have led to severe eutrophication of downstream wetlands [18,19].

For a long time, until just a few decades ago, wetlands were considered dangerous, inhospitable, and unhealthy, sources of diseases such as malaria, or at least useless areas that had to be reclaimed for some productive purpose despite severe limitations. For these reasons, wetlands have been progressively reduced with a marked acceleration in the last century to make way for agricultural activities as well as human settlements [20]. Most wetlands have been destroyed or degraded since 1900 [20], and those that remain are among the most threatened ecosystems in the world [21]. Both agriculture and urban sprawl have transformed the landscape, converting natural land to crops and pastures or creating artificial land cover, while altering previous hydrological conditions, degrading water quality and threatening biodiversity [22]. Between 1780 and 1992, 45% of U.S. wetlands were converted to other land uses, primarily agriculture [23], and by the 1980s, 60–70% of wetlands had been lost in Europe, with the main losses resulting from agriculture [24]. In total, 3.4 million km^2 of inland wetlands have been lost since 1700, primarily for conversion to croplands [25,26]. Although wetlands are among the most valuable ecosystems and have been internationally declared areas to be protected and preserved, the extent of wetlands is still declining worldwide, and their functional condition are threatened to the detriment of the ecosystem services they can deliver [21]. It has been recently estimated that the global total wetland area is a minimum of 1.5–1.6 billion hectares [27], but more relevant is that the ecological status of the ecosystem components, and the complex of benefits/services that characterize wetlands, is deteriorating over time [28]. Apart

from the Convention of the Parties in the frame of the Ramsar Treatise, no centralized database or maps of restored wetlands exist [29]. Furthermore, wetlands are often small and therefore difficult to map [30]. Even when wetlands can be detected, for example, by high-resolution, multispectral imagery, distinguishing restored versus intact wetlands may not be feasible [30].

Wetlands can provide a wide range of important ecosystem services that benefit people [31–34]. Assigning an economic value to these ecological services is a very difficult issue and has been much debated in the literature, starting with the seminal work of Costanza and co-workers [31,35]. In the case of wetlands, estimates also vary widely between different wetland types, ecological structure and function, climates, and environments. In many cases wetlands provide multifunctional benefits that should be integrated according to some specified criteria. A very rough estimate, or rather a range of estimates, allows the following assessment: wetlands 14,785 \$ ha^{-1} yr^{-1}; swamps/floodplains: 19,580 \$ ha^{-1} yr^{-1}; estuaries 22,832 \$ ha^{-1} yr^{-1} [31,35]. Considering that wetlands can be coastal or inland, and that they can be estuarine, riverine, lacustrine, or palustrine, the economic value of their ecosystem services can be roughly in a range around the previous values. In Italy, for example, the value of wetland ecosystem services was estimated to be around 11,500 EUR ha^{-1} yr^{-1}, a value not so different from previous estimates [36]. These services are the result of the full range of ecological functions that take place in this rich and diverse ecosystem. The combination of shallow water, high nutrient levels and high primary productivity creates a very complex ecosystem. Biodiversity conservation should therefore be considered the first and probably the most important service provided by wetlands [4,37–40]. Other categories of services include support, regulatory, provision, and cultural and recreational services. Wetlands have been described as the "kidneys" of the landscape because they act as downstream recipients of water and waste from both natural and human sources [6]. Wetlands have also been called nature's "supermarkets" because of the extensive food chain and rich biodiversity they support [6].

In the context of climate change, losses from degraded and flooded wetlands are significant sources of greenhouse gas emissions, but wetland rewetting has an overall positive effect on reducing total emissions to the extent that the radiative forcing caused by CH_4 and N_2O is fully offset by CO_2 uptake [41].

According to the Millennium Ecosystem Assessment [42], the conversion and consequent loss of wetlands is expected to increase, and the global area of wetlands will decrease, particularly in coastal areas, as agricultural land expands. Long-term land conversion to agriculture use is projected towards 2050, driven by the need to increase food production and ensure food security for a still growing world population. Key policy decisions over the next 20–30 years will need to address several potential trade-offs. Particularly important trade-offs are those between agricultural production vs. water quality and use, natural and semi-natural land cover, and biodiversity [42]. In regions where agricultural expansion remains a major threat to wetlands, the development and diffusion of technological innovations that could sustainably increase food production per unit area without harmful trade-offs in terms of excessive water, nutrient, or pesticide use would significantly reduce the pressure on wetlands. This is considered sustainable intensification of agricultural systems, defined as a technology-driven process in which agricultural yields are increased without adverse environmental impacts, efficient use of natural resources and avoidance of further conversion of non-agricultural land [43–46]. This approach of saving agricultural land for nature conservation is also known as "land sparing". An alternative approach is that of spatially integrating agricultural activity with nature conservation through a strategy known as "land sharing", focusing on an agricultural model that is closely linked and conducive to the conservation of wild biodiversity. This is also known as the ecological intensification of agriculture [45,47–52]. Given the local conditions considered, this second approach has been proposed for use in our wetland planning process.

Today, with wetlands so limited and rare, their conservation, restoration and even reconstruction is seen as a vital and essential strategy, but also as a very demanding issue

that requires coordinated action between managers, policy makers, stakeholders, and scientists [53–59]. A wetland conservation strategy should include understanding and addressing the interacting ecological and socioeconomic processes to manage the system and improve conditions for persistence and resilience in the face of pressures and impacts [54,60,61]. It requires a systemic planning and design process that performs complex analyses, supports transdisciplinary applications, translates qualitative considerations into a well-structured strategy, and develops sound background knowledge within a governance/policy framework [4,18,22,62–67]. The research idea we developed was to outline an integrated, possibly comprehensive, and well-structured planning framework for wetland systems. This has been carried out as a work in progress by applying the intended framework to a specific case study to guide planning, help define strategic aims for wetlands, and outline orderly, effective, and sustainable management actions. Theoretical or conceptual planning backgrounds were drawn from the previous literature on environmental engineering and biodiversity conservation [5,6,60,68–74].

With regard to the methodological approach developed in this study and proposed for more general application, we believe that the most innovative aspect is the attempt to integrate a longer-term strategy plan with a shorter-term action plan. In a nutshell, the aim is to develop an action plan to progressively achieve the final aims according to a well-defined order of priorities indicated by a strategic plan. Two different methodological tools have been used to support the development of this wetland planning process: the Yeomans scale of permanence (SoP) and the Driver–Pressure–State–Impact–Response (DPSIR) model. The useful harmonization of these two approaches has, to our knowledge, never been attempted before and should be seen as the most innovative outcome of our work in terms of a methodological legacy that can guide further wetland planning in the future.

2. Materials and Methods

2.1. Complementary Approaches to Land Planning (Including Wetland Planning)

When considering the most appropriate methodology in land planning, it is worth recognizing the different approaches that characterize a "strategy plan" versus an "action plan". Other related terminological differences should be taken into account by considering the need to distinguish between the concepts of "vision" and "mission", as well as the meaning of "aims" and "objectives". These are contrasting pairs of terms that make different contributions in a planning process.

"Strategy plan" and "Action plan" are often used interchangeably and indeed their meanings could be considered quite similar. However, strong differences should be remarked upon [75]. A strategy plan is a very general framework used to target a far-reaching goal. An action plan is a set of arrangements, patterns, programs, layouts or designs for a particular purpose (objective). In other words, while a strategy plan looks at the big picture, an action plan deals with the nitty-gritty, although the latter will fully support the former.

Similarly, there is a difference between "vision" and "mission". A vision is an idea or concept and relates to the ultimate aim that we are striving to achieve. An effective vision statement should generate a mental image of the future as it would appear if all the aims were achieved. A mission is the set of actions that people (or organizations) with a vision share as a common purpose.

Finally, the difference between "aim" and "objective" should also be clarified. In fact, an objective is more specific than an aim. An aim refers to an overall or ultimate goal to be achieved, whereas an objective refers to the requirements to be met in order to reach that goal.

Bringing together all the previous terminological definitions into an overall picture, two different planning patterns or processes can be identified: one related to the overall strategy, the other related to specific actions. Figure 1 clearly illustrates these two complementary approaches and their relationship.

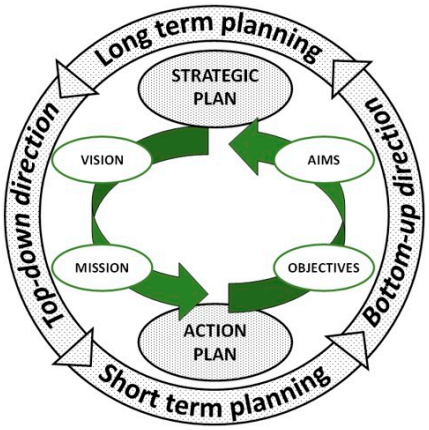

Figure 1. The planning process can be articulated in two distinct but complementary approaches: the strategy plan (top-down) and the action plan (bottom-up). The 'vision' of the one corresponds to the 'mission' of the other; the 'aims' of the one to the 'objectives' of the other. The two approaches dialogue and complement each other.

2.2. Wetland Conservation Strategies

Conservation strategies can be divided into four types of pattern when considering wetland planning (Figure 2) [63–65,76].

1. Wetland reconstruction. Actions aimed at creating new wetlands in areas where they have never existed or where they have been reclaimed for a long time;
2. Wetland restoration. Measures aimed at restoring a wetland in the same area where a wetland once existed, but which has been disturbed or altered by human activity (i.e., by drainage and reclamation);
3. Wetland recovery. Actions or operations aimed at enhancing or improving one or more functions of an existing wetland and improving its ecological performance without making significant structural changes to the system;
4. Wetland maintenance. Operations aimed at ensuring the permanence of optimal (or near optimal) wetland conditions in both old and newly created wetlands.

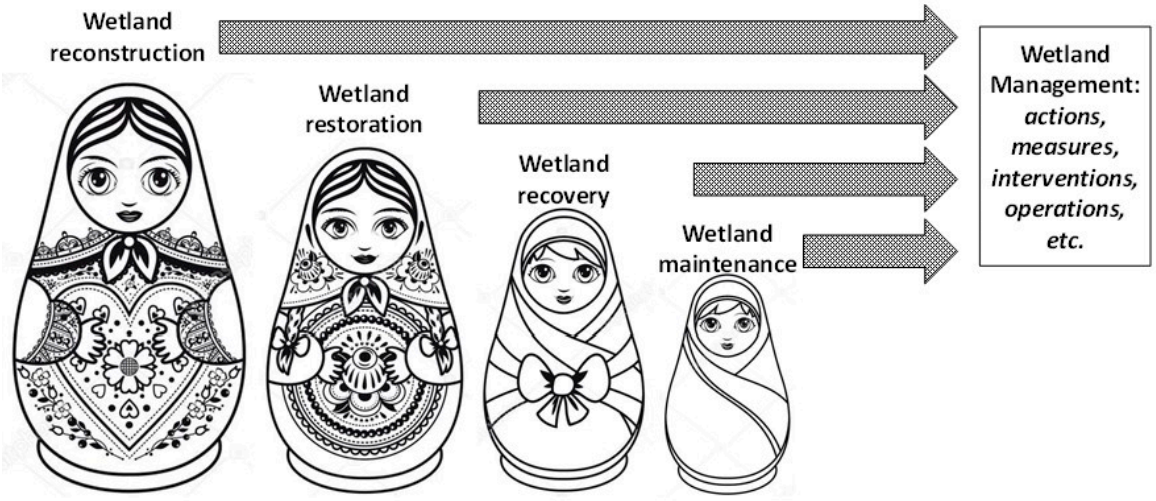

Figure 2. Wetland strategies can be divided into four types of pattern, following a nested structure similar to a series of Russian dolls (matryoshkas).

These measures, actions, and operations, according to the order listed above, are characterized by less intensity, less structural change, less capital investment, and less complexity as one moves from the first (wetland reconstruction) to the last (wetland

maintenance) type of conservation pattern. We could say that a nested structure, similar to a series of "Russian dolls" (matryoshkas, Figure 2), can be imagined, where actions at a lower hierarchical level (i.e., maintenance) are embedded within those at a higher hierarchical level (i.e., reconstruction).

2.3. Planning Approaches Can Be Different, but Should Be Integrated

Two different methodological tools have been used to support the wetland planning process, the Yeomans scale of permanence and the Driver–Pressure–State–Impact–Response model.

(A) Scale of Permanence (SoP). Originally proposed by Yeomans [77,78], this is a tool developed as part of a farming strategy called "keyline design". Having greatly appreciated Yeomans' approach, we thought it could be applied to planning contexts other than the farm and could also be favorably applied to wetland planning. SoP, in essence, is a form of site analysis and design process that follows a sequence of ordered constraints. The scale ranks various components of a design site in descending order of their persistence over time, and thus the effort required to change or modify them. The scale can be used by land planners to analyze the site and determine the most appropriate responses to the prevailing conditions. The design should follow a stepwise or sequential approach, prioritizing those landscape components that have the greatest impact but are difficult to change or modify, while leaving the easiest to change and most responsive to our efforts at the end. The ranking of each component according to the SoP was defined assuming the Yeomans scheme as modified by Jacke and Toensmeier [79], while the corresponding design checklist or actions to be taken were developed as our research outcome. The basic idea is that as you move along the list, from 0 to 6, (Figure 3), the components of the landscape become progressively less permanent, i.e., they require less energy to change and can be more easily modified.

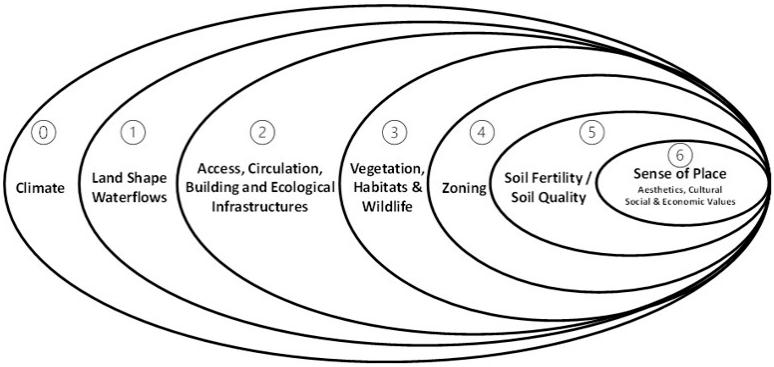

Figure 3. The Yeomans scale of permanence applied to a coastal wetland process. Moving along the scale (from 0 to 6), landscape components become less permanent, require less energy to change, and are more easily transformed. The outermost levels embrace and incorporate the innermost levels, the latter being embedded in and conditioned by the former. Rearranged according to Yeomans [77] as modified by Jacke and Toensmeier [79] and by the present authors.

(B) Driver–Pressure–State–Impact–Response: the DPSIR model. It can be defined as a functional analysis approach for interpreting the cause-and-effect relationships associated with planning and management problems [80–82]. As reported by Lewison et al. [62], DPSIR was "originally developed in the 1970s as a stress-response model, it evolved over time and was adapted by the Organization for Economic and Cooperation Development (OECD) as the Pressures–State–Response (PSR) model" [83]. DPSIR, as it is known today, was developed by the European Environment Agency [84], which added two new components: Driving Forces and Impacts, to help policymakers identify cause–effect relationships between human and natural systems. The DPSIR framework considers drivers (D), e.g., human activities that exert pressures (P) on the environment, causing changes in some states (S), i.e., environmental compartments; these changes in turn lead to impacts

(I) on the ecological system, human health, and social conditions, which may trigger a range of responses (R). Depending on the type of action taken, responses can be directed at any component of the DPSIR framework by controlling socioeconomic drivers, reducing pressures by regulating human activities, adjusting or improving the state of the environment through restoration plans or programs, and mitigating the impacts of environmental degradation [85–91]. Because of its ability to integrate knowledge from different disciplines and to help formalize different decision alternatives, the application of the DPSIR framework has considerable potential for bridging the gap between scientific disciplines and for linking science to policy and management [92,93].

2.4. Evaluation Techniques Applied to the DPSIR Model

Several methods for wetland planning and design can be found in the literature and can be selected according to whether the factors considered are directly measured or estimated by experts, whether the data evaluated are qualitative or quantitative, and several other assumptions [4]. Expert consultation is a simple, quick, and even inexpensive technique for carrying out wetland planning. By convening a group of experts who have direct information and experience about the wetland in question, they can play an effective role in wetland planning [4].

According to the literature, two expert techniques are widely used: the Nominal Group Technique (NGT) and the Delphi Technique (DT). They are commonly referred to as consensus methods because they aim to achieve a general agreement or convergence of opinion on a particular issue. These techniques are applied in research aimed at problem solving and priority setting [94] and are broadly similar to focus groups. The two techniques are similar, except that the NGT, designed by Delbecq and Van de Ven [67], requires face-to-face meetings of participating experts, whereas DT is typically conducted through correspondence. As NGT is less time consuming when experts are proximally located and requires strong interaction between experts [95], it was chosen as the technique to be used by the research team. The experts were selected from the local area and were very familiar with the case study under consideration as they were already involved in wetland management activities. The panel consisted of 7 members with the following scientific and professional backgrounds: one naturalist, one botanist, one zoologist, one engineer, one agronomist, one geologist, and one economist.

The first meeting was devoted to explaining to the panelists the purpose of the research and the design of the DPSIR model. During the first meeting, each expert was asked to identify at least five different types of “Stressors”. At a later stage of the same meeting, the panelists were asked to separate the “Stressors” between “Pressures” (factors acting on each “State”) and “Impacts” (factors resulting from each “State”) and to divide them into relatively homogeneous groups, identified as the “State” elements of the DPSIR model. In the final stage of the first meeting, the panelists were asked to proceed with the identification of a limited number, not exceeding 10, of potential “Driver” elements of the DPSIR model, i.e., the factors to which the previously identified pressures and impacts should be attributed or from which they originate, whether external (exogenous) or internal (endogenous). This was the end of the first meeting. Figure 4 summarizes the stages of the meeting and the final outcome.

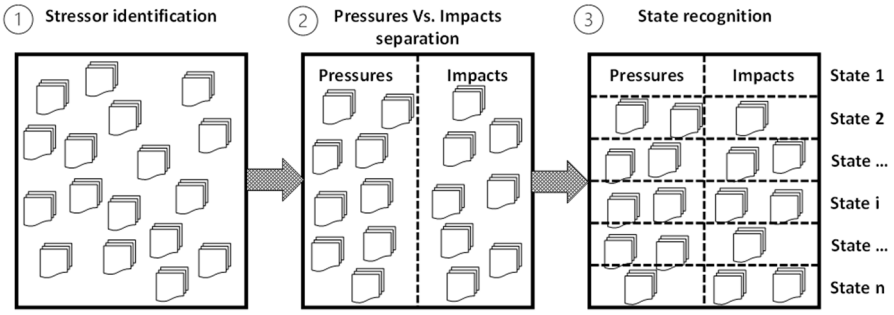

Figure 4. The three steps in the development of the DPSIR framework during the first expert panel consultation.

The research group then produced a table in which each "State" (in one column) was consistently associated with the corresponding "Pressures" and "Impacts" (in two columns next to the first) according to the previous expert clustering. All identified "Drivers" were then placed alongside this table in further parallel columns (one column for each Driver), resulting in an overall matrix with blank cells for expert scoring (Figure 5).

	Pressures	Impacts	Driver 1	Driver ...	Driver ...	Driver n
State 1			Insert score	Insert score	Insert score	Insert score
State ...			Insert score	Insert score	Insert score	Insert score
State i			Insert score	Insert score	Insert score	Insert score
State ...			Insert score	Insert score	Insert score	Insert score
State n			Insert score	Insert score	Insert score	Insert score

Figure 5. The experimental "State x Driver" double entry matrix provided to each panelist for scoring.

It was decided that the score available to the experts should be between 0 and 10, with the following classification: 8–10 = Essential; 6–8 = Important; 4–6 = Necessary; 2–4 = Useful; and 0–2 = Barely relevant. Using this scoring approach, it was possible to rank both the "Drivers" and "States" in order to identify the most relevant interventions for the preparation of the wetland action/strategy plan.

The "State x Driver" matrix was then finalized by the research team and presented to the panelists at the beginning of the second meeting, which took place four days after the first, so that they could complete the scoring themselves without interference from others. The NGT consisted of four main stages: silent generation, round robin, clarification, and ranking or rating [96]. At the beginning of the meeting, participants were given up to twenty minutes to silently reflect and record their individual scores to be assigned to the "State x Driver" matrix. The facilitator specified that a score should be assigned to each selected cell in the matrix, with larger numbers reflecting greater importance, from 0 to 10, as previously reported. The facilitator then asked one participant at a time to give their thoughts on the scoring in a "round robin" fashion. No discussion should take place at this stage, and comments and explanations by the experts are simply recorded verbatim on the whiteboard [94]. The third stage is "clarification of the ideas", which provides the opportunity to compare and discuss any possible discrepancies between experts, so that they can make an informed decision when it comes to assigning scores. The facilitator emphasizes at this stage that participants do not have to agree with all comments or suggestions made by other experts. A second round of scoring and consequent ranking

is then carried out. Finally, the scores for each "State x Driver" combination matrix are summed and presented to the panel for a final discussion aimed at identifying a set of "Responses" on a case-by-case basis, again relying on the knowledge and skills of each expert of the panel and their fruitful interaction through discussion. At this stage, having completed this last task, the second meeting also came to an end.

The "Responses" with the highest scores according to the "State x Driver" double entry matrix should be the most important, urgent, and critical actions to be activated and carried out in the planning/design implementation. Therefore, an order of priority (prioritization) is obtained to inform and guide the implementation of wetland planning.

2.5. Creating the "Big Picture" of Wetland Planning

The methodological structure of the whole planning process is shown in Figure 6, combining the SoP with the DPSIR.

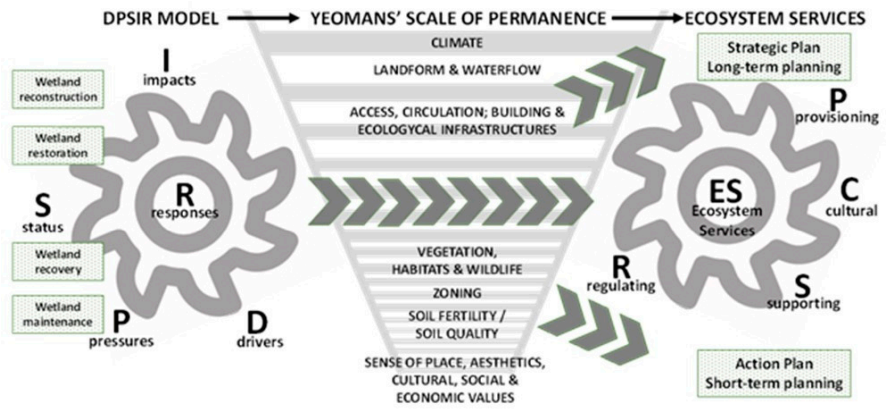

Figure 6. The overall wetland planning framework developed and proposed in this work. Responses originating from the DPSIR helix, if properly planned and applied according to the priority ranking dictated by Yeomans' scale of permanence, can activate or reactivate the full range of ecosystem services (shown as an additional helix) that promote wetland conservation and public fruition.

Like a helical rotor, the "Responses" resulting from the application of the DPSIR model (left side of Figure 6) can operate according to the hierarchical levels defined by the SoP, i.e., they have a priority order dictated by the same SoP structure that should be considered when preparing the wetland plan/design (compare Figure 3 with Figure 6 which shows the same SoP list of landscape components). These "Responses", operating at the appropriate scale of permanence, can activate a second helix representing the ecological functions of the wetland system (right side of Figure 6) and thus promote the delivery of variously classified ecosystem services (ES).

As shown in Figure 6, more persistent and long-term responses are placed at the top of the Yeomans permanence scale, and relate mainly to wetland reconstruction and restoration (see Figure 6, top left). These are the predominant features of a strategic plan (Figure 6, top right). Conversely, at the lower end of the permanence scale, short-term planning predominates, mostly relating to wetland restoration and maintenance (see Figure 6, bottom left), and an action plan is appropriate (Figure 6, bottom right). The actions implemented should be able to deliver the intended 'Responses' and induce the wetland system to deliver the full range of ecosystem functions and hence ecosystem services (ES) that the wetland itself can provide.

On the other hand, the DPSIR scores assigned by the experts make it possible to rank these "Responses" by considering those that are the most relevant and influential to be included in the same action plan. The more effective and well-applied these "Responses" are, the more they will influence the characteristics and attributes of the wetland and help to significantly improve its ecological functioning.

3. Results

3.1. "The King's Lagoon": The Case Study

The planning process has been applied to a specific case study represented by the Laguna del Re (i.e., "King's Lagoon", translated from the Italian) in Siponto (Manfredonia, Province of Foggia, South Italy). It is a coastal wetland directly connected to the Adriatic Sea, located at the mouth of the Candelaro stream, with an extension of 40 hectares, part of the whole reclamation system of the Siponto polder (Figure 7).

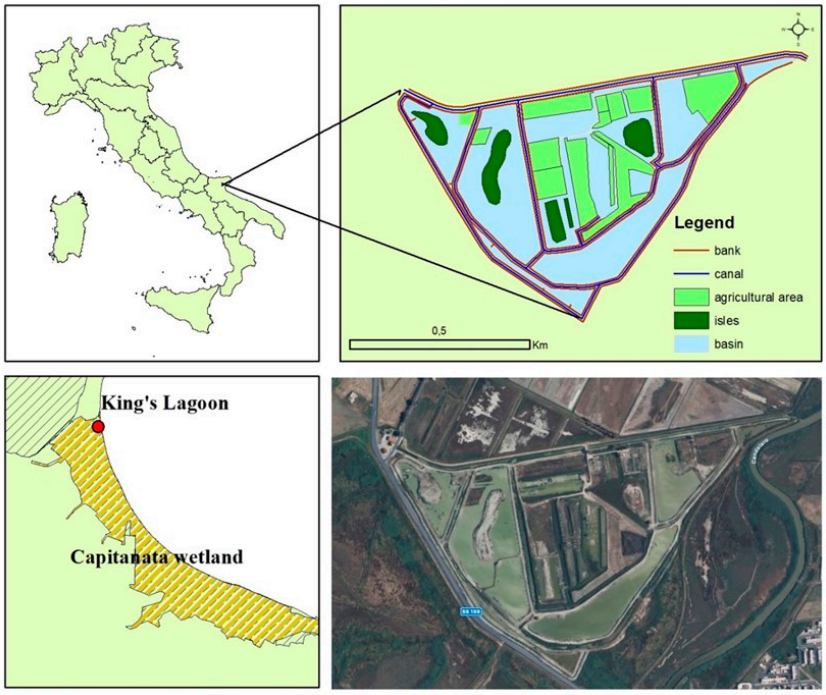

Figure 7. Satellite image and planimetric map of the King's Lagoon, the case study considered.

The reclamation began a long time ago, but was decisively carried out just before the Second World War and completed in the 1950s. It involved a radical alteration of the natural hydrological regime in order to reclaim land for agriculture and human settlement. The remaining wetlands that still exist are one of the cornerstones of the Apulian coastal landscape. Today, the King's Lagoon plays an important naturalistic role, it is included in the European Natura 2000 network and designated both a Zones of Special Conservation (ZSC), called the "Capitanata wetlands", and a Special Protected Area (SPA), called the "Marshes of the Gulf of Manfredonia". It is characterized by two priority habitats: 1150* "Coastal lagoons" and 1510* "Mediterranean salt steppes" according to the EU Habitats Directive (please note that the asterisk conventionally indicates the "priority" status of the habitat).

An important EU environmental LIFE project [97] was developed in the Siponto area; as a result, the new wetland, i.e., the King's Lagoon, was created on the site of a previously reclaimed wetland. The project was completed in 2019 after 5 years of activities. It consisted of a wetland restoration project, which was carried out by replacing agricultural and illegally built areas with a natural-looking wetland system, redesigning new and reopening old canals that had silted up, digging "valleys" (i.e., stretches of water), installing weirs to regulate water inflow and outflow, and creating sluices in order to recreate the typical transitional coastal environment, characterized by the alternation of flooded areas and dry land.

A number of illegal buildings have been demolished, due to the previous subdivision of agricultural land into small plots, resulting in a noticeable and disturbing road network. The new wetland has also been equipped with wildlife observation structures (towers,

boardwalks, and hides) to promote the naturalistic practice of birdwatching, as well as footpaths, huts, and terraces for visitors to encourage them to visit the natural oasis. It should be noted that the EU project also had an important social impact in terms of restoring legality, since after the demolition of the unauthorized buildings and the restoration of the natural environment, the former inhabitants were given small plots of land to grow fruit and vegetables under legal contracts. Today, agriculture is only allowed in certain areas of the entire wetland system.

3.2. Vision and Mission Definition

At a preliminary stage, the definition of the vision and mission has been entrusted to the research team in collaboration with the partners involved in the EU LIFE project [96]. Both the "Vision" and the "Mission" will be submitted to a wider stakeholder representation for approval and validation.

Vision statement: To achieve a harmonious conservation model that combines the effective protection of all wetland organisms with the sound restoration of natural resources. To change people's cultural perspective on nature and develop societies capable of living in peace with nature rather than fighting it. To develop innovations in science and technology, particularly in the agricultural sector and in the provision of goods and services by protecting biodiversity, conserving natural capital, and enhancing the full functioning of ecosystems, thus contributing to an effective transition to sustainability.

Mission statement: To direct and guide all possible actions useful for the achievement of the objectives of nature restoration, and thus to produce a relaunch of the territory in a new guise; that of a natural area restored for the conservation of biodiversity within an agricultural context that supports this purpose and promotes the development of the land, including the economic growth of the resident population, by activating a tourism aware of this natural wealth and respectful and sensitive.

3.3. Goal Setting: Both Aims and Objectives

The ultimate aim of wetland planning is to ensure the restoration, maintenance, and, hopefully, the expansion of existing habitats, and to promote the favorable status of wetland habitats, an important condition for the conservation of key plant and animal species. This goal must also be achieved by placing the wetland in question within an extended network of natural or semi-natural ecosystems that provide the necessary connective functional roles in the system as a whole.

The conservation of biodiversity should be closely linked to the provision of sustainable human livelihoods (such as agriculture and fisheries) and the contribution of cultural values, together with recreational activities. In our view, these are considered to be the three main pillars of a well-managed wetland such as this case study.

A long-term strategy plan has been coupled with a short-term action plan with the ultimate aim of harmonizing these three wetland pillars or dimensions: the first relates to nature, the second to human livelihoods (i.e., provision of goods), and the third to culture and knowledge (i.e., sense of place).

A number of other general objectives are linked to these three pillars; for example, rich plant biodiversity enables the activation of ecological functions related to hydrological protection, water quality, soil conservation, and many other important environmental conditions that wetlands can ensure; the maintenance of traditional human livelihoods requires the adoption of systems that are not harmful to the environment and, at the same time, promote biodiversity; finally, cultural services cannot be maintained without taking into account the traditional knowledge derived from centuries of human settlement dependent on natural resources. The three objectives are therefore closely interlinked.

3.4. Strategic Lines of Wetland Development

As anticipated, the King's Lagoon Strategy Plan is developed around three main pillars:

- First pillar: Biodiversity conservation. Identifying a set of measures to protect and conserve the biodiversity of the King's Lagoon, to promote the creation of a mixed mosaic of wetland and agricultural habitats, to maintain the ecological functionality of natural and agricultural ecosystems, and to preserve their natural capital in terms of ecosystem services.
- Second pillar: Provision of sustainable goods and services. Regenerative agriculture. This can be divided into several cultivation models, each using more than one technique. One of the most inspiring is "permaculture", a set of agricultural practices based on the natural maintenance of soil fertility, where the term itself emphasizes the concept of culture, thus a unified approach to all aspects of human society and its relationship with nature. The "regenerative agriculture" interventions planned for the King's Lagoon are therefore designed to promote crop diversity by applying a multifunctional approach to build stable, productive agroecosystems, according to a model that reconciles economic growth with nature conservation.
- Third pillar: Knowledge, education, recreation and governance. Visitors' enjoyment of the natural heritage. Since the King's Lagoon is included in the territory of the Gargano National Park and as one of the EU Natura 2000 sites, it is of paramount importance that visitor's expectations regarding the naturalistic importance of the area are confirmed. Therefore, it is essential to support and improve the response capacity to the users' needs in order to guide wetland development towards sustainable forms of natural and cultural fruition. In this regard, reference is made to the "European Charter for Sustainable Tourism in Protected Areas" [98]. The following principles should govern how tourism is developed and managed in protected areas: (1) giving priority to protection; (2) contributing to sustainable development; (3) engaging all stakeholders; (4) planning sustainable tourism effectively; (5) pursuing continuous improvement.

The previous pillars were then translated into strategic lines for wetland development (Table 1).

Table 1. Structure of the King's Lagoon Strategy Plan: pillars (I, II, III) and strategic lines (Si) are reported.

I Pillar Nature and Mankind	Biodiversity conservation	S1. Protecting the environment and biodiversity in the context of climate change
		S2. Wise use of natural spaces, agroecosystem heritage, and ecosystem services
II Pillar Human Livelihood	Provision of sustainable goods and services. Regenerative agriculture	S3. Developing regenerative agriculture through environmental quality, together with safe, healthy, and fair agri-food products
III Pillar Human Culture	Recreation and Well-Being	S4. Visitors' enjoyment of the natural heritage. Enhancing the natural environment to boost the development of the area and its attractiveness to tourists
	Knowledge, Education and Research	S5. Communication and awareness-raising to develop environmental knowledge and a sense of place and respect for nature S6. Education for sustainability
	Governance	S7. Creating new synergies and strengthening cooperation: collaboration with associations and institutional bodies

Strategy 1: Protecting the environment and biodiversity in the context of climate change. The conservation of nature (i.e., biodiversity) and of environmental systems, including natural and semi-natural landscapes, can no longer ignore climate change processes at local and planetary scales. The climatic context of the Siponto wetland system is that of the "European Mediterranean biogeographical region" and is changing rapidly. Adapting

to and mitigating climate change is undoubtedly a new and considerable challenge that requires updating and integrating the usual management tools of natural protected areas. This new synthesis of management and protection tools is considered a prerequisite for the activation of integrated management strategies that take into account both nature conservation and sustainable local development.

Strategy 2: Wise use of natural spaces, agroecosystem heritage, and ecosystem services. The quality of the environment is affirmed both by specific excellence and by the overall quality of the landscape, considering natural open spaces and environmental infrastructures as optimal for living and enjoying life. Environmental protection should become a real asset for the development of the territory. This will be achieved through forms of cooperation and collaboration with landowners, individually or collectively, and by integrating them into a well-organized system. One issue that needs to be addressed is the concept of ecosystem services that protected natural areas can provide to society. These ecological functions are particularly important for mitigating the effects of climate change and the damage caused by pollution from large urban centers, and in preserving basic natural resources such as water and soil.

Strategy 3: Developing regenerative agriculture through environmental quality, together with safe, healthy, and fair agri-food products. The quality of a land should also be synonymous with the quality and genuineness of its agri-food products and, consequently, its gastronomy. In an increasingly globalized market, where commercial food products do not always guarantee quality and authenticity, typical products with a strong and direct link to the quality of the land of origin can make the difference. Consumers are much more likely to trust a product that is associated with a specific and well-known land, whose quality and healthiness they recognize, and are therefore willing to pay more for it.

Strategy 4: Enhancing the natural environment to boost the development of the area and its touristic attractiveness. The King's Lagoon, if properly managed, should be seen as a major asset in promoting the viability of the area, whose attractiveness and competitiveness is increasingly measured by its environmental quality and the virtuous balance between socioeconomic development and nature/environment conservation.

Strategy 5: Communication and awareness-raising to develop environmental knowledge, a sense of place and respect for nature. Conservation of natural resources and biodiversity should be seen as a relevant issue and efforts to conserve species and habitats as a relevant activity for humanity. Raising public awareness is a fundamental step in creating an environment open to change and can contribute to the development of a well-informed and environmentally aware culture and knowledge. To be effective, it is essential to create an emotional connection with the public by informing them about the development lines of the wetland project and the results achieved. An even more direct involvement could be through "citizen science" initiatives, which are useful in multiplying the possibilities of collecting environmental data, but above all, in stimulating public involvement and participation. In this way, a process of consensus building is generated, creating a virtuous circle in which civil society, understanding the value of what has been achieved, becomes the carrier of a positive message within the various "social networks".

Strategy 6: Education for sustainability. This issue is particularly aimed at young people of school age. The choice of the area on which to focus the environmental education program is based to the importance of the ecological network developed at a local level, with the wetlands of the Gulf of Manfredonia as the main environmental systems. The aim of this educational program is to make a large part of the population living in the same area aware of the value of the land in which they live. Involving the educational community would break the cultural isolation of protected natural areas, especially wetlands, which are often of interest only to insiders and researchers. Education on sustainability, biodiversity, and landscape conservation, aimed at citizens and teachers, is mainly carried out through joint projects with universities, research institutes, third sector associations and other organizations.

Strategy 7: Creating new synergies and strengthening cooperation: collaboration with associations and institutional bodies. The King's Lagoon is an important reference area for environmental education and conservation actions in the province of Foggia, with particular attention to the Gargano National Park, of which the wetland is a part. The local cooperation network with all stakeholders aims to exchange experiences, coordinate actions, and share available resources. The aim is to consolidate the cooperation network, in particular with the municipal, provincial and regional departments for the environment, culture and public education, the regional education office, and other voluntary environmental and cultural associations, universities, the Provincial Natural History Museum of Foggia, and other visitor centers in the area. The creation of a local network seems strategic for the full development of the above activities, while respecting the specificity of each institution and association.

3.5. The DPSIR Components: Identification and Relationships

The expert meetings first allowed for the identification of "Pressures" and "Impacts", as described in the previous section. Soon after, each "Pressure" and "Impact" was assigned to a "State", again as a result of a participatory discussion among panelists. It was decided that "States" should broadly refer to the different environmental compartments, according to the following list: (1) water; (2) atmosphere; (3) soil quality; (4) biodiversity; (5) landscape, environmental health and human well-being (the latter being more heterogeneous than the formers). The following double entry matrix was therefore created (Table 2).

Table 2. Wetland planning process using the DPSIR model: coupling Pressures and Impacts with State (environmental compartments) in a double entry matrix.

Status	Pressions	Impacts
Environment: Water Systems	Unauthorized and unregulated water withdrawal from the wetland; unscheduled operations or irregular water inflow from the land reclamation water tower; sea level rise or fall; salt wedge intrusion; improper management of livestock effluent and civil wastewater from treatment plants.	Disturbance of the hydrological cycle (both surface and deep waters); lack of groundwater recharge; restricted use of water resources; eutrophication of surface waters; pollution of surface and groundwater.
Environment: Atmosphere	Increases in air pollutants, including particulate matter; acid rain from Sulphur and Nitrogen oxide emissions from combustion processes; fossil energy use and climate change emissions.	Changes in air quality; changes in the local/global thermo-pluviometric regime; extreme weather events and increased frequency of disasters; progressive climate warming.
Environment: Soil Quality	Excessive use of agricultural mechanization (overly heavy, frequent, and deep mechanical work); lack of hydraulic agricultural systems; failure to apply good agronomic practices, particularly in crop rotation; exclusive use of synthetic fertilizers; large use of chemicals (against pathogens, harmful insects, and weeds); incorrect use of irrigation (even with poor-quality water).	Soil compaction; loss of soil organic matter; soil salinization and alkalinization; contamination of soil by synthetic chemical compounds; reduced soil depth due to the rise of the water tables; soil loss due to erosion phenomena.
Biodiversity: Habitats and Species	Changes in land use; expansion of built-up and agricultural areas, anthropization of the ecological matrix; wildlife–vehicle collisions and noise disturbance from motor vehicle traffic; poorly planned tourist frequencies and excessive visitor flows; accidental introduction of non-native wild species; deliberate introduction of non-native species for hunting interest; illegal capture of wild species by hunters (poaching).	Habitat alteration/degradation and biodiversity loss; deterioration of ecological connections with contiguous natural areas and habitat fragmentation; wildlife disturbance; depletion of genetic resources.
Landscape, Environmental Health and Human Well-Being	Mismanagement of waste (illegal dumping, uncontrolled dumping, abandonment of waste, unsuitable or inadequate landfills for the type of waste, etc.); soil degradation, soil sealing, and land consumption due to human settlement expansion.	Impairment of the aesthetic and recreational value of the area; simplification and homogenization of the landscape mosaic; consumption of natural land cover; damage to human health.

Finally, seven main drivers were identified by the panelists: (D1) industrial installations; (D2) proximity of urban areas; (D3) road traffic; (D4) tourist and visitor flows; (D5) poaching or illegal fishing and hunting; (D6) water regimes and management (including management by the Irrigation and Land Reclamation Consortium); (D7) agriculture. Drivers 1, 2, and 3 can only affect the wetland from the outside (they are only external drivers), while drivers 4, 5, 6, and 7 can affect the wetland from both the inside and the outside. Internal drivers are under the direct control of the wetland management authority and can therefore be regulated by a local design or action plan (i.e., bottom-up and short-term planning). In contrast, the regulation of external drivers is entrusted to a much broader territorial plan, which is more policy oriented (i.e., top-down and long-term planning). Each driver (from D1 to D7), linked to the set of "Pressures" and the set of "Impacts", was cross-referenced with each of the "States" to form a comprehensive scoring matrix as described in the previous section.

The scoring process carried out by the experts made it possible to obtain priorities to be taken into account in the preparation of the strategy/action plan. The results obtained are reported as follows and can be observed in Table 3.

Table 3. Average scores assigned to "States" and "Drivers" by the panelists. The standard deviation (Std Dev.) is also reported.

Code	STATES (N = 49)	Score *	Std Dev
S1	Environment: Water Bodies	4.67	3.50
S2	Environment: Atmosphere	3.10	2.15
S3	Environment: Soil Quality	3.43	3.42
S4	Biodiversity: Habitats and Species	6.82	2.56
S5	Landscape, Environ. Health and Human Well-Being	6.59	2.03
Code	DRIVERS (N = 35)	Score *	Std Dev
D1	Industrial Installations	2.34	1.59
D2	Proximity to Urban Areas	5.00	2.85
D3	Road Traffic	4.51	3.13
D4	Tourists and Visiting Flows	3.51	2.52
D5	Poaching (Illegal Fishing and Hunting)	4.17	3.25
D6	Water Management	6.66	2.93
D7	Agriculture	8.26	1.58

Note: * maximum score = 10; minimum score = 0; 8–10 = essential; 6–8 = important; 4–6 = necessary; 2–4 = useful; 0–2 = barely relevant.

Looking at the "States", the experts judged that, on average, biodiversity (S4) and landscape (S5) were the most important, while atmosphere (S2) and soil quality (S3) were given the least priority. Water bodies (S1) was placed in the middle of the ranking. In terms of "Drivers", agriculture (D7) was judged the most influential, followed by water management (D6), while industrial installations (D1) was considered the least important.

Rather than looking at the average values of "States" or "Drivers", it is much more important to focus on the score assigned to each "State x Driver" combination, which reflects the real priorities that need to be included in an action plan that takes into account the most critical issues identified by the experts. As reported in Appendix A—Table A1, a score ≥ 8 defines an essential SxD combination, having the highest importance. There are eight combinations considered to be essential, of which the Driver agriculture (D7) appears four times (i.e., in 50% of the cases), while the biodiversity State (S5) appears three times. The combination of water bodies x water management (S1xD6), together with the combination of soil quality x agriculture (S3xD7), received the highest score (9.87) and are in fact the most critical factors to be taken into account when considering wetland management. Poaching (and particularly illegal fishing) is considered a strong limitation to biodiversity (S4xD5) and received a score of 8,71. Agriculture is considered a possible threat not only with respect to soil quality, but also biodiversity (S4xD7, score 8.71), water bodies (S1xD7, score 8.43), and landscape (S5xD7, score 8.00). The Driver water management

(D6) can greatly affect biodiversity (S4xD6, score 8.29), while the Driver road traffic (D3) may significantly affect the States landscape, environmental health and human well-being (S5xD3, score 8.00).

3.6. The Yeomans Scale of Permanence and the Associated "Responses" Identified in the DPSIR Model

As formerly reported, the DPSIR model was developed through a structured discussion and an exchange of views between the panelists (i.e., experts) and allowed for the identification of a wide range of "Responses" (i.e., actions, measures, and interventions to be taken in wetland management), as a logical combination of both "Pressures" and "Impacts". The corresponding combinations of "State" and "Drivers" were submitted for scoring by the panelists (as reported in a double-entry matrix shown in Appendix A—Table A1) to select those "Responses" with the highest relevance or influence.

The same "Responses" were also ranked in terms of "permanence", i.e., according to the ordered categories defined by the Yeomans SoP (and formerly shown in Figure 3).

We have therefore attempted to classify all the "Responses" selected and discussed by the convening experts according to the ranked categories of the Yeomans SoP. Appendix A—Table A2 shows the ordered list of all of them.

Some brief considerations about the landscape components introduced in the Yeomans SoP are the following.

P0. Climate. To be taken as it is. Only adaptation measures can be applied. The most permanent component is climate, including climate change. The overall climate produced the natural vegetation and gave the land its final shape, making it the first component on the scale.

P1. Land Shape and Waterflows. Land shape and waterflows are closely linked to climate. These components, together with climate, form the environment into which planning should fit. Although potentially modifiable, land shape and water flows, at both farm and catchment scale, would require the use of large earth moving machinery. This can be carried out at the very beginning of the wetland reconstruction or restoration process. Water infrastructure and management is of paramount importance as it has a direct impact on the wetland environment and, therefore, on the species within the ecosystem. Maintaining appropriate water levels is a key management objective; this can be achieved by properly regulating both inputs and outputs from watercourses flowing into and out of the wetland, whether these flows are natural or artificial.

P2. Access, Circulation, Building and Ecological Infrastructures. Traditionally, the term "infrastructure" has included only man-made assets and artefacts of economic interest. However, ecosystems should also be considered as a type of infrastructure that should not only be conserved but can also benefit human activities. Ecological infrastructure can therefore be defined as natural or naturally functioning ecological systems or networks that provide multiple services to people while allowing biodiversity to persist. Access, on the other hand, relates to mobility, allowing the movement of visitors, workers such as farmers, as well as machinery, and the need to avoid inappropriate concentrations of people and mass flows that may disturb wildlife or threaten habitat conservation. Buildings relates to the appropriate location of service facilities, including offices, visitor centers, storage, machine and tool sheds, and other necessary structures built according to ecological criteria.

P3. Vegetation, Habitats and Wildlife. As repeatedly emphasized, the conservation of biodiversity (at all levels: genetic, species, and landscape) is the priority objective. This is achieved through a species-specific approach (i.e., the protection of the most endangered species), but also through the conservation of the habitats and ecological niches of each species, as well as through the restoration of a complete local biocenosis.

P4. Zoning. Zoning encourages the assessment and design of activities in the wetland in terms of energy and resource requirements to reduce unnecessary travel time between different areas. Zones address the level of human activity, the efficiency of movement and the human effort required to manage the wetland. Of course, natural constraints must be taken into account, as well as the presence of areas of biodiversity that should be

preserved. Usually, and as a general rule, landscape elements (individual plots, parcels, fields, and other vegetation patches) should be placed in the landscape according to their frequency of use (i.e., closer for the most used, farther away for the least used). Different types of agroecological structures (agroforestry, food forest, orchard, wild garden, wild marsh vegetation, etc.) should be placed differently according to their management needs.

P5. Soil Fertility/Soil Quality. Maintaining and continually improving the fertility and agronomic qualities of the soil is an important objective underlying the agroecological and regenerative techniques that must be applied in cultivation. The initial conditions of the soil were very unfavorable and represent a strong limitation on productivity. This suggests the use of specific techniques which, in addition to increasing the organic matter content of the soil, can mitigate the effects of very clayey soil with a high concentration of salts, particularly sodium. Crop rotation, soil organic amendments, cover crops, conservation agriculture, compost and biofertilizer applications, etc., are a diverse set of tools for applying consistent agroecological farming management.

P6. Sense of Place, Aesthetic, Cultural, Social, and Economic Values. Social and economic factors can strongly influence wetland management, both in terms of biodiversity and agriculture. National and regional regulations and laws can also influence a wide range of decisions. Wetland management should be a strong magnet for cultural initiatives, training, environmental education, and a tireless center for the promotion of environmental and natural values. This should encourage continuous cultural development, broad participation of people, and the development of a sense of belonging and attachment to the place.

3.7. The Making of the Wetland Action Plan

Taking into account both the key DPSIR "Responses" resulting from the combination and scoring of "State" and "Driver" (shown in Appendix A—Table A1) and the same "Responses", this time ranked according to the Yeomans scale of permanence (shown in Appendix A—Table A2), a final "Wetland Action Plan" was developed. Table 4 summarizes the structural framework of the action plan.

Table 4. Structural framework of the Wetland Action Plan, according to the scale of Permanence ranking. Only the high score "Driver x State" combinations have been considered (score ≥ 8).

# Scale of Permanence	Driver and State	Priority Score	Reference to Appendix
Scale of Permanence 1 Land Shape and Waterflows	Driver 6. Water management State 1. Environment: water bodies	9.86/10	Appendix B.1
	Driver 6. Water management State 4. Biodiversity: habitats and species	8.29/10	Appendix B.2
	Driver 7. Agriculture State 1. Environment: water bodies	8.43/10	Appendix B.3
Scale of Permanence 2 [. . .] Ecological Infrastructure	Driver 7. Agriculture State 4. Biodiversity: habitats and species	8.71/10	Appendix B.4
Scale of Permanence 3 Vegetation, Habitats and Wildlife	Driver 7. Agriculture State 4. Biodiversity: habitats and species	8.71/10	Appendix B.5
Scale of Permanence 4 Zoning	Driver 7. Agriculture State 4. Biodiversity: habitats and species	8.71/10	Appendix B.6
Scale of Permanence 5 Soil Fertility/Soil Quality	Driver 7. Agriculture State 3. Environment: soil quality	9.86/10	Appendix B.7

Table 4. *Cont.*

# Scale of Permanence	Driver and State	Priority Score	Reference to Appendix
Scale of Permanence 6 [. . .] Social and economic values	Driver 5. Poaching (illegal hunting/fishing) State 4. Biodiversity: habitats and species	8.71/10	Appendix B.8
	Driver 3. Road Traffic State 4. Landscape, environ. health [. . .]	8.00/10	Appendix B.9
	Driver 7. Agriculture State 4. Landscape, environ. health [. . .]	8.00/10	Appendix B.10

The "Driver x State" pairs are clearly indicated in the same table, together with the corresponding score. Only the "essential" DxS combinations (i.e., score ≥ 8) have been considered in the development of the Wetland Action Plan, ordered according to the SoP ranking. For the sake of synthesis, and in order not to exceed the length of the text, the authors decided to present the action plan as a collection of factsheets reporting the full list of responses with a more detailed operational focus. For an in-depth examination of each of these factsheets, the reader is referred to Appendix B.

4. Discussion

4.1. Discussion of the Wetland Planning Outcomes

Expert scoring allowed the resulting DPSIR "Responses" to be ranked in terms of their relevance and influence on the development of the Wetland Strategy and Action Plan, while a priority order for their implementation was assessed according to the Yeomans scale of permanence.

Agriculture was the highest rated "Driver", while biodiversity (habitats and species) the highest rated "State". As a result, agriculture in general is seen as detrimental to the quality of the environment and therefore requires a complete rethink of farming concepts and practices, for example, through an agroecological transition. On the other hand, biodiversity has been identified as the most fragile and damaging of the environmental components and should be protected with great care. Their combination (agriculture and biodiversity) should be regarded as the strategic cornerstone of the whole planning framework. This means designing and implementing a system in which agriculture and nature (in our case a wetland) are allied ecological systems in mutual compensation, according to the way natural elements are embedded in the agricultural system.

Furthermore, agriculture as a "Driver" relates to each individual level of the Yeomans scale of permanence. At the first level of permanence, agriculture interacts with the water bodies through the regulation and management of the water supply (i.e., water pumping, floodgates, and sluices) and the monitoring of water quality. At the second level of permanence, it interacts with biodiversity through the creation of natural elements for ecosystem diversification and vegetation infrastructure (buffer zones, hedges, natural stepping stones, and other structures with an ecological function), thus promoting ecological connectivity for wildlife within and between the agricultural matrix. Similarly, at the third level of permanence, agriculture is again called upon by biodiversity, considering the need to maintain or even expand the wetland and increase wetland vegetation, to prevent the spread of allochthonous plant species and to monitor the quality of the habitats and the presence of wildlife species. Agriculture and biodiversity are a persistent combination also at the fourth level of permanence where recovery, restoration, and the protection of undisturbed "priority" habitats should be defined through zoning, together with farmland within the wetland, thus preventing its drainage. At the fifth level of permanence, agriculture is linked to soil quality and, at this level, low-input/low-impact farming practices should be planned, including permaculture, agroforestry, regenerative agriculture, and the cultivation of traditional crops and ancient varieties. Finally, at the sixth level of permanence, social, economic, and cultural values are involved in shaping the landscape, as well pro-

tecting the environment and human health through information, dissemination, education, and research with particular reference to sustainable agricultural training, both concepts and practices.

4.2. Discussion of the Wetland Planning Methodologies

The DPSIR model has been widely used in the assessment of coastal areas, wetlands, and lagoons; conversely, the approach proposed by Yeomans is of little or no use in general and has never been applied to these types of ecosystems in particular. It was therefore of great interest to examine its application compared to other approaches that also aim to prioritize actions and interventions to be undertaken. In this respect, the DPSIR model was often closely associated with some multi-criteria decision analysis (MCDA) techniques [62]. One of the most commonly used MCDA tools in participatory planning is the analytic hierarchy process (AHP), originally developed by Saaty [99]. This method, or similar methods in the same MCDA family, has been applied to the strategic and operational assessment of wetlands with encouraging results [54,55]. While the AHP method has been used in our previous research activities (e.g., recently in forest planning [100]), this time we wanted to turn to different prioritization methods belonging to another type of methodological approach referred to as expert group techniques for program planning, with specific reference to the Nominal Group Technique [71]. However, we would like to emphasize the significant difference between the prioritization methods already mentioned (the MCDA and NGT tool families), all of which aim to highlight the most relevant and critical actions, and Yeoamans' approach, which identifies a scale of priorities in terms of a sequence, considering factors of a more permanent nature (to be addressed first) as opposed to others that are easier to change (to be addressed later). This second approach is not at all documented in the literature and, in our opinion, needs to be considered instead.

The Nominal Group Technique (NGT), when applied, proved to be effective in reaching a general agreement among the participating experts. The application of this method did not force a complete overlap of judgements, nor a perfect convergence of opinions. This is frequently a critical point of the technique and one that is widely debated [71]: how much to push for greater uniformity in the judgments of experts, or to preserve their differences of opinion. In our study, a double run of the NGT procedure was considered sufficient to achieve an approximate level of expert agreement, but this is not always the case. Differences in scoring were detected by calculating the Std Dev, which ranged between 0 and 1.92; in 12 out of 35 cases the Std Dev was less than 1.0, while in 6 cases it ranged between 1.5 and 1.92. This observed variability was considered reasonable and fully justifiable given the different technical backgrounds of the experts.

The combination of the DPSIR model and Yeomans' scale of permanence proved to be of considerable methodological value, as it was able to effectively discriminate and group together the various interventions and actions developed in response to the planning process of the King's Lagoon. On the one hand, through the convergence of the opinions of a composite panel of experts, the DPSIR model made it possible to define a ranking of the importance of stressors (i.e., both impacts and pressures) considered critical in relation to different drivers and status conditions, and to properly identify actions that adequately respond to the real needs of the wetland. On the other hand, the scale of permanence made it possible to establish an order of priority, based on the fact that certain interventions must be carried out before others, because they are necessarily preparatory and indispensable for the success of subsequent ones. The guidance provided by the Yeomans' scale (and subsequent modifications by other authors) has been very helpful in this definition. We therefore believe that the integration of these two approaches, although unprecedented, has made the planning process particularly effective and has greatly enhanced its ability to interpret and guide interventions, actions, and transformations in dealing with the reconstruction, restoration, recovery, and management of wetlands [61,63–65,76,101–103].

In preparing this planning framework, it was particularly useful to distinguish between exclusively external (D1, D2 and D3) and predominantly internal drivers (D4, D5,

D6 and D7). This made it possible to highlight the responses that are inevitably linked to large-scale territorial policies, which are superimposed on instruments and interventions at the local level. It is precisely on the basis of this distinction (exogenous vs. endogenous drivers) that the planning process has been divided into a strategic plan, which is more time-relaxed and relates to the more stable and permanent landscape components, and an action plan, which relates to the landscape components that are more dynamic over time and more easily changed. Indeed, a considerable number of laws and regulations operate at the international, European, and national levels, with particular reference to international agreements (e.g., the Ramsar Convention), the European Biodiversity Strategy, the Natura 2000 network, the Water Framework Directive, as well as the Italian legislative framework for environmental protection. These policies also have an impact at the local scale and at the level of the wetland system, such as that of the study area.

Considering the possible limitations of the methodological approach used, this refers to the exclusive, albeit preliminary, involvement of experts. We wanted to create a panel with different technical and scientific backgrounds, while keeping the total number of experts within reasonable limits. As a result, only the opinions of the experts were taken into account in the development of the wetland planning procedure at this stage. This means that the process is only partial and will inevitably involve a subsequent phase of wider discussion, possible further elaboration and, more generally, an exchange of views between stakeholders both within and outside the King's Lagoon site. This phase of plan sharing and co-planning was not included in this study and will be concerned with the progress of ongoing initiatives at King's Lagoon. In fact, we believe that the participation of residents and visitors, administrators and citizens, farmers and naturalists in the decision-making process regarding the development of the wetland is of great importance and a tool to achieve wide-ranging stakeholder involvement.

One potential constraint on the implementation of the wetland plan is a limiting aspect of a cultural nature. A barrier to be overcome in order to meet the expectations of good wetland management is the fact that the wetland itself should not be considered as a separate, independent tile in the territorial mosaic, unrelated to the context in which it is embedded. This limitation is shared with several other planning process reported in the literature [54,55,104]. Unfortunately, the services and products that a wetland can provide are still little appreciated by both residents and local authorities, whereas the full development of the wetland can only be activated by promoting awareness and appreciation of a wide range of tangible and intangible products, direct and indirect services, and ecological functions that stabilize the environment and renew its quality and livability.

Wetland restoration can promote the recovery of ecosystem services, and as the recovery of biodiversity within the wetland gradually increases, a wide range of ecosystem services can also increase significantly, thus generating a mutually supportive circle. The greater the biodiversity, the more intense the flow of ecosystem services, which reinforce and consolidate the increasing level of biodiversity. Our trust, at this early stage of the King's Lagoon's recovery, is the startup of these positive feedback loops, supported by experimental evidence from meta-analysis studies by other authors [98,105]. It follows that another limitation of the study relates to the uncertainty regarding trends in biodiversity development, which were not ascertained but only assumed. While wetland restoration can increase biodiversity to levels that are quantitatively similar to natural wetlands, it is not yet certain that this improvement will have a real impact on ecosystem functionality and thus on the restored ecosystem services to be provided. Unfortunately, greater diversity by itself do not ensure a high level of ecosystem functioning [106]. These considerations open the way for further research and future developments. It follows that the recovery dynamics of the numbers and categories of species recolonizing the restored wetland must be carefully monitored in order to identify (quantitatively and qualitatively) the effects of restoration, also in terms of species associations, relative species proportions, and ecological

functionality, taking into account the design of the area's management and the applied conservation programs.

Considering other limitations, this work has focused on the wetland planning methodology, but inevitably neglects a more quantitative treatment of the numerous environmental indicators that are nevertheless necessary and must be progressively implemented in future research developments in order to establish a rigorous data-centered approach. Therefore, monitoring should also include the chemical and physical characteristics of the wetland's environmental compartments, in order to develop a thorough and integrated database of information that can be used to track the restoration process. Further research applications will include wetland management tools to be used in conjunction with simple and rapid assessment methods [107]. All the information obtained should be fed into assessment support systems, both in terms of valuing the reactivated ecosystem services [108] and estimating the health of the wetland; taking into account its achieved ecological status [109].

We are aware that our present analysis and consequent methodological proposal has been made at a general, still highly hierarchical level and at an early stage of wetland restoration. Further development will consist of a more detailed and explicit assessment in terms of scientific data analysis, which can be developed as information becomes available during the ongoing restoration process. Well-calibrated, comprehensive, and high-resolution interpretation models can generate scenarios of great interest, but obviously require a lot of data, which is not yet available. The importance of this work is therefore to properly frame and guide the planning in its early stages, so that serious and irreversible mistakes are not made and the restoration process is properly implemented and directed in the most appropriate direction.

5. Conclusions

Systematic and comprehensive wetland planning is needed to govern the wetland in the long term and to manage it in the short term, according to three important strategic pillars: (1) biodiversity conservation; (2) provision of sustainable goods and services (including regenerative forms of agriculture); (3) knowledge, education, and recreational values. This aim can be particularly difficult to achieve without a rigorous and effective methodology that takes into account all of the various but specific characteristics of a wetland and the several planning dimensions to be considered (i.e., nature and biodiversity, agriculture and other socioeconomic activities, tourism and recreation, scientific research, education and training, cultural heritage and traditions, etc.). Therefore, a unified framework has been defined to identify the drivers, pressures, states, and impacts, their complex interrelationships, and the set of responses to be implemented, according to well-defined relevance ranking and priority hierarchy, and to be achieved progressively in order to guide the full development of the wetland over time. In this respect, the combination of two different approaches has been proposed: the Yeomans scale of permanence and the DPSIR model. A specific study case (the King's Lagoon) was considered to evaluate and validate the methodology. The Nominal Group Technique was used as a consensus method to achieve general agreement and convergence of opinion among the seven experts involved, who formed a composite panel. The DPSIR model allowed the identification of a wide range of "Responses", after first identifying their influencing "Pressures" and "Impacts", and taking into account the "State" that each "Response" affects and the "Driver" that it can counteract. Each "Response" was ranked according to the average score of importance assigned by the panelists and then projected onto the appropriate level of the permanence scale to determine its priority order. In this way, the wetland strategy and action plan was prepared and ready for implementation, subject to approval by a wider stakeholder representation.

The performance of the proposed methodology was found to be useful and effective, with considerable potential to assist land planners, decision makers, administrative managers of public government bodies, nature conservation agencies, and NGO representatives. For this reason, we encourage the adoption of the methodology developed here and its

wider evaluation under different wetland conditions for ecological, naturalistic, land use and land cover, anthropogenic pressures, and many other factors that could affect their management and development.

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Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A. DPSIR and Yeomans Scale of Permanence Application

Table A1. Average scores assigned to "States" and "Drivers" combination by the panelist. The standard deviation (Std Dev.) is also reported.

Code		Drivers	States	Average	Std Dev	Judgment
D6	S1	Water Management	Environment: Water Bodies	9.86	0.35	Essential
D7	S3	Agriculture	Environment: Soil Quality	9.86	0.35	Essential
D5	S4	Poaching (Illegal Fishing or Hunting)	Biodiversity: Habitats and Species	8.71	1.28	Essential
D7	S4	Agriculture	Biodiversity: Habitats and Species	8.71	1.28	Essential
D7	S1	Agriculture	Environment: Water Bodies	8.43	0.49	Essential
D6	S4	Water Management	Biodiversity: Habitats and Species	8.29	0.88	Essential
D3	S5	Road Traffic	Landscape, Environmental Health and Human Well-Being	8.00	1.07	Essential
D7	S5	Agriculture	Landscape, Environmental Health and Human Well-Being	8.00	1.07	Essential
D2	S5	Proximity to Urban Areas	Landscape, Environmental Health and Human Well-Being	7.71	1.39	Important
D3	S4	Road Traffic	Biodiversity: Habitats & Species	7.43	1.59	Important
D6	S3	Water Management	Environment: Soil Quality	7.14	0.83	Important
D2	S1	Proximity To Urban Areas	Environment: Water Bodies	6.86	1.36	Important
D5	S5	Poaching (Illegal Fishing or Hunting)	Landscape, Environmental Health and Human Well-Being	6.43	1.92	Important
D7	S2	Agriculture	Environment: Atmosphere	6.29	1.48	Important
D2	S4	Proximity to Urban Areas	Biodiversity: Habitats and Species	6.29	1.03	Important
D4	S4	Tourists and Visitor Flows	Biodiversity: Habitats and Species	6.29	1.58	Important
D6	S5	Water Management	Landscape, Environmental Health and Human Well-Being	6.29	1.28	Important
D4	S5	Tourists and Visitor Flows	Landscape, Environmental Health and Human Well-Being	6.14	1.12	Important
D3	S2	Road Traffic	Environment: Atmosphere	4.57	1.05	Necessary
D1	S5	Industrial Installations	Landscape, Environmental Health and Human Well-Being	3.57	1.68	Useful
D1	S2	Industrial Installations	Environment: Atmosphere	3.00	1.85	Useful
D2	S2	Proximity to Urban Areas	Environment: Atmosphere	3.00	1.77	Useful
D5	S1	Poaching (Illegal Fishing or Hunting)	Environment: Water Bodies	2.43	1.40	Useful
D5	S3	Poaching (Illegal Fishing or Hunting)	Environment: Soil Quality	2.29	1.28	Useful
D4	S2	Tourists and Visitor Flows	Environment: Atmosphere	2.14	1.25	Useful
D1	S1	Industrial Installations	Environment: Water Bodies	2.00	1.07	Useful
D1	S4	Industrial Installations	Biodiversity: Habitats and Species	2.00	1.07	Useful

Table A1. *Cont.*

Code		Drivers	States	Average	Std Dev	Judgment
D6	S2	Water Management	Environment: Atmosphere	1.71	0.88	Barely relev.
D3	S1	Road Traffic	Environment: Water Bodies	1.57	1.05	Barely relev.
D4	S1	Tourists and Visitor Flows	Environment: Water Bodies	1.57	0.73	Barely relev.
D4	S3	Tourists and Visitor Flows	Environment: Soil Quality	1.43	0.73	Barely relev.
D1	S3	Industrial Installations	Environment: Soil Quality	1.14	0.35	Barely relev.
D2	S3	Proximity to Urban Areas	Environment: Soil Quality	1.14	0.35	Barely relev.
D5	S2	Poaching (Illegal Fishing or Hunting)	Environment: Atmosphere	1.00	0.00	Barely relev.
D3	S3	Road Traffic	Environment: Soil Quality	1.00	0.00	Barely relev.

Table A2. Yeoman scale of permanence and indicative checklist of the factors and responses to be considered in the wetland planning process.

CODE	SCALE OF PERMANENCE (Landscape Components)	DESIGN CHECKLIST (Jacke And Toensmeier, [79])	RESPONSES (As a Result of the Expert Consultation through Nominal Group Technique—NGT)
P0	Climate	Latitude, sun exposure and angles; annual precipitation and seasonal distribution; temperatures (max/min); frost-free days; plant hardiness zone; wind: directions, desirable, damaging; humidity; extreme weather potential: storms, hail, frost; predicted climate changes	To be taken as it is; only adaptation measures can be applied.
P1	Land Shape and Waterflows	Geology; elevation; slope; aspect; position of the land; existing sources of supply: location, quantity, quality, reliability, sustainability; potential sources of supply: location, quantity, quality, reliability; flooding, ponding and puddling areas; infrastructure: culverts, wells, water lines, tanks; location of all on-site and nearby off-site culverts, wells, water lines, old wells, etc.; potential pollution sources: water runoff, chemical runoff; erosion areas.	- Reconstructing, restoring, and maintaining the wetland hydraulic network; - Reopening of the canals and excavation of the "valleys"; - Installation of hydraulic organs to regulate the inflow and outflow of water; - Recovering and improving the historic hydraulic systems of the former fishing valley; - Control of natural wetland siltation; - Maintaining and restore irregular bank or channel profiles; - Water depth differentiation; - Measures to restore deep basins Regulation and management of water supply; - Regulation and management of water supply; - Scheduling of water pumping tower activities and restoration of floodgates and sluices; - Water quality monitoring; - Adoption of water phytodepuration techniques.

Table A2. *Cont.*

CODE	SCALE OF PERMANENCE (Landscape Components)	DESIGN CHECKLIST (Jacke And Toensmeier, [79])	RESPONSES (As a Result of the Expert Consultation through Nominal Group Technique—NGT)
P2	Access, Circulation, Building and Ecological Infrastructure	Activity nodes, paths, roads, gates, storage areas; pedestrian, bike, and vehicle access points, frequency of traffic, current and potential patterns of heavy or light vehicles; material flows: mulch, compost, produce, firewood, etc.; building conditions and use; building, both existing and possible: size, shape, functions; power lines (above and below ground) and electric outlets; outdoor water faucet, septic system, well locations; fences and gateways.	- Creation of natural elements for ecosystem diversification and vegetation infrastructure (buffer zones, hedges, natural stepping stones, and other structures with an ecological function); - Favoring ecological connectivity for wildlife within and between the agricultural matrix; - Composting systems from crop residues and organic waste; - Small plants for the production of biofertilizers, biostimulants, and biocorroborants; - Construction of a fishing pond;
P3	Vegetation, Habitats and Wildlife	Existing plant and animal species: locations, sizes, quantities, patterns, uses; invasiveness, weediness, what they indicate about site conditions; ecosystem architecture: layers and their density, patterning and diversity; ecosystem types; species and habitats: state of conservation.	- Maintenance, restoration, and enlargement of the wetland together with wetland vegetation and wildlife; - Control and prevention of the presence and spread of allochthonous plant species; - Periodic monitoring of habitat quality, presence of wildlife species, population dynamics, etc.
P4	Zoning	Existing zones of land and water use; current uses by neighbors and passersby; visiting areas; agricultural/agroforestry areas; natural and semi-natural areas; integral reserves and protected areas.	- Create areas for the recovery, restoration, and protection of undisturbed "priority" habitats; - Control and prevent the cultivation of natural salt marshes; - Allow cultivation only in specific and well-defined areas of the wetland; - Elimination of uncontrolled grazing by livestock through a local grazing plan.
P5	Soil Fertility/Soil Quality	Soil types: texture, structure, consistence, profile, drainage; management history; topsoil fertility: pH, OM, N, P, K, Ca; soil toxins: lead, mercury, cadmium, asbestos, etc.	- Promoting low-input/low-impact farming practices; - Development of agronomic practices based on the ecosystem structure and functioning; - Application of innovative cropping models and agricultural practices related to permaculture (food forest) and agroforestry; - Cultivation of traditional crops, old varieties and alimurgic (i.e., wild and edible) species; - Creation of permanent strips of spontaneous or cultivated vegetation; - Properly use of brackish water irrigation techniques; - Application of alkaline soil remediation techniques; - Cultivation of halophytic species; - Rational agronomic use of available livestock manure and animal sewage as fertilizer and soil improver; - Climatic adaptation to increase the resilience of farming systems (mixed- and inter-cropping, minimum soil mechanical disturbance, maintenance of a permanent soil cover, diversification of plant species, prevent soil losses from water run-off and erosion, improve the agricultural soil quality, etc.).

Table A2. *Cont.*

CODE	SCALE OF PERMANENCE (Landscape Components)	DESIGN CHECKLIST (Jacke And Toensmeier, [79])	RESPONSES (As a Result of the Expert Consultation through Nominal Group Technique—NGT)
P6	Sense Of Place, Aesthetics, Cultural, Social, and Economic Values	Landscape quality, sensations, functions, features; where time is and will be spent by visitors (views creation or selection); visitor experience of arrival and entry; property lines; environmental and other legal limits (e.g., wetlands regulations, zoning regulations); applications and fees; electricity; sales of produce; hospitals, schools, shops, recycling centers, plant and seed sources; material flows: sand, gravel, timber, mulch, water, fodder, clay, stone, machinery; imports/exports: food, building materials, fossil fuels, waste, etc.	- Regulation of hunting and fishing activities and the suppression of poaching; - Implementation of a larger protected natural oasis also considering a ban on hunting and fishing; - Territorial control of legality: surveillance, prevention, repression; - Control of the tourist pressure to mitigate the resulting disturbance of habitats and species; - Reduction in the tourist pressure through the creation of an adequate trail network; - Information, awareness and dissemination activities on biodiversity protection and sustainable, organic and regenerative agriculture; - Creation and management of a farmers' market; - Control and planning the grazing of cattle, sheep and buffalo; - Regulation of water withdrawals from rivers and canals; - Management plan for the conservation of wild fauna and flora; - Information and awareness-raising actions on the value of wild species and biodiversity; - Improvement of waste management (separate collection, reuse, recycling); - Urban development plan compatible with the management of the natural area limiting soil consumption.

Appendix B. The Wetland Action Plan (King's Lagoon, Siponto, FG, Italy)

Appendix B.1.

Scale of Permanence 1	Driver 6. Water Management	Priority Score:
Land Shape and Waterflows	State 1. Environment: Water bodies	9.86/10

Actions:

- Reconstructing, restoring, and maintaining the wetland hydraulic network;
- Reopening of the canals and excavation of the "valleys";
- Installation of hydraulic organs to regulate the inflow and outflow of water;
- Recovering and improving the historic hydraulic systems of the former fishing valley;
- Control of natural wetland siltation.

Description:

The restoration of the coastal King's Lagoon covered an area of about 40 hectares of marshland that had previously been cultivated and used illegally for fishing through constructed "valleys". The intervention was carried out near the Candelaro stream, owned by the State Property Office—Land Reclamation Branch, and granted in concession to the Consortium for the Reclamation and Irrigation of the Capitanata (Figure A1).



Figure A1. Demolition of illegally constructed buildings, canals, valley (i.e., body of water) and island construction, and other earth moving works.

On this previously flooded and largely cultivated land, the first step was to demolish illegally constructed buildings. The land was then excavated to an average depth of 1 m over an area of about 20 hectares to create a series of "valleys" separated by embankments and connected by canals with the necessary hydraulic regulation organs. The remaining 10 hectares were reclaimed and the adduction channels and hydraulic regulation organs were restored. In addition, four islands were created by the accumulation and compaction of successive layers of excavated material in the adjacent areas, covering a total of 2.5 hectares and reaching a maximum height of approximately 6.5–7.0 m (taking into account the slope of the banks). The construction of these islands was considered necessary in order to naturalize the restored habitat as much as possible, to increase the ratio of water surface to bank length, and to create areas of high conservation value; indeed, islands in marshes, lagoons, etc., are the areas with the greatest biodiversity, due to their suitability for plant species, but above all their attractiveness for bird species, which find safe nesting and trophic conditions.

Maintaining a wetland's hydraulic network allows water to flow in and out safely, which is essential to provide the environmental conditions and ecological functions typical of a wetland. An efficient network of canals for water circulation is important for both the construction and maintenance of a wetland. Often the canals built for reclamation purposes are still the primary hydraulic system relied upon for current water management. Unfortunately, when the reasons for using the wetland cease to exist, the hydraulic network can quickly fall into disrepair. In particular, the network of small channels suffers the most damage from vegetation overgrowth, debris accumulation, siltation, etc., which reduces or eliminates their functionality. This can lead to localized disruptions in the flow of water, with negative consequences for the overall hydrological cycle and therefore for the conservation of habitats and wildlife. Siltation is the most serious and widespread problem that needs to be addressed to ensure wetland conservation. It is usually caused by natural processes such as suspended solids in turbid water and the accumulation of plant biomass. The addition of sediment from the Candealro stream causes the long-term deposition of material carried in suspension by the water and the closure of free water bodies. The control of siltation is very complex and should involve the entire

catchment area and require the implementation of specific water regulation measures through hydraulic works and hydraulic installations to control erosion, reduce the rate of sediment transport, and slow down the siltation of both the reclaimed channels and the wetland ponds. Concerning the King's Lagoon, a reclamation tower pump to catch the draining water from the surrounding polders is in operation. It is therefore necessary to reactivate a series of hydraulic artefacts to facilitate the inflow and outflow of water across the wetland. Special attention should also be paid to the proper planning of water use, limiting water withdrawals for agricultural use and avoiding sudden drains with negative effects on aquatic avifauna. The relationship between the fresh water entering from the inland river and the brackish water entering from the coast should be controlled by hydraulic works to prevent the upwelling of salt water whose uncontrolled entry into the wetland could alter its ecological status. Wetland ecosystems are, by their very nature, transitional environments whose vegetation communities naturally tend to evolve towards more terrestrial successions. This is due to the rapid growth of the vegetation, which tends to invade the stretches of water as the bottom rises due to sediment deposition. In a non-human context, the natural loss of these ecosystems would be compensated by the colonization of other areas in a virtuous ecological functional dynamic; in a highly anthropized territorial context, however, such compensation is unfortunately impossible.

Appendix B.2.

Scale of Permanence 1	**Driver 6. Water Management**	**Priority Score:**
Land Shape and Waterflows	State 4. Biodiversity: Habitats and Species	8.29/10

Actions:

- Maintaining and restore irregular bank or channel profiles;
- Water depth differentiation;
- Measures to restore deep basins.

Description:

Irregular wetland perimeters and the presence of creeks, jagged banks, and gentle slopes towards the water bodies ("valleys") result in shallow water profiles close to the banks and create favorable environmental conditions for many bird species [110]. The increase in the length of riparian strips and their irregular morphology is a significant environmental improvement. Indeed, these are the areas where the conditions for the greatest biological richness and diversity are found and where the most important ecological functions can best develop (Figure A2).

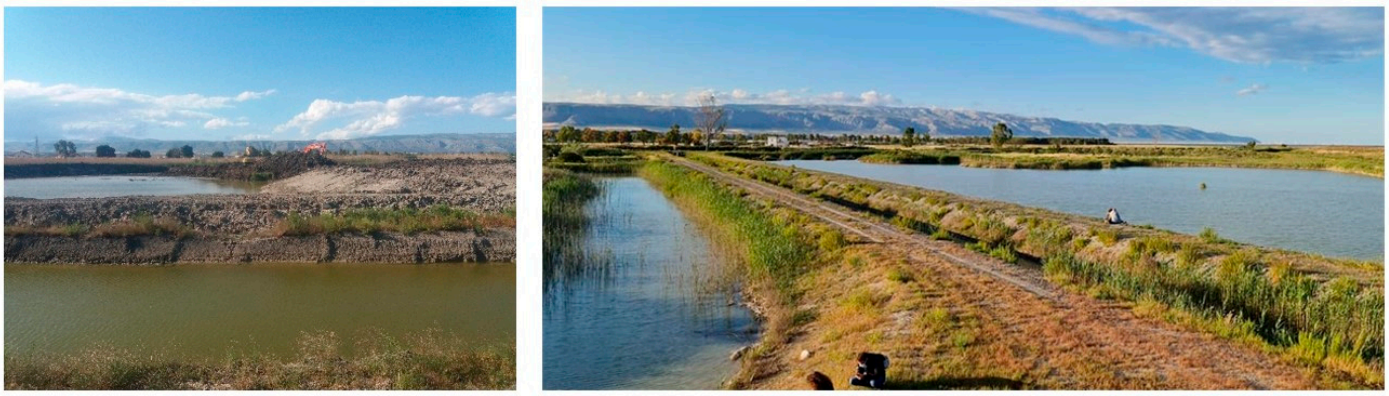

Figure A2. Some views of the lagoon after the series of soil modelling and reshaping together with hydraulic works in the area considered in the study case.

In order to make the perimeter of the wetland more irregular, various measures can be taken, such as the remodeling of the banks by excavating and filling successive contiguous sections with the same excavated material, extending the wetland with dams that divert

water from the main body to dry areas, constructing ditches that branch off from the main wetland and connecting it to new dry areas, together with the independent regulation of water levels by means of river sluices, the creation of islands or even peninsulas jutting out into the water [110]. A wetland with considerable differentiation in water depth, with irregular bank morphology, and a varied distribution of emergent and semi-emergent areas is capable of supporting a greater number of plant and animal species, other things being equal. In fact, under these conditions, very diverse plant communities can develop, with which different groups of wetland animals are associated. This is why it is so important to create or increase the width of these flooded areas, which extend from the banks to a depth of one or two meters [110]. A significant contribution to the potential expansion of wetlands can be made by interventions on marginal agricultural land of low productive value. In these cases, modest structural interventions can allow the creation of periodically flooded areas with limited water depths to recreate environments suitable for staging, feeding, and breeding for many bird species. This can be achieved through the use of hydraulic techniques such as surface remodeling, the construction of dams, canals and other hydraulic works to regulate inflows and outflows [110].

Appendix B.3.

Scale of Permanence 1	**Driver 7. Agriculture**	**Priority Score:**
Land Shape and Waterflows	State 1. Environment: Water bodies	8.43/10

Actions:

- Regulation and management of water supply;
- Scheduling of water pumping tower activities and restoration of floodgates and sluices;
- Water quality monitoring;
- Adoption of water phytodepuration techniques.

Description:

The King's Lagoon has a tower pump that periodically draws water from the surrounding agricultural polders and discharges it into the wetland. It is necessary to determine the quantity of this water, the frequency of this discharge, and its quality in terms of physicochemical properties (especially salinity, together with macronutrients) and possible chemical contaminants. In fact, periods of low water or, on the contrary, periods of excess water must be avoided, except in the case of exceptional rainfall or flooding of the Candelaro stream. The monitoring of water quality is a crucial operation in order to obtain the evidence needed to make informed decisions on water management. The surrounding agriculture affects water quality through the release of nutrients (as a result of soil management and fertilizer application) and other chemicals (e.g., pesticides), biological contamination (e.g., from animal sewage and manure), and soil erosion. The main nutrients entering water bodies from agriculture are nitrogen and phosphorus in their various forms, which contribute to eutrophication and associated toxic algal blooms. In addition to nutrients, the main chemical pollutants from agriculture are organic compounds (including herbicides, insecticides, and fungicides). The effects of these types of chemicals are complex and sometimes their breakdown products can also be very harmful to aquatic life. There are also concerns about veterinary pharmaceuticals entering watercourses and their impact on ecological processes. These chemicals are designed to be biologically active and therefore have the potential to pose a risk to aquatic and terrestrial habitats if released. It is therefore necessary to quantify the relative contributions from agricultural sources and to ensure that remediation strategies are in place where necessary. One of these mitigation strategies is the phytodepuration of water by the natural wetland vegetation that develops in the upper part of the lagoon, i.e., where the water enters, and along the path that the water takes within certain wetland areas that are particularly rich in vegetation.

Appendix B.4.

Scale of Permanence 2	Driver 7. Agriculture	Priority Score:
[. . .] Ecological Infrastructure	State 4. Biodiversity: Habitats and Species	8.71/10

Actions:

- Creation of natural elements for ecosystem diversification and vegetation infrastructure (buffer zones, hedges, natural stepping-stones, and other structures with an ecological function);
- Favoring ecological connectivity for wildlife within and between the agricultural matrix;
- Composting systems from crop residues and organic waste;
- Small plants for the production of biofertilizers, biostimulants, and biocorroborants;

Description:

Linear and non-linear vegetation structures ("patches"), such as hedgerows and rows of trees, provided they are made up of autochthonous species, increase the complexity of the ecosystem, enrich and diversify the landscape, strengthen ecological networks, and provide shelter and reproduction sites for wild animals moving through the area. They therefore play an important role in conserving biodiversity and restoring ecological connectivity, as opposed to a hostile "matrix" generally represented by agricultural land use. Natural or semi-natural ecosystems with different types of vegetation, natural or planted, such as hedges, flower strips, solitary trees, woodland-grassland systems, coastal dune systems, open and vegetated water areas, etc., provide habitat, shelter, and food for a variety of animals and plants. The establishment of even small-scale hygrophilous mixed forests along the banks and embankments of flooded areas is extremely important for increasing the ecological diversity of ecosystems. In addition to their size and degree of connectivity, semi-natural habitats must have a certain quality in order to be ecologically functional and used by animals and plants as described above. Quality is expressed, among other things, by the richness and diversity of landscape elements (according to the Shannon and Margalef indices), the geometric irregularity of the patches, the plant species composition corresponding to the potential vegetation of the area.

Agricultural practice must focus on the exclusive use of products of natural origin, rather than through industrially synthesized chemical processes. This requires the intensive use of all vegetation residues and organic waste from the management of semi-natural areas, such as reed beds and their periodic thinning to prevent them from closing off the open water bodies ("valleys"). Vegetation control, through mowing and mulching, proves to be a useful practice for thinning and renewing vegetation cover. This type of intervention should be undertaken only in the pre- or post-reproductive periods (winter, late summer–autumn) and exclusively on part of the area occupied by the present vegetation, trying to achieve an uneven-aged stand of it by alternating the areas of intervention.

The production of compost and other types of organic fertilizer (together with soil conditioners, biofertilizers, bio-stimulants, stabilized manure, etc.) must become a continuous and characteristic activity in the management of wetlands, both for the benefit of the internal agricultural activity, and possibly as a commercial activity for the benefit of farmers in neighboring areas.

Appendix B.5.

Scale of Permanence 3	Driver 7. Agriculture	Priority Score:
Vegetation, Habitats and Wildlife	State 4. Biodiversity: Habitats and Species	8.71/10

Actions:

- Maintenance, restoration, and enlargement of the wetland together with wetland vegetation and wildlife;
- Control and prevention of the presence and spread of allochthonous plant species;

– Periodic monitoring of habitat quality, presence of wildlife species, population dynamics, etc.

Description:

Agriculture and wetland conservation have traditionally been in conflict, as widely reported here. Now, however, the time has come to forge a new alliance and ensure the coexistence of the two systems in order to secure sufficient and appropriate land for wetland conservation. For the first time in history, in certain geographical areas, agriculture is retreating and wetlands are advancing, occupying limited space in the once much larger Siponto coastal wetland system. Therefore, wetlands can be extended and improved by converting adjacent agricultural land. In such cases, in addition to modest hydraulic landscaping and the installation of small water management structures, appropriate vegetation interventions can significantly improve wetlands, including flooding and the renaturation of even small areas. Proper management of wetland vegetation is essential to ensuring good wildlife functioning in a wetland ecosystem. Vegetation plays a crucial role as a direct food source, the creation of prey-rich ecological niches and as a refuge and nesting site for wildlife. The enrichment of any wetland with wildlife must therefore provide for the rational maintenance of the native vegetation and, in particular, the species of greatest interest to the local avifauna. Therefore, efforts should be made to promote the heterogeneity of the plant species present, trying to avoid the dominance and overgrowth of some species over others, maintaining an appropriate balance of species and plant communities, promoting the less common but more interesting plant species in the community, renewing and revitalizing the species already present while limiting the presence of invasive species, reducing the excessive density of some species over others, increasing the food supply, nesting and refuge areas for different animal species, increasing the diversification of habitats, and allowing regular water flows within the wetland [110].

In the area, inside and outside the King's Lagoon, it is possible to observe some alien species, the origin of which can be traced back to the anthropic activities carried out in recent decades. These species now have a high dispersal capacity, in particular *Acacia cyanophylla*, *A. horrida*, *Eucaliptus camaldulenses*, *E. globus*. The impact of allochthonous species is particularly negative with regard to the protection of sensitive and priority habitats (such as 2270*), given the high diffusion and spread capacity of the alien species already mentioned. In fact, by competing for space, they can replace native vegetation and cause a reduction in the vitality of the tree layer of native plants, completely altering the habitat.

Appendix B.6.

Scale of Permanence 4	**Driver 7. Agriculture**	**Priority Score:**
Zoning	State 4. Biodiversity: Habitats and Species	8.71/10

Actions:

– Create areas for the recovery, restoration, and protection of undisturbed "priority" habitats;
– Control and prevent the cultivation of natural salt marshes;
– Allow cultivation only in specific and well-defined areas of the wetland;
– Elimination of uncontrolled grazing by livestock through a local grazing plan;

Description:

Zoning, i.e., the delimitation of areas of the wetland to be allocated to different and distinct land uses, is an essential procedure to rationalize the management of the lagoon and to ensure the respect and conservation of all the vegetation and fauna components of the area, notwithstanding human activities that do not interfere with nature conservation. This implies the need to separate areas of naturalistic interest from those more frequently used for human purposes, particularly agricultural activities (Figure A3).

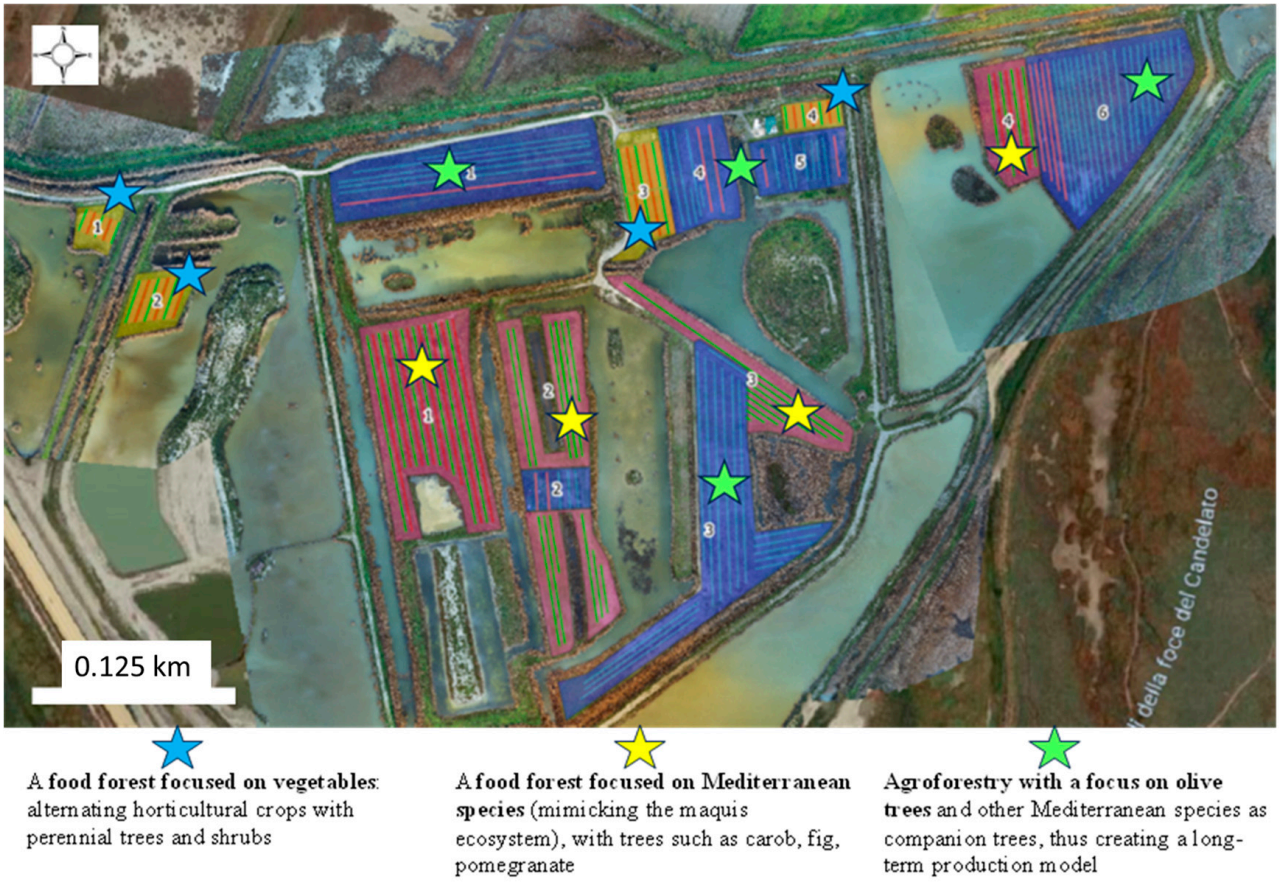

Figure A3. Wetland zoning. Colored stars, together with sequential numbers, indicate the area devoted to agriculture according to the permaculture design, focusing specifically on different typologies of agroforestry and food forests.

The presence of a large network of buffer zones allows the mitigation of different types of disturbance to the natural environment. Areas designated for agricultural activities should be easily accessible via farm roads and close to the wetland entrance area. The most sensitive areas should preferably remain isolated and away from congregation points, accessible only on foot and by slow-moving roads.

The King's Lagoon, together with other neighboring wetlands ("Lago Salso" and "Palude di Frattarolo"), should be considered as a residual wetland of the whole coastal area, near the Carapelle stream and at the mouth of the Candelaro river to the sea. The conversion of land from natural to cultivated has taken place, threatening the survival of the wetland biotopes associated with the "Mediterranean salt steppes" (1510*), reducing their extent and indirectly reducing the environmental suitability for several priority species (such as the *Numenius tenuirostris*, which is on the verge of extinction, together with some other species of aquatic birds) and the entire ecological system. For this reason, it is strategically important to allow cultivation only in specific and well-defined areas of the wetland, to avoid at all costs the cultivation of natural salt marshes, and to prevent uncontrolled grazing of livestock in adjacent areas by drawing up a local grazing plan.

Appendix B.7.

Scale of Permanence 5	**Driver 7. Agriculture**	**Priority Score:**
Soil Fertility/Soil Quality	State 3. Environment: Soil Quality	9.86/10

Actions:

- Promoting low-input/low-impact farming practices;
- Development of agronomic practices based on the ecosystem structure and functioning;
- Application of innovative cropping models and agricultural practices related to permaculture (food forest) and agroforestry;
- Cultivation of traditional crops, old varieties, and alimurgic (i.e., wild and edible) species;
- Creation of permanent strips of spontaneous or cultivated vegetation;
- Properly use of brackish water irrigation techniques;
- Application of alkaline soil remediation techniques;
- Cultivation of halophytic species;
- Rational agronomic use of available livestock manure and animal sewage as fertilizer and soil improver;
- Climatic adaptation to increase the resilience of farming systems (mixed- and intercropping, minimum soil mechanical disturbance, maintenance of a permanent soil cover, diversification of plant species, prevent soil losses from water run-off and erosion, improve the agricultural soil quality, etc.).

Description:

In many cases, agriculture remains a constant human activity, even in wetlands [23]. Wetlands and agriculture are still closely linked [111]. According to the Ramsar Convention on Wetlands (2014), 20% of Ramsar sites (wetlands of international importance) contain agricultural wetland types, 78% support agricultural production and more than 50% are threatened by agricultural activities. Agriculture can be a risk factor for the conservation of these ecosystems or, conversely, a strengthening element for their productivity and stability. This depends entirely on the agricultural model applied. Agricultural practices should not only be fully compatible with the conservation of this fragile ecosystem, but should also contribute to its regeneration and further diversification. At the same time, we expect that wetland agriculture and its associated biodiversity will be able to benefit from a compensatory effect resulting from the functioning of the wetland ecosystem, thus achieving greater autonomy from agrotechnical inputs and a higher level of stability and resilience. Therefore, the wetland planning process should conceive and design agricultural activity to work in alliance with, rather than in opposition to, the conservation of biodiversity, both wild and cultivated (Figure A4. Rather than simply improving the efficiency of the use of agrotechnical inputs, the aim should be to promote the whole transformation of the farming system within, and possibly beyond, the wetland boundaries. This transition should be based on the ecosystem services associated with wetland biodiversity and should take place at both field and landscape scales, as the two dimensions are strongly interlinked.

Some general but essential operational concepts need to be followed in order to move the system towards a new and improved ecological complexity; we have tried to achieve a kind of synthesis with the following bullet points:

- promote intensification through nature-based solutions that mimic nature, its biological regulation and control, and the complexity of ecosystems (i.e., biodiversity). This should allow for limited external inputs, input substitution, and a good degree of resilience;
- genetic and species diversification of agroecosystems should be planned in time and space;
- maintain heterogeneity at both land and field scales;
- promote complex trophic levels along the ecological food web, with particular attention to soil organisms—the greater the complexity, the lower the risk of pest outbreaks;
- promote interactions between all living organisms, at all ecosystem levels and in all environmental compartments;
- adopt and take advantage of complementary functional traits, beneficial biological interactions. and biological regulation to achieve a broad range of products and services;

– improve nutrient flow and recycling within the agroecosystem compartments to achieve optimal resource self-sufficiency.

The transition to ecologically sound, smaller-scale, diversified farming systems is specifically addressed by agroecology (and the many agricultural practices that fit into this riverbed). Researchers have often looked outside conventional science to gain insights and contributions to this transition process from traditional and innovative practices. For our research team, this was the case of permaculture, which has grown alongside agroecology since the late 1970s. According to [112] (one of its co-founders), permaculture can be defined as "consciously designed landscapes that mimic the patterns and relationships found in nature while producing an abundance of food, fibre and energy to meet local needs" [112].

In this respect, permaculture can act as a framework for integrating knowledge and practice across disciplines to support collaboration with mixed groups of researchers, stakeholders, and land users [113]. In general terms, this agricultural model of ecological intensification can include a wide variety of agroecological practices (organic, regenerative, syntropic, imitating nature, conservation agriculture, agroforestry, etc.) that have in common, to varying degrees, the aim of transforming, from negative to positive, both the impact of the surrounding natural environment on agriculture and the impact of agriculture on the surrounding natural environment. This means designing and implementing a system in which agriculture and nature (in our case a wetland) are allied ecological systems in mutual compensation, according to the way natural elements are embedded in the agricultural system [49].

Food forestry or garden forestry is a type of low-maintenance, multifunctional cultivation based on imitating the forest ecosystem, where fruit trees, timber plants, vegetables, flowers, medicinal herbs, honey plants, etc., are intercropped. The different essences form different layers along the entire canopy profile, as in the forest ecosystem. The minimum number of layers required to create a food forest, including at least one tree species, is therefore three (tall tree, shrub, and herb). Following the principles of permaculture, the team is currently evaluating different food forest models:

– A food forest focused on vegetables: alternating horticultural crops with perennial trees and shrubs;
– A food forest focused on Mediterranean species (mimicking the maquis ecosystem), with trees such as carob (*Ceratonia siliqua* L.), fig (*Ficus carica* L.), mulberry (*Morus nigra* L.), pomegranate (*Punica granatum* L.), quince (*Cydonia vulgaris Pers or Pirus Cydonia* L.), almond and pistachio (*Prunus amygdalus Batsch* and *Pistacia vera* L.), mastic and therebint (*Pistacia lentiscus* L. and *Pistacia therebintus* L.), hawthorn (*Crataegus monogina Jacq.*), associated with capers (*Capparis spinosa L.*) and asparagus (*Asparagus officinalis* L.), artichoke (*Cynara cardunculus scolymus* L. *Hayek*), and some other small fruits such as blackberries (*Robus* spp.).
– Agroforestry with a focus on olive trees and other Mediterranean species as companion trees, thus creating a long-term production model. (*cf. SoP 4: Zoning*).

Conventional breeding has led to a loss of genetic variability, reducing the adaptability of crops to different ecosystems and pedoclimatic conditions [114,115]. Wild edible plants have been an extremely useful source of food to cope with recurrent famines and poor agricultural conditions in past decades. Today, it is very important to preserve this cultural heritage due to the high nutraceutical value of these plants and their interesting genetic traits with excellent adaptation to local environmental constraints. Some of the activities to be promoted are:

– Recovery of germplasm and cultivation of ancient species;
– Conservation of genetic diversity through the maintenance and/or restoration of endangered species/varieties;
– Information and extension activities for farmers.

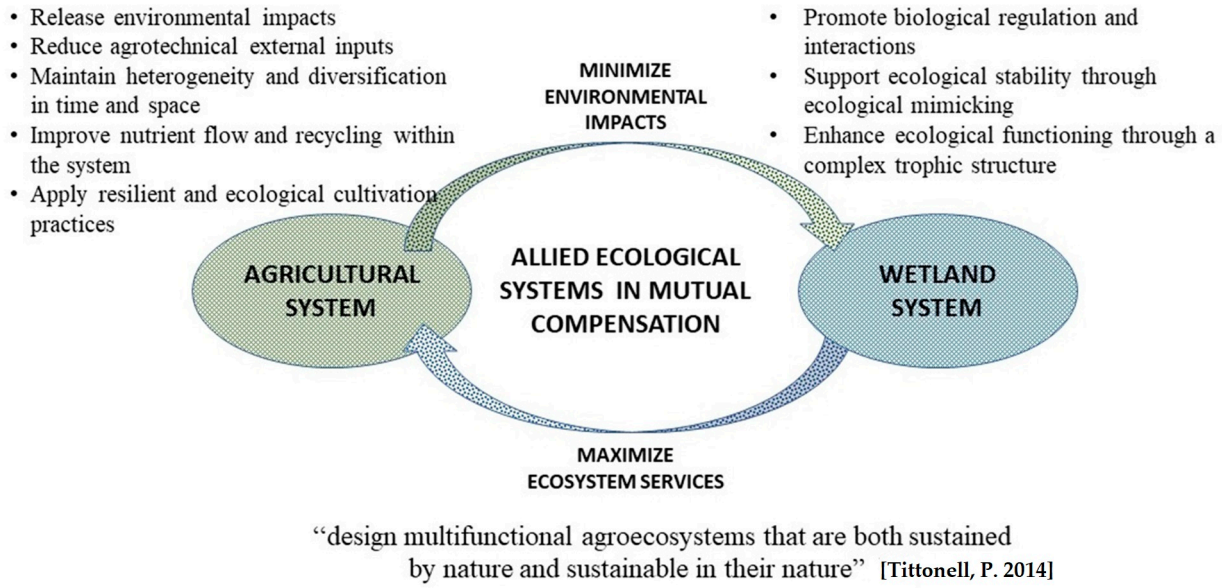

Figure A4. Wetland and agriculture are designed to be allied and complementary, mutually offering services and compensations [49].

Plants found in natural environments have adaptation mechanisms that facilitate minimising damage that occurs only under extreme conditions [116]. The selection of plants for landscaping and cultivation proposed in this paper has the potential to result in significant savings in water consumption and increased yields for agricultural crops in areas with inadequate irrigation conditions.

The implementation of agri-environmental measures (now known as "eco-schemes" in the PAC framework), such as wildflower strips, riparian buffer strips, grassland restoration and field margins left uncropped, is considered a significant ecological improvement. Several studies have shown how these diversifying ecological structures can positively affect ecosystem services: increase crop yield [117,118], improve water quality [119], enhance carbon storage [120], enable natural pest regulation, pollination, nutrient capture and cycling, and reduce erosion [121,122].

Animal manure and slurry can be used directly in the field (on condition of their stabilization), or they can be important ingredients of compost and biofertilizer products (e.g., bokashi, teku kana). In particular, manure can be used in combination with hay, mown green biomass, straw, wood chips, and sawdust to produce compost or, alternatively, in combination with sugar, ash or rock dust, yeast, milk or whey to produce biofertilizer. Compost can be also supplanted with biochar obtained from wood pyrolysis treatments. The application of stabilized or composted manure can result in increased soil nutrient concentrations and a higher level of organic matter [123,124]. Residual effects of manure or compost application on crop yield and soil properties can last for several years [125,126] due to a slow, long-term mineralization process. There is evidence that the diversification of the cropping system, such as mixed and intercropping, diversification of plant species, together with permanent soil cover and minimum soil mechanical disturbance, improves biodiversity [127,128], prevents losses of arable land, increases soil quality, and preserves water resources [129,130].

The management of wetland agriculture raises some specific critical issues. In particular, the availability of poor irrigation water quality and poor soil quality due to salinity (i.e., high EC, electrical conductivity) are both expected conditions. If these constraints are combined with a high Sodium concentration in the water (SAR) and a high Sodium percentage in the soil exchange complex (ESP), and if the soil itself is predominantly clayey, then unfortunately the worst agricultural conditions prevail and the possibility of cultivation is very limited. Nevertheless, the application of appropriate agronomic techniques

(pH correction, soil amendment with an abundant supply of organic matter, salt leaching, selection of salinity resistant or tolerant species and varieties, etc.) can allow for discreet agricultural activity. Crop species and ecotypes should be selected from those that are already present and widespread in the wetlands and that are well adapted to these very difficult conditions, by collecting and propagating their seeds or propagules. This will enable intelligent agriculture, with "niche" production of wild species for food use, highly qualified from a nutraceutical point of view, offering a product of excellent quality, even if not in large quantities. In this context, the term *alimurgic* refers to edible plants that grow spontaneously in the natural environment, thus recognizing the nutritional capacity of certain wild plants, which are therefore edible and traditionally used in times of famine or simply for health reasons. Currently, the term phytoalimurgic qualifies edible plants (with leaves, stems, buds, flowers, roots, tubers, bulbs, or berries as edible parts) that grow wild in the natural environment, but can also be propagated and cultivated in the same area.

Halophytes are promising plants for resilient farming systems due to their adaptation to extreme salinity conditions. Thanks to their ability to accumulate large amounts of salt in their shoots, halophytes are well known for their potential to remediate saline soils in the long term, allowing for the subsequent cultivation of less tolerant crops. This trait can also be used to improve the productivity of salt-sensitive crops (*glycophytes*) by growing them in intercropping systems with halophytes, creating more resilient farming systems and reaping the economic benefits of harvesting both plant species.

Appendix B.8.

Scale of Permanence 6	Driver 5. Poaching (Illegal Hunt./Fishing)	Priority Score:
[. . .] Social and Economic Values	State 4. Biodiversity: Habitats and Species	8.71/10

Actions:

- Regulation of hunting and fishing activities and suppression of poaching;
- Implementation of a larger protected natural oasis also considering a ban on hunting and fishing;
- Territorial control of legality: surveillance, prevention, repression.

Description:

Hunting and fishing are still allowed during the appropriate seasons and in areas outside the perimeter of the protected natural oasis (King's Lagoon). Hunting cause direct disturbance to habitats of high natural value (such as 1150* and 1510*) due to the risk of accumulation of toxic substances and elements such as lead in the soil and shallow water; secondly, due to soil compaction and the risk of accidental fires, particularly in the months of September and October. It should also be remembered that there is a high level of disturbance to the species that frequent the site, especially "priority" species such as *Botaurus stellaris*, *Aythya nyroca*, *Numenius tenuirostris*, *Phalacrocorax pygmeus*, and *Falco biarmicus feldeggi*, which are present in the area during the hunting season as migratory and wintering species. Illegal fishing is also common in the wetland and its surroundings and should be prevented by strict and careful surveillance by authorized personnel (park rangers). More generally, habitat and species disturbance is caused by uncontrolled human presence, which should be strictly limited and regulated by distinguishing between open and closed visitation areas (see "zoning" and the corresponding set of actions).

Appendix B.9.

Scale of Permanence 6	Driver 3. Road Traffic	Priority Score:
[. . .] Social and Economic Values	State 4. Landscape, Environ., Health [. . .]	8.00/10

Actions:

- Control of the tourist pressure to mitigate the resulting disturbance of habitats and species;

– Reduction of the tourist pressure through the creation of an adequate trail network;

Description:

The pressure of tourism is given by the presence of tourist villages along the coast in a short distance from the King's Lagoon. In summer, the surrounding area is visited by about 10–15 thousand people. Moreover, the inappropriate use of the wetland by birdwatchers and nature lovers is another cause for concern, as the King's Lagoon is one of the classic destinations for nature tourism in the whole of the Apulia region. Tourist pressure is a constant source of direct disturbance to highly sensitive and priority habitats (such as 1150* and 1510*) due to the unregulated human presence, soil compaction caused by trampling and, last but not least, the risk of accidental fires, especially in summer. Habitat disturbance through trampling is mainly due to the use of motorized vehicles, which also disturb fauna during the migration, foraging, and breeding periods. Tourist mobility within the wetland area should be restricted to a well-marked and visible network of trails, accessible by car only at selected points, to minimize vehicle traffic.

Appendix B.10.

Scale of Permanence 6	**Driver 7. Agriculture**	**Priority Score:**
[. . .] Social and Economic Values	State 4. Landscape, Environ., Health [. . .]	8.00/10

Actions:

– Information, awareness, dissemination and training activities on sustainable, organic and regenerative agriculture (including biodiversity protection);
– Creation and management of a farmers' market.

Description:

Political and institutional frameworks have a profound influence on wetland management. Similarly, effective initiatives to promote biodiversity conservation and regenerative agricultural applications must take into account broader social and political considerations. In particular, improved linkages between research and extension, inter-institutional partnerships and cooperation, and greater stakeholder involvement in policy formulation and implementation should be promoted through key principles and effective strategies. A good but not exhaustive list is presented here: (1) Increase participation, start from local priorities, be inclusive, work with local knowledge and available resources, increase involvement of local actors in decision making. (2) Develop projects and methods in cooperation with local communities, taking into account their needs, interests and capacities. (3) Start with small, manageable projects that allow people to build confidence and skills through practical experience without exposing them to significant risk. (4) Encourage democratic (rather than autocratic) leadership styles and independent learning (experimentation, analytical skills, and self-discovery), encouraging communities to generate projects and providing organizational support, information, didactic materials, and logistical support.

At present, agricultural production does not allow for the creation of a virtuous economic cycle capable of contributing to the overall development of the area; local farmers within the King's Lagoon produce for their own consumption and sell some of their products at the nearest city market. The creation of a quality label for all agricultural products is being promoted, as is the creation of a "farmers' market" within the wetland company center for the direct sale of agricultural products. In this way, it will be possible to rediscover the relationship with one's own territory, to respect seasonality (farmers' markets make it possible to immediately appreciate the sense of the seasons, as the product grown out of season requires excessive energy consumption), and to develop new economic incomes.

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