BLUEMISSION AA

Building a coordination hub to support the mission implementation in the Atlantic and Arctic Basin

D1.3
Ecosystem Restoration Case Studies: Best Practices and Opportunities for Scalability and Replication

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List of Acronyms

Acronym	Definition
A-AAGORA	Horizon Europe funded project focusing on demonstrating restoration activities in three regions covering the Atlantic-Arctic basin and blueprints for replication to support the implementation of the EU Mission to restore oceans and costs by 2030, in the Atlantic and Arctic Basin.
AWS	Alliance for Water Stewardship
BlueMissionAA	Horizon Europe funded project focusing on building a coordination hub to support the implementation of the EU Mission to restore oceans and costs by 2030, in the Atlantic and Arctic Basin.
BNG	Biodiversity Net Gain
CIC	Community Interest Company
CLIMAREST	Horizon Europe funded project focusing on developing and testing technological, logistical, social, and economic innovations for the restoration of marine ecosystems in five demonstration sites and five replication sites to support the implementation of the EU Mission to restore oceans and coasts by 2030, in the Atlantic and Arctic Basin.
CRM	Customer Relationship Management
DEFRA	Department for Environment, Food & Rural Affairs
EBM	Ecosystem-based management
KPI	Key Performance Indicator
NGO	Non-Governmental Organisation
NbS	Nature-based Solutions. 'Actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine

	ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits' (United Nations Environment Assembly, 2022)
RAG	River Action Group
RESTORESEAS	RESTORESEAS is a collaborative multi-disciplinary research project coordinated by the Centre of Marine Sciences (CCMAR) in Portugal and has a consortium of 13 partners including universities, research institutes, and museums.
REST-COAST	REST-COAST is an EU funded project aiming to implement large scale RESToration of COASTal ecosystems through rivers to sea connectivity
SER	Society for Ecological Restoration
SPV	Special Purpose Vehicle

1 Executive Summary

Ecological restoration is an important tool for mitigating and adapting to the impacts of climate change and other anthropogenic threats to social-ecological. The United Nations and European Union, along with national and subnational governments, civil society organizations, industry, and others have made commitments to restore ecosystems and habitats and set ambitious goals and targets for 2030 and neyond. The EU Mission Restore our Ocean and Waters by 2030 is one such commitment to protect ecosystems, address water pollution, and achieve a circular blue economy.

Individual restoration projects as well as broader, regional restoration programmes, aim to help meet these targets. These projects or programmes present an opportunity to develop best practices, learn lessons and scale up effective marine conservation through restoration. To ensure and maximize effective restoration, BlueMissionAA serves as a coordination hub where such information can be shared across the Arctic and Atlantic basin that comprise much of the European coastal and marine territory. **This report, a deliverable of BlueMIssionAA, highlights some of these best practices from six restoration projects or programmes across the Arctic and Atlantic basins.**

Using a desktop review and semi-structured interview methodology, the authors of this report demonstrate and organize these best practices across five components of restoration project governance, as defined by the Society for Ecological Restoration. These five components are: Assessment, Monitoring & Design, Implementation, Ongoing Management, and Monitoring & Evaluation.

Some key findings include that during the **Assessment** phase, case study projects have conducted evaluations, based on existing knowledge, literature review, and key informant interviews or self-assessment. This allowed projects to identify how they can provide suitable solutions and actions to a given problem, pinpoint opportunities and barriers, and enable early collaboration and relationship building. In the **Planning & Design** phase, projects were embedded within the community, especially in remote areas or where trust in scientists is low, and interdisciplinarity was incorporated to help set and streamline project goals and ensure stakeholder considerations were reflected in the project footprint. During **Implementation**, regular communication with stakeholders, broad outreach, and partnering with local governments buoyed public support and maintained interest in the outcomes of the project. In projects that reached the **Ongoing Management** component, flexibility and adaptive structure proved essential to respond to uncertainties and unexpected outcomes. This was achieved through regular demonstration of project outcomes with stakeholders and partners, and the quintuple helix approach to adapt to new information through iterative testing and refinement. Lastly, **Monitoring & Evaluation** initiatives were planned, tested, and improved upon early in the projects life to ensure that methods are tailored to a project context and replicable at the same time. Stakeholder data was collected and used to develop strategies

to foster long-term engagement. Ecological data was collected to determine the extent to which the project met restoration objectives.

In successful projects, there is interest in scaling and replicability to increase benefits. Long-term financing and relationships are among many enabling conditions required to ensure scaling and replication. Each of the six evaluated projects indicated some interest in or action being taken to scale or replicate. Some such opportunities include, where appropriate, embedding the restoration activities in a market-based model, such as ecotourism or biodiversity credits, where income can be generated from and be used to finance sustained restoration activities. Finding efficiencies and synergies in collaborative relationships can also help scaling and replication. For example, restoration projects can partner with fishermen to support activities such as data collection and invasive species harvest, which can provide co-benefits for all parties involved depending on their specific needs and investment in the restored area. In some of the cases, replication and scalability is embedded into the project life. For example, CLIMAREST is piloting solutions and activities in one demonstration site for the exact purpose of scaling and replicating in another. If successful, the intentionality and mandate to scale and replicate within a project can serve as a model to guarantee those outcomes. Further, the best practices identified above and others that are shared among practitioners can be incorporated into scaled and replicated projects to further ensure effective outcomes.

The best practices that are highlighted in this report are not exhaustive. Rather, they serve as a starting point from which to consider how to develop and implement a restoration project or programme, who to engage with, how to engage with them, and how to be adaptive and flexible as inevitable uncertainties arise. Sharing such best practices, and others, through hubs such as BlueMissionAA is an important component to meeting Mission goals to Restore our Oceans and Waters by 2030.

2 Introduction

Current efforts to protect and restore ecosystems across the EU are not projected to meet targets set by international and EU policy (European Commission, Directorate-General for Research and Innovation, 2023). Mission Restore our Ocean and Waters by 2030 aims to address this under three linked objectives: 1) Protect and restore marine and freshwater ecosystems and biodiversity; 2) Prevent and eliminate pollution of our ocean, seas, and waters, and 3) Make the sustainable blue economy carbon-neutral and circular. To achieve this, a Mission Implementation Plan has been developed. Organised into two five-year phases, the Mission Implementation plan aims to develop and pilot restoration solutions between 2021-2025 (phase 1), in lighthouses in four major European sea and river basins. In 2026 to 2030, phase 2 focuses on the deployment and upscaling piloted restoration solutions (BlueMissionAA, 2024). To support the implementation of this plan, the Mission includes the development of enabling conditions for successful restoration governance, namely a knowledge platform and participatory governance.

BlueMissionAA is a project intended to support this Mission, serving as a coordination hub for implementation in the Atlantic and Arctic Basin. This report is a deliverable nested within Work Package 1, "Mission governance and implementation in the Atlantic & Arctic," focused on building and mobilising governance frameworks and networks to support mission targets. In this report, we highlight best practices for effective restoration as evidenced by six unique restoration projects and/or programmes across the EU.

The Problem

In Europe, and globally, coastal ecosystems provide tremendous ecological, social, and economic value while simultaneously being vulnerable to a multitude of synergistically acting threats, including sea level rise, land and sea-based sources of pollution, erosion, and subsidence (Moraes et al., 2022; Paprotny et al., 2021). Across the European continent, close to half of the population lives within 50 kilometres of the sea. People living within the coastal zone, many of whom are reliant on intact coastal ecosystems for employment, recreation, cultural value, nutrition, and more, are vulnerable to the impacts associated with degraded coastal regions, including increased flooding and the decline of ecosystem services(Paprotny et al., 2021).

There are several categories of interventions that are being developed and implemented to both adapt to and mitigate the harms of coastal ecosystem loss and degradation. One such intervention is restoration, which is defined by the United Nations as "assisting in the recovery of ecosystems that have been degraded or destroyed, as well as conserving the ecosystems that are still intact" (What Is Ecosystem Restoration?, 2024) and by the Society for Ecological Restoration (SER) as the "process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed" (Society for Ecological Restoration Science and Policy Working Group, 2002). Restoration is gaining momentum regionally and globally. In 2021, the UN Environment Programme launched the UN Decade on Ecosystem Restoration, passed by

UN Resolution 73/284, to support the scaling of efforts to 'prevent, halt, and reverse the degradation of ecosystems worldwide and raise awareness of the importance of successful ecosystem restoration" (United Nations General Assembly, 2021).

This is concurrent with the EU Mission *Restore our Oceans and Waters by 2030*, beginning in 2021 (European Commission, 2024). Restoration in Europe provides several key benefits, including biodiversity gains, climate change mitigation, climate change adaptation and resilience, increased revenue from recreation, nature-based tourism, food security, human health, wellbeing, flood damage savings, and more (European Environment Agency, 2023). In fact, European Commission estimates that for every €1 spent on restoration, there is a return between €8 and €38 (European Environment Agency, 2023).

Restoration, though a promising solution that can yield social, economic, and ecological benefits, is not necessarily easy or affordable to design, implement, and maintain (Abelson et al., 2020; Sewell et al., 2016). Likewise, restoration projects are not always successful for many reasons, and the results of successful projects are not immediately apparent and take time to be observable. Certain environments or habitat types are particularly difficult to restore or require significant costs and infrastructure that are unattainable or unrealistic to obtain. Restoration may also have unintended consequences on other habitats or communities (Jones et al., 2022). As such, guidance based on implemented restoration projects is needed to maximise the possibility of success in restoration projects.

The Five Components of Restoration

The Society for Ecological Restoration (SER), a global network connecting restoration practitioners and researchers and a partner of the UN Decade on Ecosystem Restoration, is one such institution providing that guidance. For the UN Ocean Decade, SER developed a framework that organises the stages of a restoration project life as five interconnecting components (see Figure 1) and identifies critical and common sub-components (Nelson et al., 2024). These components (Assessment, Planning and Design; Implementation; Ongoing Management; and Monitoring and Evaluation) and their common sub-components (e.g., Broad Engagement; Sharing; and Adaptive Management) are neither linear nor discrete, but rather a useful way to develop and evaluate the life of a restoration project or programme (Nelson et al., 2024).

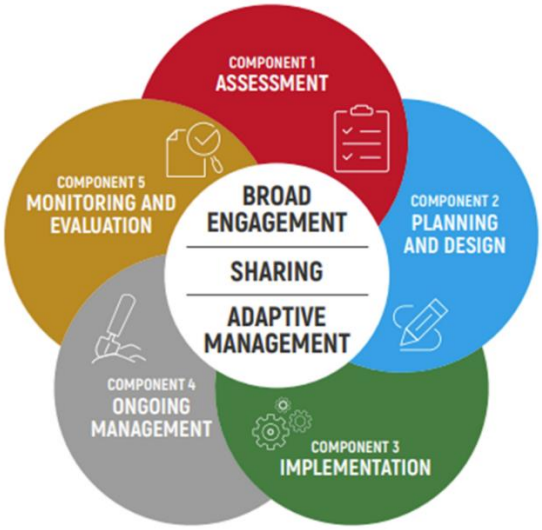

Figure 1: The five components of the restoration process (Nelson et al., 2024)

Each of the six case study chapters in this report which focus on unique restoration project or programmes, are organized with this framework as a structural guide. These case studies vary in many ways: by geography (e.g., Atlantic and Arctic), by which component they have achieved (e.g., where they are in their project life), by scale (e.g., individual restoration projects vs. EU-wide program of restoration projects), and by purpose (e.g., research or implementation), demonstrating the diversity of restoration projects with insights to offer. To standardise the case studies, we use the SER framework to aid cross-cutting analysis[1].

The objectives of this report

This report is intended to support Work Package 1 (WP1) of BlueMIssionAA, to mobilise the multi-disciplinary and multi-sectoral cooperation governance framework and network needed to deliver the Mission targets. This report will review restoration projects and programs, to identify their governance structure, showcase best practices and formulate proposals towards an effective governance architecture at multiple scales that will underpin the Mission implementation phase. This work will be continued in the future work of BlueMissionAA, which will propose an innovative governance structure for large-scale ecosystem restoration. Additionally, this report contributes to the Mission Ocean objectives to *Protect and restore marine and freshwater ecosystems and biodiversity*, in line with the EU Biodiversity Strategy, by contributing to knowledge in governance of restoration projects, programmes, and initiatives[2].

The authors of this report chose to focus primarily on best practices and identified opportunities for scaling and replicability, rather than governance structures, challenges or pitfalls. This was an intentional decision to maximize information captured through a time-limited review and in order to test the evaluation framework (see more in methods). Other deliverables within the BlueMIssionAA project will provide insight into governance and the relationship between broader EU regulations and restoration, as well as challenges and pitfalls.

Intended audience

This report is intended for the European Commission, restoration practitioners, other EU-funded projects focused on the Mission, and the research community that is interested in the governance of restoration projects and what determines their success.

[1] *See methods section on how we selected case studies.*
[2] *Mission Ocean Implementation Plan, pg. 19*

3 Methods

In this report, we refer to best practices as gold nuggets (Figure 2), which are valuable insights into practices, principles, and methods that restoration practitioners in existing projects have highlighted as useful, productive, and unique. For each case study, a set of gold nuggets are identified and categorised within each of the five components in the SER framework. Across all six case studies, these are then synthesised to demonstrate gold nuggets across a restoration project's life. These are meant to provide some, but not all, guidance on what makes restoration projects or programmes effective in achieving goals, engaging stakeholders, and ensuring long-term sustainability.

Figure 2: Gold nuggets in this report are denoted with this icon.

The two research teams from the BlueMissionAA project responsible for this report (1:MaREI, the SFI Research Centre for Energy, Climate and Marine hosted by University College Cork (UCC), and 2: the Norwegian Institute for Water Research (NIVA)) sought research ethics approval from their respective research ethics councils in UCC (SREC) and Norway (SIKT) in order to conduct interviews for this research.

Responsibility for the six case studies was distributed across four researchers; two researchers from UCC developed the four Atlantic case studies, and the remaining two researchers from NIVA worked on each of the Arctic case studies. The steps below outline the methods used to collect information on each case study and identify both common and unique gold nuggets to highlight for this report.

Selection of case studies

BlueMissionAA Milestone 1.1 developed guidelines and selection criteria to identify the case studies evaluated in this report, which was published in the report "Selection of six biodiversity/ecosystem restoration case studies" in 2023. The selection criteria included geographic scale, timeframe, thematic focus, innovation actions, and definitions of success. For considerations under each criterion, the following decisions were made: four cases would be from the Atlantic area and two from the Arctic area; there should be equal representation of projects across timeframes (e.g., recency of implementation and monitoring), thematic representation across restoration, conservation, and preservation as the focus of the project, and whether the project addresses innovation actions as defined by the European Commission. Based on this, six case studies were selected (Box 1) and comprise the body of this report.

Case 1: REST-COAST (Atlantic)
Focus on large-scale seagrass restoration
Case 2: 3DPARE (Atlantic)
Project focuses on 3D-printing artificial reefs – particular interest in Santander Bay
Case 3: RESTORESEAS (Atlantic)
Restoration of corals, seagrasses, and seaweeds. Offers insights into stakeholder engagement and policy making.
Case 4: Thames21 (Atlantic)
Creating urban wetlands on the River Thames in London boroughs.
Case 5: CLIMAREST demo site Svalbard (Arctic)
Increasing the resilience of coastal ecosystems in Arctic Fjords through mitigation of land-based pollution discharge and nature-based solutions against coastal erosion.
Case 6: A-AAGORA demo site Troms Arctic Archipelago in Norway (Arctic)
Restoration of kelp forest that has been razed by sea urchins ("sea urchin barren") through the removal of sea urchins.

Box 1 Review of six case studies, adapted from "Selection of six biodiversity/ecosystem restoration case studies"

Development of interview instrument

The interview instrument was developed based on SER's Standards of Practice to Guide Ecosystem Restoration guidelines, (referred to as the SER Framework in this report) created for the United Nation's Ocean Decade[3] (Nelson et. al., 2024). This framework provided the basis for the development of the interview process, structured the research approach, and, as a result, the format of this report.

The interview process and questions were developed in close alignment with the five overarching components of the SER Standards of Practice framework (Assessment, Planning & Design, Implementation, Ongoing Management, and Monitoring & Evaluation). Questions were developed under each component and entered into a spreadsheet (Appendix 1). This process helped to visually display and understand the framework as an interview guide prior to the research commencing. For each interview, a selection of these questions was asked based on the context and stage of the case study.

Using the SER Standards of Practice has benefits and limitations. Namely, it allows for comparison between restoration projects and has been useful in identifying and highlighting 'gold nuggets' or best practices for restoration throughout the research. However, this framework is also limited in that each of the case studies selected for this report is at a different stage of implementation and some projects have many components beyond restoration – this has challenged comparison between case studies.

This was an iterative process: the research team met regularly to check in, assess the current progress of the interviews, and share preliminary learnings. Questions were modified or

prioritised as this process continued, and some questions were removed altogether and replaced with desk research (e.g., who the project funder is, where restoration activities are taking place) to extrapolate more value from the time-limited interviews.

Desktop research on each case

To become familiar with each case study including relevant context (e.g., habitat threats that are relevant to the case), the researchers conducted a background desktop review. This included reviewing the project websites and all publicly available reports, as well as finding scientific articles and grey literature focused on the type of restoration (e.g., 3D-printed reefs) or the specific area (e.g. the river Thames) and its unique context. This provided the researchers with baseline information about the project before interviewing project experts.

Selection of interview candidates and interview process

For each case study, the project team conducted at least one interview with a relevant expert, typically a researcher or practitioner involved with all or most of the components. For some of the chosen sites, the researchers had pre-existing relationships with the interviewees. This is because the EU Mission is a connective tissue for many region-wide restoration research and practice efforts, such as CLIMAREST and A-AAGORA. For other sites, the lead researcher developing the case study identified the relevant expert(s) based on online research and reached out to them. Virtual interviews took place for the four Atlantic case studies, where travel to the site was not feasible. For the two Arctic cases, travel to the site was possible, and the interviews took place on-site. One interview did not occur, but rather, the relevant experts answered the questions provided by the interview framework template via email. In total, 11 interviews took place with 13 interviewees.

In some cases, after interviews, the interviewees shared additional resources (including internal documents that are not public) to provide more information and context on the case. All information gathered was used to develop a summary of the case study, organised using the SER Framework.

Identification and synthesis of gold nuggets

All the information collected from interviews and desktop research was synthesised and organised according to the SER Framework. The researcher for each case identified potential "gold nuggets," (Figure 2) best practices from across each phase of the project life that can be useful and relevant for other projects with aligned objectives to restore oceans and coasts. Once researchers identified all potential gold nuggets for individual case studies, they were compiled and discussed during a full team meeting. In some cases, gold nuggets from across case studies were similar, and the project team chose to consolidate them within this report. From this, the final list of gold nuggets was determined.

Case study review by interviewees

A draft report with the case studies as well as any remaining questions or information gaps was sent to all interviewees for review and comments. This ensured that the authors of this report appropriately captured and presented the case studies and some of their gold nuggets, as intended by the interviewees.

Presentation of results

The SER Framework graphic (figure 1) was re-purposed in this report to represent the status of the selected case studies at the time of writing (June 2024). A fully shaded segment indicates a completed stage; a partially shaded segment indicates an uncompleted stage, meaning it had not yet been initiated or was ongoing.

3. Results: 3DPARE

Project Overview

History and background

Figure 3: 3DPARE has completed all five SER Components

The Interreg-funded[4] 3DPARE project, which ran from 2018-2023, was led by the University of Cantabria in Spain and included in its consortia Bournemouth University in the UK, the University of Porto and the Portuguese Institute of Sea and Atmosphere in Portugal, and the Caen Institute for Civil Engineering and Construction in France. The objective of the project was to test whether 3D-printed reefs made from eco-friendly materials would be more effective than traditional concrete block reefs[5] in achieving biological colonisation. The project 3D-printed artificial reefs with varying features made from eco-friendly materials that traditional concrete reefs do not possess, such as tunnels and holes. The objective was to assess the hypothesis that 3D-printed reefs would attract more species of animals and plants than concrete block reefs. This was proven to be true throughout the project.

Geographical context

The 3D-printed reefs were deployed in four Atlantic locations: Poole Bay (UK), Matosinhos Beach (Portugal), Santander Bay (Spain), and the Bay of Saint Malo (France). These sites were selected based on several selection criteria, including ease of acquiring a license, biodiversity conditions at the sites (i.e., sandy floor and relatively poor biodiversity), and tidal level (e.g., all units needed to be fully submerged at all times between 4-8 meters below the water surface).

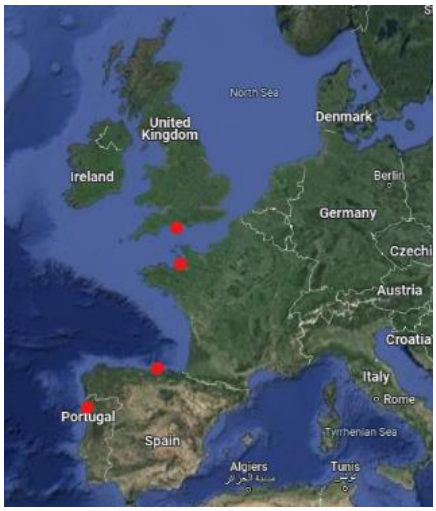

Figure 4: Map of 3D-printed reefs deployed in 3DPARE (credit: Google Maps)

Governance structure

3DPARE was a research project consisting of seven work packages. As is typically the case with research projects, the work outline was written into the grant agreement, and the work followed this pre-agreed structure. Project meetings were held twice a year, starting in 2018 and becoming virtual with the onset of the global COVID-19 pandemic.

4 Interreg is a European Union program designed to foster cooperation across borders by funding projects that promote regional development, innovation, and sustainable growth among member states and neighbouring countries.

5 A 3D-printed artificial reef is an underwater structure produced using additive manufacturing techniques, designed to mimic natural reef habitats and support marine life biodiversity.

Evaluation of 3DPARE under SER Framework

Planning & Design

The objectives of the project were scientifically driven and multi-disciplinary from the beginning. Each project partner chose to focus on a different aspect of the design of the 3D-printed reefs: biodiversity was the main focus for the UK project partner, aiming to assess the impact on marine biodiversity of the reefs and whether 3D-printed reefs attract more biodiversity than concrete block reefs. Meanwhile, the French partner focused on assessing the different types of concrete and other materials used to create the reefs, and the Spanish partner focused on developing the 3D-printed reefs.

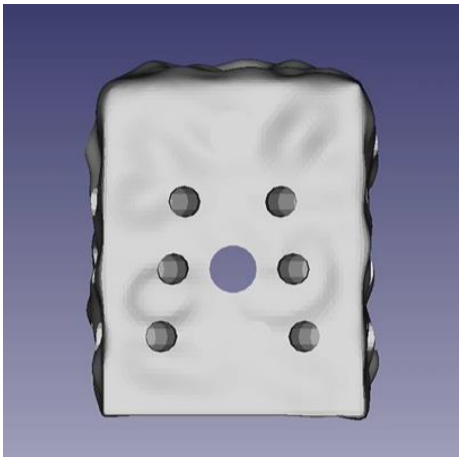

Figure 5: Model of 3D-printed reef (credit: 3DPARE)

Implementation

In total, 32 3D-printed reefs were planted in the pilot sites: eight in each site with one control block, representing traditional concrete artificial reefs. The 3D-printed reefs were consistently better at enhancing the local biodiversity when compared to concrete block reefs – this has been so effective that in the four years since the 3D-printed reefs were deployed in Santander Bay, they are now indistinguishable from the bay floor.

Figure 6: Deployment of 3D-printed reef in Poole Bay, UK (credit: 3DPARE)

Stakeholder and public engagement

All project partners committed to hosting promotional events about the project throughout its lifetime, and to invite at least two stakeholder groups to attend and participate as guest speakers. This encouraged interest in the project from local stakeholders and the public broadly and helped to foster relationships between the project partners and the unique stakeholder groups, which included local communities, recreational diving clubs, the media, and professionals from engineering and the 3D-printing industry.

In Spain, relationships were built with the Port Authority of Santander Bay, two recreational diving groups, and the local authority through meetings and collaborative workshops. As a result, the Port Authority was brought in as a project partner in the later stages of the project. Since then, discussions have been held between the Port Authority and the local government about the potential applicability of 3D-printed reefs along the coast of Cantabria. Interest in the project has also been garnered from the energy industry in Spain, with companies approaching the project requesting information on the financial cost of 3D-printed reefs as an offset measure to offshore wind developments. Local communities and citizens have also been engaged with the project in Spain through talks given at local schools and the Cantabrian Maritime Museum and by placing 3D-printed reefs in display tanks in the San Sebastian Aquarium in Gipuzkoa and the Cantabrian Maritime Museum.

Figure 7: 3D-printed reef on display in San Sebastian Aquarium (credit: San Sabastian Aquarium)

Communications

Work Package 2 focused on project communications and managed the creation of a brand identity for 3DPARE, the creation and maintenance of the project website, the organisation of promotional events, and press and media relations. 3DPARE's communication strategy and the implementation of its communications objectives was identified throughout the interviews as a strength of the project.

Gold Nugget: National media

In terms of publicity and public engagement with 3DPARE, the project received attention and publicity from national broadcasters of all partner countries, with a news or television segment being done on the project in each country. In the UK, 3DPARE received a lot of attention from local stakeholders and the wider public following a segment on the popular BBC show 'The One Show'. This segment is available online[1] and shows television presenter Bill Bailey visiting the 3D-printed reefs in Poole Bay with a project staff member to view and assess the colonisation of the reefs one year later. The segments done by SIC (Portugal), TVE News (Spain), France 3 News (France), and an additional report by TVE News, are all available online.

Ongoing Management

Stakeholder engagement

Stakeholder engagement in 3DPARE at the beginning of the project was minimal for the UK partner beyond the national Marine Management Organisation, who was engaged to advise on licensing requirements and development consent[6]. COVID-19 also restricted the level of possible stakeholder engagement, resulting in an extension to the project which improved stakeholder engagement during the latter stages of the project. In 2023, the Yorkshire Marine Research Centre, a partnership-led research organisation, was brought in to hatch a cluster of juvenile lobsters – who were threatened by overfishing – and release them among the 3D-printed reefs in Poole Bay as a means of demonstrating to stakeholders the potential value of the reefs. Throughout the project, interest was also expressed by a local aquarium to include a 3D-printed reef in their display tanks – however, due to the large size and weight of the reefs, this was not possible.

Monitoring & Evaluation

Data

Categories of project data were governed and organised by the partner interested in that data. For example, Bournemouth University, being most interested among the participating institutions in collecting biological data, was responsible for devising the collection methods, analysis, and storage of biological data. However, while partners were responsible for developing a data collection methodology, they were not responsible for collecting that data – this was done locally by other partners who employed different data collection practices.

Figure 8: Velvet swimming crab in 3D-printed reef (credit: 3DPARE)

Planned monitoring and evaluation

Project partners are responsible for ongoing monitoring in the pilot sites. However, monitoring in the UK site, Poole Bay, has been suspended due to a recreational diving prohibition in the local area resulting from a change in the land zoning. Thus, long-term monitoring and evaluation of the UK-based 3D- prnted reefs has not been possible.

In Santander Bay, there are plans for ongoing monitoring led by the University of Cantabria as a new project will soon be underway where more 3D-printed reefs will be placed nearby to

[6] *Development consent refers to the authorisation granted by a government or regulatory authority for a proposed development project, indicating compliance with relevant laws, regulations, and planning policies.*

the 3DPARE reefs – the project team in Spain intends to monitor both sites. Legally, the 3D-printed reefs in Santander Bay are protected by temporary permits – temporary permit acquisition is a faster process than acquiring a permanent permit, so in Spain it is easier to continue to apply for rolling temporary permits. At present, it is unknown if there are plans for long-term monitoring of the 3D-printed reefs planted by the French and Portuguese partners.

Opportunities for scalability and replication

Opportunities for scalability of the 3DPARE project have been identified by the project partners and are being explored. In the UK, an enterprise known as Resting Reef has been in touch with the UK partner, exploring opportunities to use similar technologies as the 3DPARE project to create an eco-friendly burial option for people who wish for their ashes to be buried at sea. The person's ashes are infused with the reef, which is then put into the sea and can support ecosystem restoration while also providing an alternative to traditional below-ground burials.

Opportunities are also being explored for 3D-printed reefs in offshore wind developments in Spain and the UK to offset some of the potential negative impacts of offshore turbines on the sea floor. In Spain, the project has been approached by companies looking for information on the financial and logistical cost of producing the reefs. There are also opportunities for industry-academia collaboration here, as some companies may lack the technical knowledge to build the units, while academia may lack the means to produce units on a larger scale, such as is needed for offsetting biodiversity loss on the seabed near offshore wind developments.

Another opportunity for similar projects in the future would be to incorporate a citizen science element into the ongoing monitoring and evaluation stage of the work right from the beginning of the project. Involving recreational divers would require minimal financial input from the project, as the only ongoing management needed would be the data synthesis because much of the data collection could be done by ordinary citizens. Additionally, involving recreational divers would have educational benefits for the individual divers and their communities, in turn leading to further project visibility, improving the project's public image.

4 Results: Thames21

Project Overview

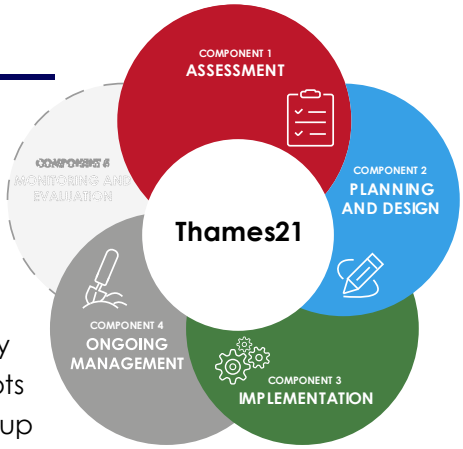

Figure 9: Thames21 has reached component four of the SER Framework

History and background

Thames21 is a charity with a 30-year history, starting in 1994 with the initiation of ThamesClean, a research project by Keep Britain Tidy aiming to investigate whether using grassroots groups could be an effective approach to cleaning up increasingly high levels of litter in the river Thames in London. Having sparked interest beyond the iconic main body of the river Thames in the greater London community, ThamesClean became an independent registered charity in 2004, according it its legal status, and was re-named to Thames21 – the '21' referring to Agenda 21, the roadmap for achieving global sustainability in the 21st Century, adopted at the 1992 United Nations Rio Earth Summit.

While local litter clean-up events remain one of the central elements of the charity's activities, it has significantly expanded its remit in the last two decades. Its current activities include research on river pollution, citizen science initiatives, funded restoration projects, pollution reduction education campaigns, corporate volunteering, and organising the annual London Rivers Week.

Likewise, it boasts partnerships with influential organisations such as the UK's Environment Agency, the Port of London Authority, Thames Water, the City of London, the Department for Environment, Food & Rural Affairs (DEFRA), the Rivers Trust, and Keep Britain Tidy. Its funders in 2022-2023 included Bloomberg, Coca-Cola, Google, Greggs, and the National Lottery. This chapter will focus on Thames21's engagement with local stakeholders and communities under its partnership model of community empowerment, its governance structure and day-to-day implementation, and its plans for future organisational sustainability.

Figure 10: Volunteers engaging in citizen science (credit: Thames21)

Thames21's stated objectives are:

- Engaging people of all ages, abilities and from all parts of society in their local waterways
- Removing litter
- Creating new habitats for wildlife, flora and fauna
- Controlling non-native invasive species
- Introducing reedbeds to tackle pollutants

- Creating sustainable drainage solutions to improve water quality and reduce flood risk
- Promoting safe and equitable access to waterways
- Undertaking monitoring and research into the health of our local rivers
- Deliver environmental education to children and adults
- Campaigning against waterway pollution and promoting sustainable behaviour
- Accrediting and training community groups to deliver safe and sustainable waterway improvement events

Geographical context

Thames21 operates not only within the city of London but also in the Thames catchment, which covers 16,000 sq. km in southeast England. The western end of the catchment is predominantly rural, encompassing the towns of Swindon, Oxford, the Cotswolds, and Basingstoke. Further east, the catchment covers increasingly urban areas such as Reading and Greater London. The official source of the river Thames, Thames Head, is found in a meadow in Gloucestershire – the entire river flows for approximately 235 km to the tidal limit in London.

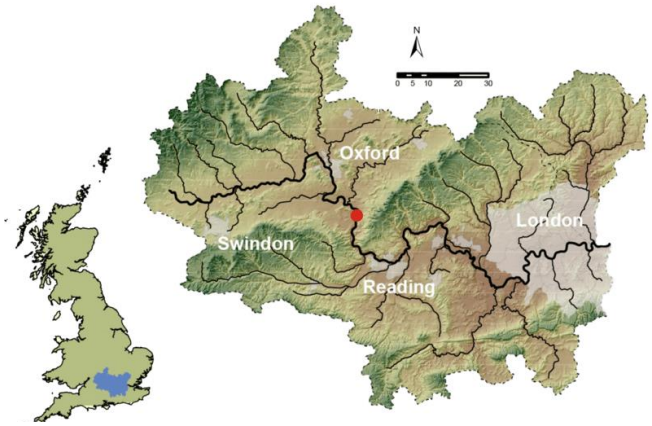

Figure 11: Map of Thames River catchment (credit: Feld, et. al., 2017)

The entire Thames basin is an area experiencing regeneration and urban growth, with developments planned in strategic areas. Being the primary water source for Greater London, the Thames catchment is an area of significant regional importance in the south-east of England and is highly vulnerable to climatic changes, pollution, and changes in land use.

Additionally, urbanisation and agricultural practices contribute to pollution and habitat degradation. These changes threaten local wildlife habitats, reducing biodiversity and disrupting ecosystems. Restoration efforts are crucial to mitigate these impacts by improving water quality, enhancing flood resilience, and improving habitats for species biodiversity. This will help ensure the long-term sustainability and health of the Thames River ecosystem, benefiting both nature and human communities.

Governance structure of Thames21

Thames21 is governed by a CEO overseeing a senior management team, which reports to a Board of Trustees. This senior management personnel's responsibilities are divided across two teams: Improving Rivers, and Engagement & Learning. Under the senior managers are personnel within both teams who are responsible for different areas of Thames21's activities, such as programme and project managers, programme officers, and community and volunteer engagement personnel. In addition to this, the senior management team also consists of an operational team responsible for HR, finance, and fundraising. In total, the

Thames21 staff team consists of between 40-45 people (this figure may fluctuate according to vacancies).

The Board of Trustees comprises 13 people from diverse backgrounds, including present and former senior civil servants, restoration practitioners, researchers, legal, and corporate sector representatives. It meets four times a year to steer and shape Thames21's work. Thames21 involves volunteers in river restoration through a partnership model, explained in greater detail throughout this chapter.

Financing

Thames21 funds itself through various sources, which is typical of charitable organisations. Through its corporate volunteering programme, in which Thames21 is paid by companies to host team-building activities, the charity generates a surplus, which is re-invested into its operational costs. It also receives funding through individual donations and has a dedicated fundraising manager to explore potential avenues of donation income. It also has a Charitable Trusts fundraising manager, who sources funding under the charitable trusts legislation, and also receives funding directly from the UK Government. Thames21 also wins a small portion of its funding through funding calls[7] to fund specific projects or activities with a defined endpoint. The charity is currently transitioning to ensure its long-term funding sustainability, explained in further detail in the *Adaptive finance management* section below.

Evaluation of Thames21 under SER Framework

Implementation[8]

Stakeholder engagement

Volunteers are involved in Thames21 in two main ways:

Corporate volunteering: Thames21 hosts corporate volunteer events, engaging approximately 2,500 individual volunteers annually to 'Corporate Enrichment Days' for a fee per event. These activities include removing litter from the Thames, planting reed beds, river restoration (such as weir removal), and managing woodland and vegetation. Demand has grown in recent years for such activities, allowing for a steady source of income to be created for the charity, which is invested into operational costs.

Figure 12: Volunteers cleaning up a riverbank (credit: Thames21)

[7] *A funding call is an official invitation for organisations or individuals to submit proposals for financial support to undertake specific projects or initiatives.*

[8] *The Assessment and Planning and Design components are not included in this case study as they happened over twenty years ago and were not discussed during the interviews. They have, however, been completed.*

River Action Groups: Thames21 supports and coordinates approximately 35 River Action Groups (RAGs), which are volunteer-led groups, some of which formed as legacy groups from completed funded projects. By supporting these groups to become semi-autonomous, Thames21 retains ongoing engagement and access to these volunteers, while also empowering local communities to take the initiative in river restoration in their own local areas.

Gold Nugget: Establishing long-term partnerships

Interested community members must first take part in Thames21's 2-day tailored training course Leading Action for Healthy Rivers, which covers the basics of setting up a RAG and how to implement and monitor the activities of a group. Thames21 then provides on-going support (including insurance, tools & equipment, and advice and guidance) to the RAGs once they are established for a period of 6-12 months. This is a two-way relationship, with Thames21 benefitting from ongoing access to volunteers and citizen science data, which can be used to influence policy and decision-making.

Relationship building

Thames21 supports the involvement of stakeholders in day-to-day river restoration activities as a beneficiary of the Catchment Partnership Action Fund, provided by the British Government. This system allows for local stakeholders (e.g., farmers, businesses, local authorities, citizens, NGOs, etc.) to gather around a table and discuss common issues relating to the Thames River and its catchment. Thames21's role is to support the implementation of these partnerships and monitor their outcomes.

Following guidance from the Alliance for Water Stewardship (AWS)9, Thames21 supports stakeholder engagement in river restoration in two main ways.

Figure 13: The AWS Standard

Firstly, the principles of the AWS Standard[10] are embedded into the work that Thames21 does with its River Action Groups. The intention is to promote a sense of agency among local communities over their local rivers, so that they feel they can have meaningful input and influence over decisions made by governing bodies, such as local authorities.

[9] A global membership of businesses, NGOs, and public sector agencies which promotes a universal framework (the AWS Standard) for the sustainable use of water.

[10] Understand water dependencies and impacts; Mitigate operational and supply chain water risks; Ensure responsible water procedures are in place; Build relationships with local water-related stakeholders; Address challenges shared with others in the catchment

Secondly, Thames21 collaborates on water quality improvement projects with corporations (such as Microsoft, Coca-Cola, and Google) following the AWS Standard framework. Such projects are run and managed by Thames21 and involve volunteer engagement in restoring water quality in a given area through means such as constructive wetlands management or agricultural management. Such projects deliver multiple co-benefits in addition to water quality improvements: helping companies to offset their environmental impact, providing a space for volunteer involvement in restoration, and delivering a project which will continue to benefit the local area for decades to come.

Ongoing Management

Adaptive finance management

As a charitable organisation, Thames21 is limited in the level of financial risk it can assume – the organisation sees Special Purpose Vehicles (SPVs)[11] in the form of Community Interest Companies (CICs)[12] as a method of circumventing this limitation in order to be able to deliver on the environmental outcomes needed to achieve river restoration in the Thames catchment. One method being explored takes advantage of Biodiversity Net Gain (BNG) legislation, which took effect in the UK in February 2024.

Under BNG legislation, all property developers will be required to prove that their development (e.g., construction of housing, offices, etc.) will contribute a net 10% increase in biodiversity in the area, ensuring that the biodiversity of the locality is measurably improved by the development. The BNG legislation prioritises on-site biodiversity improvement measures within the red line boundary of the development – however, as this is not possible in all developments, an alternative to on-site biodiversity improvements is the acquisition of statutory biodiversity credits from the UK Government, which will be re-invested into biodiversity and habitat creation in England.

Thames21 is exploring the possibility of securing its long-term funding through CICs, which, beginning with an initial loan to begin restoration work, would create and sell biodiversity credits. Biodiversity credits can then be sold to the UK Government and the profits re-invested into future restoration activities. By combining the new BNG framework and CICs, Thames21 intends to secure its long-term financial stability. Additionally, this model would also provide long-term legal protection to sites that Thames21 has restored, as these sites would be protected for up to 30 years under the Biodiversity Net Gain legislation.

Monitoring & Evaluation

[11] A Special Purpose Vehicle (SPV) is a subsidiary created by a parent company to isolate financial risk, typically for specific projects or transactions.

[12] A Community Interest Company (CIC) is a type of social enterprise in the UK designed to benefit the community, with legal obligations to use its assets and profits for public good rather than private gain.

Strategic reporting and evaluation

It is the CEO's role to report on the activities, achievements, and any challenges faced or envisioned by the senior management team. The reporting regime has recently changed to reflect a more strategic approach, detailing developments and issues instead of a narrative of recent activities. This change has allowed for better planning of charitable activities and flexibility when issues and challenges arise.

In a conscious effort to build the organisation and its programmes more strategically, since 2016, Thames21 has published two strategic five-year plans covering the periods 2016-2021 and 2023-2028, both of which are available on its website. Recently, the charity has shifted its focus to outcome-based targets[13] as opposed to output-based targets, allowing both for more flexibility and strategic prioritisation in its activities.

Gold Nugget: Outcome-oriented approaches

Funding agencies increasingly are requiring evidence of project impacts which go beyond static outputs (e.g., tools, deliverables, policy briefs, etc.) but which instead provide sustainable solutions, models, or relationships (e.g., innovation clusters, frameworks, expert panels, etc.). Thames21's shift toward outcome-orientated work has helped the charity navigate this evolving landscape and is a key factor consider when planning a project or initiative and appealing to funders.

This shift toward outcome-based evaluation is part of a wider recognition of the value of impact evaluation within the charity (particularly impacts on its volunteers), which is increasingly required by funding agencies. However, Thames21 is experiencing logistical challenges regarding impact evaluation to determine the impact of their programmes on their volunteers (e.g. increased knowledge, behavioural changes, contributions, enhanced wellbeing, etc.). Time and financial constraints, and a lack of adequate long-term volunteer engagement, are all challenges to adequate impact evaluation of volunteering on volunteers. Solutions to this issue include fencing resources for impact evaluation at the start of new projects.

Data

Thames21 collects data on its volunteers by using a Customer Relationship Management (CRM) platform – in the future, it intends to migrate to a more interactive and integrated platform, where volunteers can create their own user profiles, sign up for events and newsletters, and provide feedback on events they have attended. This will streamline impact

[13] *Outcome-based targets are specific, measurable goals focused on the desired end results or impacts of an activity or intervention rather than the processes or inputs used to achieve them. By contrast, output-based targets are goals that focus on the immediate products, services, or deliverables generated by an activity or intervention.*

evaluation, allowing quick and easy access to metrics, which will aid in improving KPIs and quickly identifying areas for improvement.

Gold Nugget: Data management

The value of data management when coordinating a group of stakeholders (e.g., volunteers) can often be overlooked. For organisations or projects aiming to foster long-term sustainable engagement with stakeholders, it can be useful to consider what kinds of data are being collected on the people involved, and how best that data can be used. For example, collecting event impact evaluation data (such as by using a Likert scale, or soliciting feedback from attendees) can help to track outcomes and feed into forward planning for future stakeholder events. Additionally, a 'soft data' evaluation through a social network analysis can help in identifying the key stakeholders who can act as a bridge between groups of stakeholders, or can bridge the project to untapped stakeholders, thus broadening the reach of the project or organisation.

Ecological data is also collected by Thames21, using both citizen science approaches (through River Action Groups) and professional surveyors. As part of a funded project, Road Pollution Solutions, road run-off data has been made publicly accessible on an online platform[14], to be used by local authorities, developers, and individuals to lobby for environmental protection in their communities. A traffic light system has been created so that areas where road run-off is a hazard can be quickly identified and potential solutions can be acted upon. Road run-off data includes levels of pollutants such as zinc, pyrene, benzo-a-pyrene, copper, and cadmium.

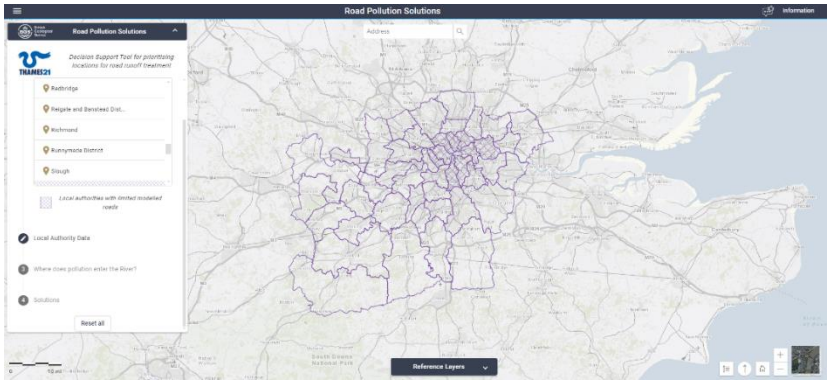

Figure 54: Road Pollution Solutions platform (credit: Thames21)

[14] *Road Pollution Solutions platform. Available at: https://mapapps.bgs.ac.uk/road-pollution-solutions/*

Opportunities for scalability and replication

Thames21's partnership-based approach, through its empowerment of local community groups to undertake restoration activities, is rich with opportunities for scalability. With enough support and funding, this approach applied in other contexts and places could provide a framework for other organisations (NGOs, charitable trusts, semi-state bodies, etc.) looking for methods of building climate-aware communities. This method could also be used for building or enhancing community resilience regarding adaptation to climate change, in addition to building capacity around climate mitigation, such as river restoration.

The Special Purpose Vehicle funding model, building on the new Biodiversity Net Gain legislation discussed previously, is another area ripe for scalability and is an emerging market in the restoration sector in other countries with similar legislation in place. This model, applied in other contexts, could resolve long-term funding insecurity issues, and enable restoration outcomes, particularly within the charitable sector.

5 Results: REST-COAST

Project Overview

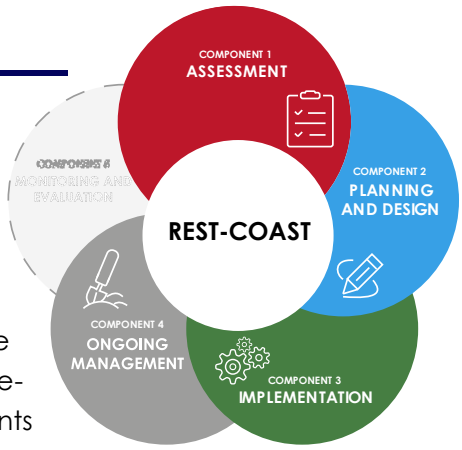

Figure 65: REST-COAST has reached component four of the SER Framework

History and background

REST-COAST is a restoration research project funded under Horizon 2020 – the EU Research and Innovation Programme (2014-2020). The project aims to demonstrate how Nature-based Solutions (NbS) applications in coastal environments can be a viable and low-carbon solution to climate adaptation challenges. The project's stated goal is to "overcome present hurdles to upscale coastal restoration interventions through new technical, financial, management and transfer tools, aligned with the needs of vulnerable coastal regions and society."

REST-COAST has 37 partners from eleven countries (Germany, France, Italy, Bulgaria, the Netherlands, Israel, Spain, the United Kingdom, Turkey, Poland, and Switzerland). The project is currently in the process of applying NbS solutions at nine pilot sites in partnership with local stakeholders.

Geographical context

REST-COAST works across nine pilot sites (Figure 16), which are:

- Arcachon Bay (Atlantic Ocean basin)
- Ebro Delta (West Mediterranean)
- Foros Bay (Black Sea)
- Nahal Dalia (East Mediterranean)
- Rhone Delta (Central Mediterranean)
- Sicily Lagoon (Central Mediterranean)
- Venice Lagoon (Adriatic Sea)
- Vistula Lagoon (Baltic Sea)
- Wadden Sea (North Sea basin)

Figure 76: Map of REST-COAST pilot sites (credit: REST-COAST)

Governance structure

REST-COAST is structured according to eight work packages, covering finance, transformative governance, adaptation management, climate risk reduction, project implementation, dissemination, ethics, and project management. In addition, smaller working groups exist within the REST-COAST project, focusing on thematic areas allowing for greater horizontal

collaboration between work packages. There are also PhD students and early-career professional working groups.

The relationship between the pilot sites and the REST-COAST project is collaborative and partnership-based. Pilot sites are free to self-organise and self-govern their own NbS activities. The pilot sites report their findings to the wider project. Additionally, different work packages will request relevant results relating to governance, finance, or ecological outcomes.

Evaluation of REST-COAST under SER Framework

Assessment

The initial idea to begin the REST-COAST project arose from a perceived gap in the research domain for a restoration project which focused on delivering 'river to sea' restoration activities, covering a broader geographic area and potential for commercialisation. Project coordinators from the beginning also wanted to design a project that supported and empowered local stakeholders to implement NbS activities in local areas that most needed them – with a focus on proving that NbS activities can be profitable and thus financially sustainable.

The pilot sites were chosen following a selection criterion aiming to capture the diversity of geographies, local coastal issues, local governance structures, expertise, and contexts. Pre-existing working relationships and connections to the sites resulting from previous work were also a factor in site selection. This allowed for opportunities for pilot sites to co-learn from each other throughout the REST-COAST project.

Gold Nugget: Pilot-site self-assessment

Once chosen, the pilot sites were then invited to take part in a self-reflective survey aiming to assess the baseline situation regarding restoration governance. The pilot sites were asked to identify key barriers to NbS application in their local area, existing policies and laws which impact restoration, and actors relevant to implementation of NbS activities in the local area. This assessment was used in the project design phase to refine and improve the design of REST-COAST, and is an approach which can benefit similar projects with the aim of empowering local communities or demonstrating best practice in restoration through the use of pilot sites or demonstration sites.

Implementation

Stakeholder engagement

Stakeholder engagement is a key component of the REST-COAST project. At the pilot site level, the involvement of local authorities with jurisdiction over implementing NbS activities is essential. As part of NbS implementation, each pilot site developed 'platforms' with the aim of bringing together local actors of various nature, from business to governance, up to associations dedicated to environmental conservation, with an interest in discussing the development of NbS and successful restoration in the pilot site. Within these platforms, stakeholders catch up on recent initiatives, familiarise themselves with barriers and enablers of restoration, and discuss their common vision for restoring the pilot site. These platforms meet on average twice a year.

Gold Nugget: Partnering with local governance structures

The involvement of local government is key to the success of the REST-COAST project. Local governments and competent authorities hold power over NbS activities within their jurisdiction. As such, their cooperation is key to NbS activities being successfully implemented. In REST-COAST, this is evident in the Ebro Delta pilot site (Spain), in Venice Lagoon (Italy), and the Wadden Sea (Netherlands) where the local authorities have been brought on as project partners. This has ensured that the local authorities are informed of project activities, and have input into decision-making around NbS applications, in addition to learning more about the benefits and long-term sustainability of NbS. Additionally, this approach can help to foster relationships between local research centres and researchers, and local authorities and decision-makers. These relationships can lead to future collaboration and closer networks of practice within local communities, given the complementing competencies within such organisations.

Ongoing Management

A challenge highlighted by an interviewee is the flexibility associated with the implementation of project deliverables – this is a common issue within research-based projects, wherein the workload is often written years before the work takes place, and most often by different people compared to those doing the project work. One prominent issue is the timing of deliverables, which may no longer align with current market needs by the time they are completed. Additionally, new advancements and developments, which often arise quickly, may not be captured in the initial grant agreement. This misalignment can create challenges for ongoing management, as it may necessitate adjustments, complicate reporting requirements, and strain resources to adapt to the evolving context. Effective strategies to mitigate these issues include incorporating flexibility in project timelines, allowing for periodic review and adjustment of deliverables, and maintaining open communication channels with stakeholders to ensure ongoing alignment with evolving needs.

Gold Nugget: Peer Exchange for science and practice

REST-COAST held its annual consortium General Assembly in concurrence with its sister project funded under Horizon 2020, WaterLANDS, in April 2024. This in-person joint General Assembly enabled networking and discussion of future work and collaborations between projects with shared Mission objectives. Oftentimes within the ecosystem restoration research landscape, there can be projects pursuing common goals and objectives – there can also exist opportunities for complementary work. Meeting in-person, at a joint General Assembly, can be a way to overcome some of these challenges, while also exploring opportunities for new avenues of research.

Monitoring & Evaluation

Data

Different types of data are requested from the pilot sites by the work package leaders leading work packages 1-5 – these data refer to topics such as governance, management, finance, risk reduction, and restoration modelling. Data is collected through templates which are circulated around the pilot sites periodically. Templates are established by the work package leaders and are filled in by the pilot sites. These templates can be questionnaires or Excel sheets. Such data are collected both from literature reviews and active monitoring campaigns in the pilot site. Other work packages, such as the WP6 on communication and dissemination, have a more flexible approach whereby the pilot sites can implement their own communication and engagement activities while keeping the project partners informed of their activities. This informal approach is supported through regular online and in-person meetings between project partners, pilot sites, and stakeholders.

Opportunities for scalability and replication

REST-COAST has already begun to identify opportunities for scalability of its pilot sites and the applied methodology (techniques, finance, planning, governance and engagement), but it is too early to define what should be the best scalability plan, particularly when considering the worldwide coasts also included within a project task. However, given the range and diversity of locations, coastal systems, and management practices under investigation in the project, there are likely to be lessons of value for other sites identified in REST-COAST.

6 Results: RESTORESEAS

Project Overview

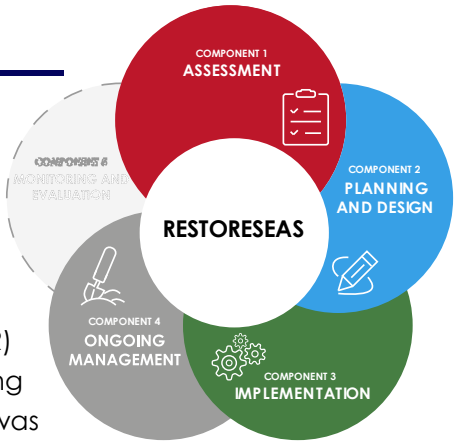

Figure 87: RESTORESEAS has reached component four of the SER Framework

History and Background

RESTORESEAS is a collaborative multi-disciplinary research project coordinated by the Centre of Marine Sciences (CCMAR) in Portugal and has a consortium of 13 partners including universities, research institutes, and museums. The project was established following a previously completed restoration project in which CCMAR was involved. In this previous project, Gorgonian coral reefs were restored in a marine park in Arrábida in Setúbal, Portugal. Having identified an interested consortium of colleagues wanting to build on the results of the previous project, CCMAR embarked on coordinating RESTORESEAS, which is due to run from 2022-2025.

Geographical context

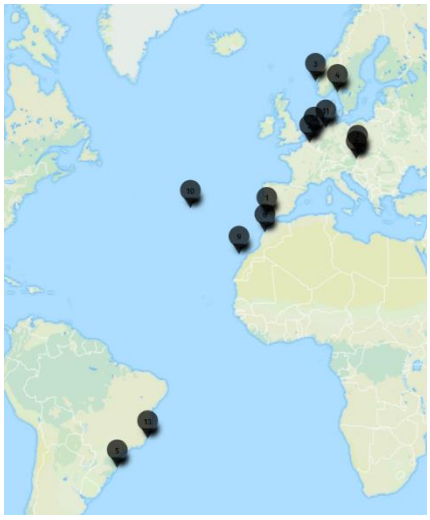

Figure 98: Map of RESTORESEAS pilot sites (credit: RESTORESEAS)

RESTORESEAS operates around the Atlantic Ocean, with partners from Europe, Africa, and South America. Its involvement in West Africa makes the project more unique, because according to an interviewee from RESTORESEAS, this is an area often overlooked by such research projects, particularly on a partnership basis. RESTORESEAS has academic partners from West Africa and has also involved private industry in restoration activities in Mauritania, Guinea Bissau, Cabo Verde, and Namibia. Additionally, with the involvement of partners from South America, RESTORESEAS achieves a much more diverse perspective on restoration across the Atlantic.

Governance structure

RESTORESEAS is led by CCMAR and is organised into work packages, as is typical of scientific research projects: WP1 (Cross-systems approaches, led by CCMAR and UFSC), WP2 (Deeper marine forests, led by UGOT and SGN), and WP3 (Marine forests of plants and macroalgae, led by UGENT and DCU). It is funded under the Biodiversa+ European Biodiversity Partnership fund with a grant of just below €2 million.

Evaluation of RESTORESEAS under SER Framework

Assessment

Based on the extensive experience of the consortium members, the RESTORESEAS project developed its four objectives: firstly, to predict future distributions of Atlantic marine forests

Gold Nugget: Interdisciplinarity built into project structure

The diversity of perspectives and skills within the RESTORESEAS consortium (including specialists in pathogens, microbial symbionts, coral reproduction, seagrass, and public engagement and outreach) is key to the project's success. Interdisciplinarity and transdisciplinary is increasingly popular among research projects and can be hugely beneficial to a project's work and can amplify and improve its outcomes and outputs. Additionally, taking an intergenerational approach can also have many benefits for a project with the involvement of Early Career Ocean Professionals (ECOPs) such as PhD and masters students. Planning for the involvement of ECOPs in a project from the beginning can help them learn lessons for their future careers from more experienced team members, and they can also contribute to the practical research needed to deliver the project.

(kelp, seagrass, and corals) against future climate changes; secondly, to integrate enhanced recognition of genetic diversity into marine restoration practices; thirdly, to assess critical mass in species populations to develop indicators of ecosystem stability and function; and finally, to integrate citizens and stakeholders into project activities to raise awareness of the project and its findings. Additionally, stakeholders have been engaged in RESTORESEAS since the project began in 2022; for example, a group of fishers in Sagres, Portugal was involved since the project proposal stage.

Implementation

Stakeholder engagement with RESTORESEAS

Through the duration of the project, a programme has been developed whereby these fishers help with coral restoration. Corals often accidentally get caught in fishers' nets and are discarded after the fish have been harvested. Through RESTORESEAS, these fishers now save the corals caught in their nets and keep the corals alive in tanks on board the fishing ships. When they come ashore, these recovered corals are moved to larger tanks in a safe place and are kept alive with the help of volunteers who feed the corals. Once the corals are strong enough, they are replaced back in their original habitat – volunteer divers are also engaged here to help replace the corals. In addition to this restoration activity, the fishers have also been engaged in the RESTORESEAS project to assist with seabed mapping, allowing scientists to collect data from fishing vessels. In this way, stakeholder engagement has a complementary benefit for both the fishers and the marine scientists involved in RESTORESEAS. The fishers become actively engaged in restoration activities, and the scientists benefit from having access to the fishers' ships, which saves financial and logistical costs in their species distribution mapping activities.

The RESTORESEAS project is also involved in organising the Marine Forest Festival, which in 2024 was held between 7 and 11th May in Porto da Baleeira, Sagres, Portugal. At this festival, members of the public can learn more about the coral restoration work involving the fishers, including at a public lecture given by the fishers themselves. The RESTORESEAS project has also engaged the local Municipality of Vila do Bispo in this festival. The municipality has provided logistical support, including a venue, catering, transportation, and equipment for the festival and helped to engage local businesses, such as restaurants, to help increase interest in the festival among members of the community and tourists.

Gold Nugget: Stakeholder engagement from the assessment phase

The involvement of stakeholders from the Assessment phase of a project can greatly benefit and positively impact the project's success, given that it will have learned important local lessons by involving the people most directly impacted by restoration activities. In this way, early stakeholder engagement can also have a dual benefit for the stakeholders, as they can feel a heightened sense of agency over the project's outputs and can input into the design of the project to best meet their needs. Early involvement of stakeholders can also help to dispel misconceptions around restoration, such as the conception that restoration disturbs other activities (e.g., fishing) occurring in the same area. This theme has emerged throughout this report and applies to RESTORESEAS, REST-COAST CLIMAREST, and AA-AGORA.

Additionally, RESTORESEAS also engages citizens in data collection activities through an open platform called Marine Forest[15]. This platform was created to help fill the knowledge gap identified by RESTORESEAS in the area of genetic diversity on the ocean floor, particularly in marine forests. Volunteers can upload photographs from diving trips, e.g., of kelp forests, to help map the distribution of kelp on the seabed. A second platform which RESTORESEAS has developed alongside another project, MarAfrica, acts as a central hub to streamline access to open source biodiversity data on the Bijagós Archipelago and the Banc D'Arguin National Park off the western coast of Africa[16]. Both platforms provide a space for citizens and scientists to upload data. promote the open sharing of information and data on biodiversity, and provide access to already existing datasets.

Ongoing Management

Reporting to funders

Reporting on the RESTORESEAS project is done through two channels. The first is from RESTORESEAS partners to their funders – formats of reports may vary on a country-specific basis.

[15] www.marineforest.com
[16] www.marafrica.net

The project also reports to the European Union through the Biodiversa+ fund, through periodic reporting meetings. A benefit for RESTORESEAS of being funded under Biodiversa+ is that the mid-term report meetings have previously been held in person and have included other projects under the same fund, fostering a space for informal networking discussions with colleagues working on other projects in the same research area, a similar experience as was previously described by REST-COAST.

Monitoring & Evaluation

In terms of how the project determines success, this is mainly done through the evaluation of metrics and Key Performance Indicators (KPIs) such as deliverables completed, number of stakeholders engaged in the project, and number of events held under the project. Another more qualitative measure of success on the project is the level and depth of collaboration between partners and between different countries involved in the project, linking to the added value of RESTORESEAS.

Opportunities for replicability and scalability

RESTORESEAS has identified several areas worthy of further investigation and the project team has plans for future projects working off the findings discovered throughout RESTORESEAS. This includes improving the efficiency of seagrass plantation and integrating fish farms as stakeholders in restoration activities.

The collaboration with the fishers in Sagres, Portugal is a key area for potential scalability – activities around this are already being planned by the project team, in which project partners will meet in Sagres and collect biological data on the restored coral plantations, such as the genetic diversity, parasites, and the microbiomes living among the corals. This model of working collaboratively with the fishers to restore coral accidentally harvested during fishing is one which can be upscaled in Portugal and replicated elsewhere also.

Involvement of citizen scientists in data collection, and the creation of a central hub of open-source data, is another model which can be replicated and upscaled, taking key learnings from RESTORESEAS into account.

7 CLIMAREST Svalbard

Project Overview

History and Background

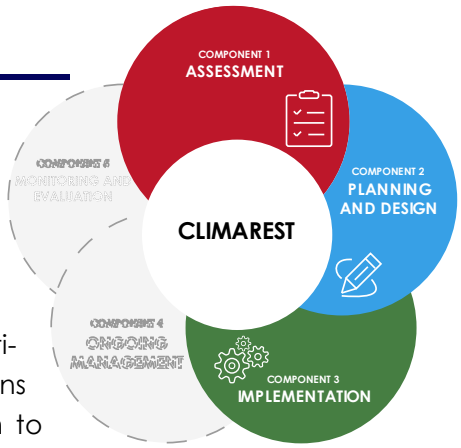

Figure 109: CLIMAREST has reached component three of the SER Framework

CLIMAREST is an EU Horizon-funded project, one of several intended to support the EU Mission. The project uses multi-disciplinary and bottom-up approaches to develop innovations for coastal and marine ecosystems. It aims to pay attention to among the most fragile, vulnerable, and difficult-to-restore sites identified by the project as Arctic oligotrophic coastal areas, seagrass meadows, shallow-water rocky bottoms, oyster reefs and soft bed benthic habitats. It also aims to develop tailored solutions for restoration sites that are compromised by data scarcity, low public awareness, and limited information on the costs and benefits of restoration. The project aims to develop a toolbox that facilitates effective restoration, using insights gained from piloting and implementing restoration projects and tools in five demonstration sites. The toolbox will be organised into a generalisable framework and incorporate the key lessons to emerge from CLIMAREST research. It will include tools to facilitate stakeholder and community involvement, analysis, planning, monitoring, and more (*CLIMAREST*, 2024).

The Marine Restoration Toolbox and innovations developed by the project will be developed, implemented, and refined in five demonstration sites across the Arctic and Atlantic (Figure 20). This case study will primarily focus on the northernmost demonstration site in Svalbard, Norway and occasionally offer insights from the CLIMAREST project more broadly.

Figure 20: Five demonstration sites associated with CLIMAREST. (credit: CLIMAREST, 2024)

Geographic Context

Svalbard is an archipelago found halfway between mainland Norway and the North Pole, with three main climatic regions: 1) sub-Arctic climate and varying sea-ice presence (West Svalbard), 2) a mixed Atlantic and Arctic climate exposed to the Arctic Ocean and consolidated pack ice (North Svalbard), and 3) a cold Arctic climate and extensive seasonal

sea-ice formation (East Svalbard). Across the region, Svalbard is synergistically threatened by temperature rise, ice cover retreat, permafrost degradation, changes in hydrology and geomorphology of fjords and coastal waters, wastewater, industrial fishing, and more (Weslawski 2024; Søreide, et al, 2021). Longyearbyen, the northernmost settlement in the world with over 1000 permanent residents, is the target area for the Arctic site of the CLIMAREST restoration project. Much of the Arctic marine-based tourism sector is based in Longyearbyen and is expected to increase as climate change expands tourism potential in the region (Dannevig et al., 2023). This may apply additional pressure on Longyearbyen, for example through an increase in tourist-generated waste in Longyearbyen. Implementing coastal restoration projects in this region is difficult due to the harsh climate, short seasonality for transport of materials, remoteness, and limited availability of local materials (CLIMAREST, 2024). As a result, determining the best practices to ensure successful restoration outcomes is paramount for the region.

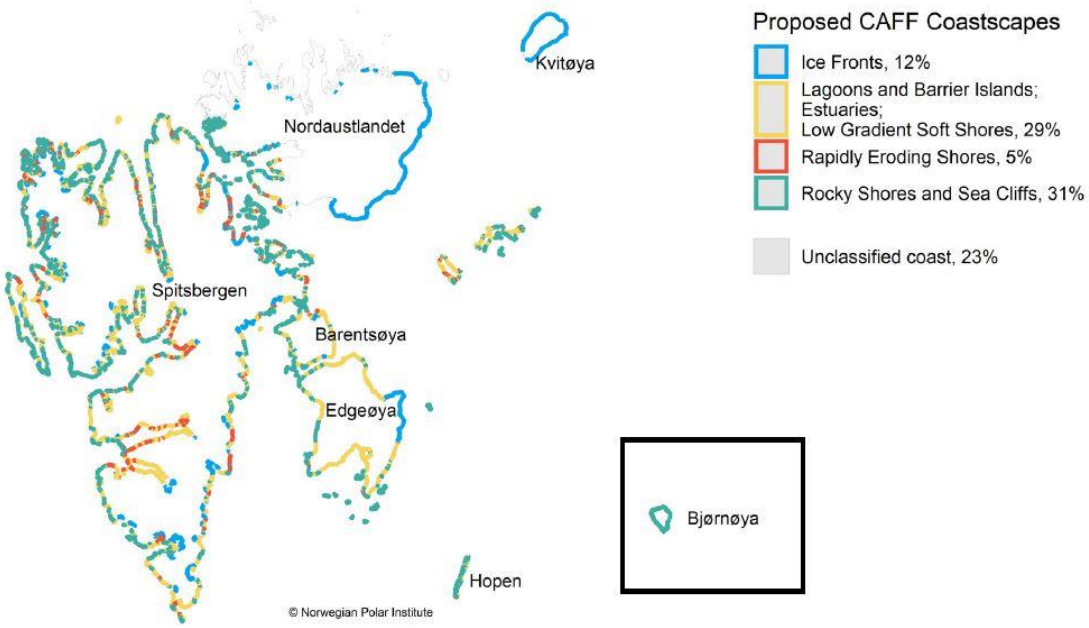

Figure 21: Geomorphological data from aerial photos (1987–1991) (unpublished data, Norwegian Polar Institute) (credit: Søreide, et al, 2021)

Governance Structure

The CLIMAREST project is coordinated and administered by SINTEF Ocean, based in Norway, and comprises 18 partner institutions across Europe. It is organized across six work packages, each led by one or two partners.

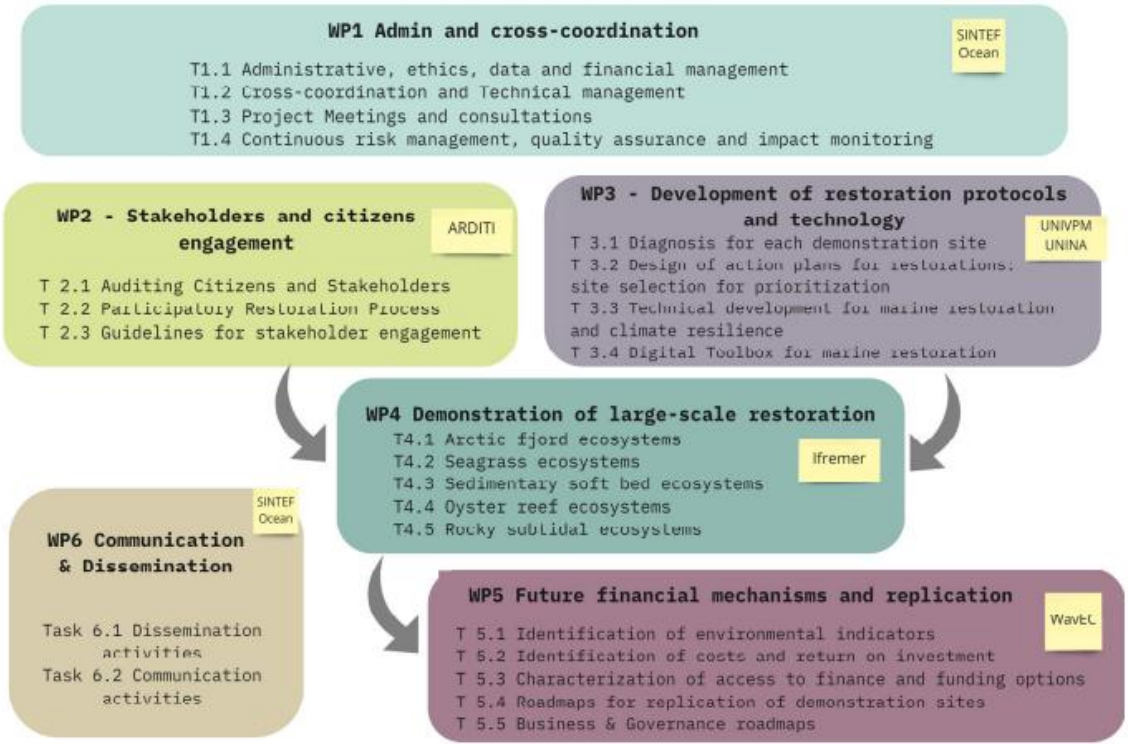

Figure 22: CLIMAREST Work Package Overview (credit: CLIMAREST, 2024)

The Svalbard demonstration site is organised according to two central components:

- Improved wastewater management in Arctic Settlements for local fjord ecosystem restoration
- Nature-positive mitigation of coastal erosion in permafrost shorelines for the protection of urban infrastructure

The components are largely coordinated by different project teams and utilise diverse stakeholder-driven methods to achieve the intended goals. Across both components, the following three steps are to be taken:

- Map the vulnerabilities of the site to identify and develop, with stakeholders, appropriate solutions
- Develop and implement pilot studies in Svalbard to demonstrate tools and methods
- Develop guidelines for best practices based on pilot projects

This chapter focuses on these steps to the extent that they are developed at the time of writing.

Evaluation of Svalbard demo site of CLIMAREST under SER Framework

Assessment

In the assessment phase, the project team began by engaging with local authorities in Longyearbyen, known as Lokalstyret, to identify their current environmental management challenges and determine how CLIMAREST outputs can be tailored to address them. As the problem owner, e.g., the institute with the most responsibility for addressing environmental issues, the local government was asked for input on their ideas and perspectives on how

CLIMAREST could be designed to be complementary or additive to ongoing work. This is aligned with CLIMAREST's ambition to "develop appropriate solutions/measures for maintaining climate resilient Arctic ecosystems and human communities."

The local governments identified wastewater pollution as an issue for CLIMAREST to address. The CLIMAREST team was already familiar with local concerns around coastal erosion in Longyearbyen, and as such that was chosen as the second issue for CLIMAREST to address. These challenges are a result of anthropogenic activity emanating from local sources (e.g., pollution), as well as global sources (e.g., climate change and subsequent erosion in Longyearbyen). There have been ongoing efforts by administrative authorities in Longyearbyen to address these, including restoration in coastal areas and the installation of a sieve for the mechanical treatment of wastewater. As a result of these ongoing efforts, established stakeholder networks were already in place and certain baselines have been established which can support monitoring within the CLIMAREST project. From that moment the two projects (wastewater pollution and coastal erosion) were managed separately.

Gold Nugget: Work with problem owners in the assessment stage

The CLIMAREST team chose to work with problem owners (the local government) in the assessment stage to jointly identify several key components that would determine the remainder of the project. Together they identified: 1) the problems to focus on, 2) which relevant stakeholders to involvement and include, 3)what are ongoing and future actions, and 4) how the restoration actions of a project can be complementary, additive, desired by your partners.

After agreeing to focus part of the project on wastewater pollution, the local authority recommended that the project team tailor their output towards tourists. Subsequently, the local tourist office, Visit Svalbard, recommended focusing on and including hotel companies in Longyearbyen in the remaining stages of the project. This is because wastewater pollution is a locally generated environmental problem resulting from improper disposal of items (e.g., cigarette butts, sanitary pads, and wet wipes) into the wastewater system. Hotels have direct access to tourists who may otherwise be unfamiliar with how to sort and dispose of waste properly in Svalbard. During the Planning & Design phase – the next section in this chapter – these were the primary stakeholders involved, as well as the local government.

For the coastal erosion, the stakeholders involved were the central and local authorities. The leads of the work package had already gained extensive knowledge of coastal erosion in urban areas at permafrost coastlines and had established connections in Longyearbyen. As a result, going into the project they already had a baseline vision for implementing a project to develop a nature-based solutions prototype, and toolbox based on the specific context in Longyearbyen. The stakeholders then provided feedback and additional insights into the

challenges, which the project leaders were able to incorporate into the following planning and design stages.

Planning and Design

Wastewater Pollution. Based on the initial consultations with the local authorities, the project decided to develop a social campaign tailored to hotels because of their access to tourists who contribute to the wastewater pollution entering the fjord. The project team conducted a preliminary brainstorming of which actors to engage and how to engage them, prior to reaching out to individual hotel companies. These initial consultations aimed to identify their needs, interests, perspectives, and suggestions regarding how to reach tourists most effectively on the topic through a social campaign. Based on these initial consultations, the project team decided to develop a standard set of products: stickers to be placed in toilets within hotels and a video that can be played in hotel lobbies. After drafting content for this campaign, the project team then convened all the involved stakeholders in a virtual working session for iterative feedback. Using this, the project finalized content for the social campaign. During the interview, the project team shared that while this approach enabled the development of a standard social campaign across hotels, there may have been value in tailoring the campaign to specific hotels depending on their infrastructure and amenities. This reflection can be incorporated into the planning and design of future social campaigns.

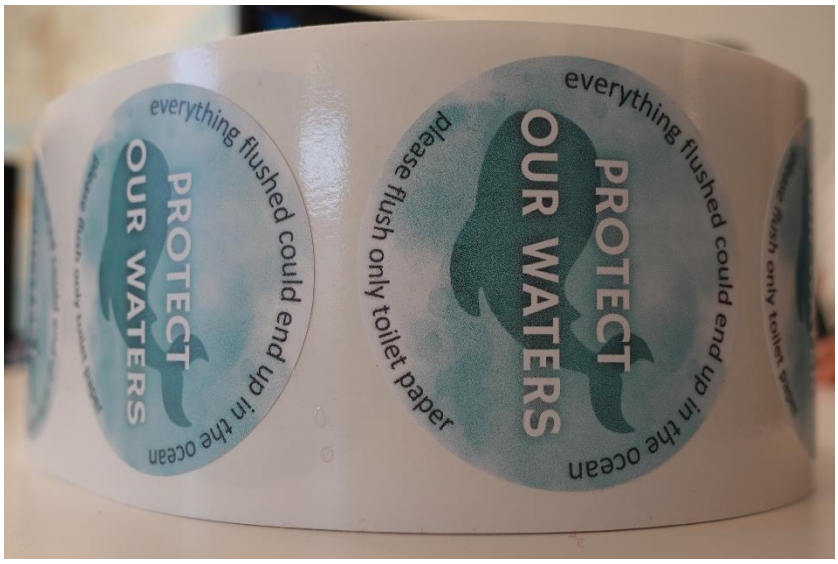

Figure 23: Social campaign stickers (credit: Rachel Karasik, NIVA)

Nature-based structural solution to address coastal erosion. The planning and design stage for the coastal erosion project similarly had meaningful stakeholder engagement. In the fall of 2023, the project team hosted a co-creation workshop in Longyearbyen, with 25 participants representing residents, local governments, businesses, tourist operators, and students among other stakeholders. The main objectives of the workshop were to: a) identify the public's needs that could be met through the development of interventions to address eroded coastal areas, and b) propose solutions. The participants identified several human use needs, including pathways for pedestrians, access to water, infrastructure, including streetlights and toilets, as

well as safety, recreation activities, aesthetics, and broader environmental needs including climate resilience, control of coastal erosion, sustainability, and durability of construction. To address those needs, the participants also identified solutions which can be included in the design of restoration plans for areas experiencing coastal erosion. These identified solutions are stairs to access the water, benches, changing rooms, walking paths and saunas, toilets, streetlights, street food, mooring facilities, sustainability art made from marine litter, and the creation of kelp habitat.

Figure 24: Identified problems and solutions associated with coastal erosion in Longyearbyen (credit: Sinitsyn et al., 2024a)

This feedback was subsequently incorporated into the design of a blueprint (Figure 25) for a nature-based structural solution, an intertidal pool and timber revetment, that would subsequently be tested in the pier area of Longyearbyen, called Bykaia, and then replicated elsewhere in the Arctic. This blueprint was based off the project team's original vision, through modified and strengthened from stakeholder input.

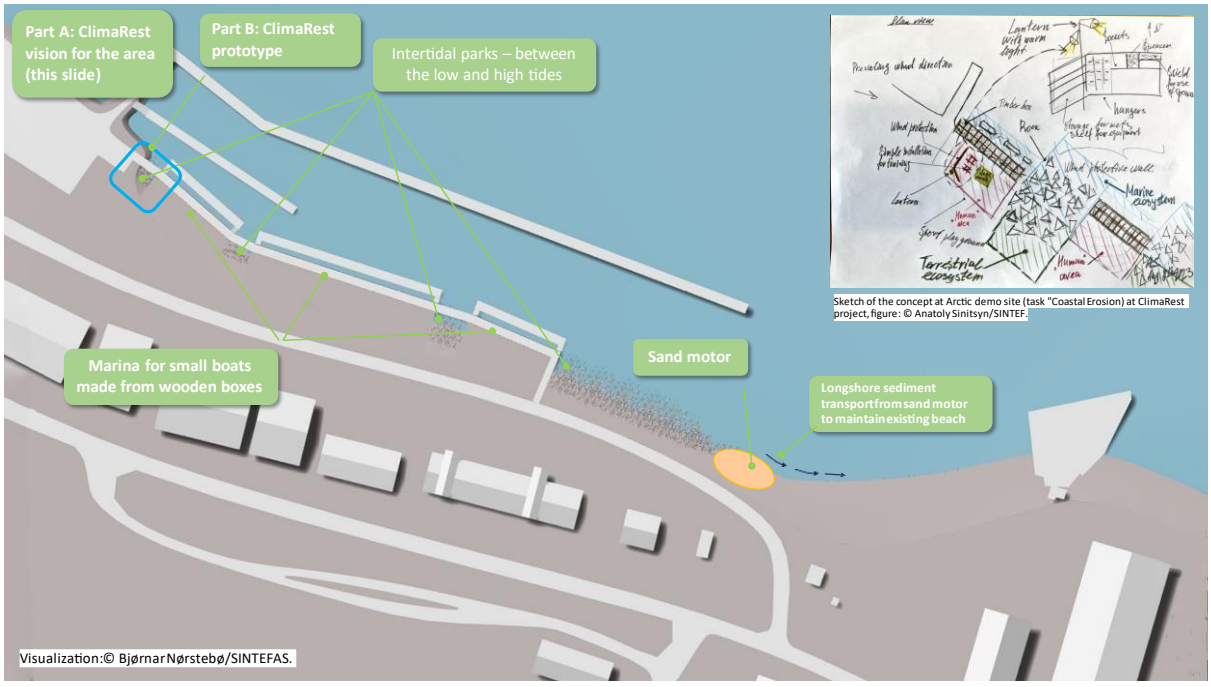

Figure 25: Visualized concept for Svalbard demonstration site (credit: Sinitsyn, 2024b)

Implementation

At the time of writing, implementation is in its very early stages for the social campaign for wastewater pollution. The coastal erosion component of the project has not begun yet. However, throughout the duration of the project, the team intends to report achievements to certain stakeholders (e.g., the Port of Longyearbyen). For both components, the project team is dedicated to routine communication with stakeholders during and after implementation.

Wastewater pollution. In June 2024, the project team launched the social campaign in hotels and stores in Longyearbyen. The launch consisted of three activities. First, hotels and several small businesses informed about the project received stickers to place in public toilets. Additionally, the CLIMAREST social media launched the video which was subsequently shared by other stakeholders involved in the project to the public. Lastly, the project team participated in the Sustainability Day in Longyearbyen, with a booth that had interactive programming for kids and adults alike to learn about the campaign, better understand the problems it is addressing, and commit to behavior changes that will reduce improper waste entering the wastewater (e.g. sewage) system. This campaign will be on going through the duration of the project and the local government plans to share the campaign as well.

Nature based structural solution to address coastal erosion. The project team expects to break ground on the prototype in the Port of Longyearbyen in the autumn of 2024.

Monitoring and Evaluation

One component of CLIMAREST is to develop innovative tools for 'custom designed protocols for restoring and monitoring multiple coastal habitats (Climarest, 2024). This means that throughout the duration of the project's life, the project teams are developing and testing tailored and accessible monitoring methods at the same time as the restoration activities are being developed and implemented, ensuring monitoring is not overlooked in the process. One challenge identified by the project, and that is common across other such products, is that change may take a long time to monitor and may only be detectable beyond the life of the project. In addition to developing protocols to enable long-term monitoring, projects that are slated to end will also need to identify which entity (e.g. local government) will be able to monitor

Wastewater pollution. The project has identified several methods to measure ecological and socioeconomic outcomes resulting from the implementation of a social campaign. First, the team is piloting the use of an underwater drone from Blueye Robotics to determine the state of the benthic community. This monitoring is done to support the hypothesis that wastewater pollution often ends up in and changes the benthic community of the fjord. This methodology is piloted and refined throughout the duration of the project to develop a baseline, refine monitoring methods that are useful in the context, and determine replicability in other contexts. Another method available to the project is from the local government, who weighs waste in the sieve weekly. The weight of the sieve serves as an indicator of the amount of macroparticles (e.g., trash) moving through the wastewater system. A relatively high weight indicates that a lot of waste is entering this system, and a reduction in the weight indicates less waste entering the system. Because a positive campaign would lead to a reduction in the

mass of waste collected on the sieve, this monitoring method can provide insight as to whether the social campaign is having a desired effect on the behavior of tourists and residents in Longyearbyen. Finally, the project team is exploring the use of socioeconomic data collection to monitor stakeholder perceptions on the impact of the campaign. Collecting this data can support replication in other sites by providing insight on what did and didn't work well from the perspective of public.

Nature based structural solution to address coastal erosion. The project team has collected baseline data on soil conditions, permafrost, waves, and sea ice, which was used in the design of the blueprint. Monitoring of these ecological conditions can help determine the impact of the NbS.

Opportunities for scalability and replication

For the Svalbard case specifically, there are built-in opportunities for replication or scalability. The social campaign, for example, can be scaled beyond hotels to include more public buildings, commercial centers, and schools in Longyearbyen and other settlements in Svalbard. Such social campaigns focusing on human behavior with respect to waste sorting and disposal has taken place in other locations, already demonstrating replicability and scalability across other contexts. For the nature-based solutions component of the project, the project plans include expansion beyond the initial blueprint prototype in the Port of Longyearbyen to include a wider stretch of the shoreline, as well as other sites in and near Longyearbyen.

Gold Nugget: Incorporate replication and scalability into the project life

The CLIMAREST team, as part of its mandate, identified opportunities for replication and scalability throughout the term of the project. By putting out funding calls, the project was able to find additional sites for replication and scalability. Intentionally and proactively identifying opportunities for replication has the added benefit of further building inter-regional relationships to facilitate effective transfer of good practices and techniques for effective nature restoration.

Additionally, a component of the broader CLIMAREST project is to identify official replication sites to repeat and refine the restoration methods and tools created across the five demo sites. To identify replication sites, CLIMAREST published open calls for applications for other sites. As of the time of this writing, CLIMAREST has funded replication sites in Germany (replicating the France demo site), Cyprus (replicating the Madeira demo site), Greece (replicating the Ireland demo site), and Croatia/Greece (replicating the Spain demo site). An Arctic replication site

has not yet been identified at the time of this writing. Replication projects are expected to take place from 2026 to 2030, in alignment with Phase 2 of the Mission.

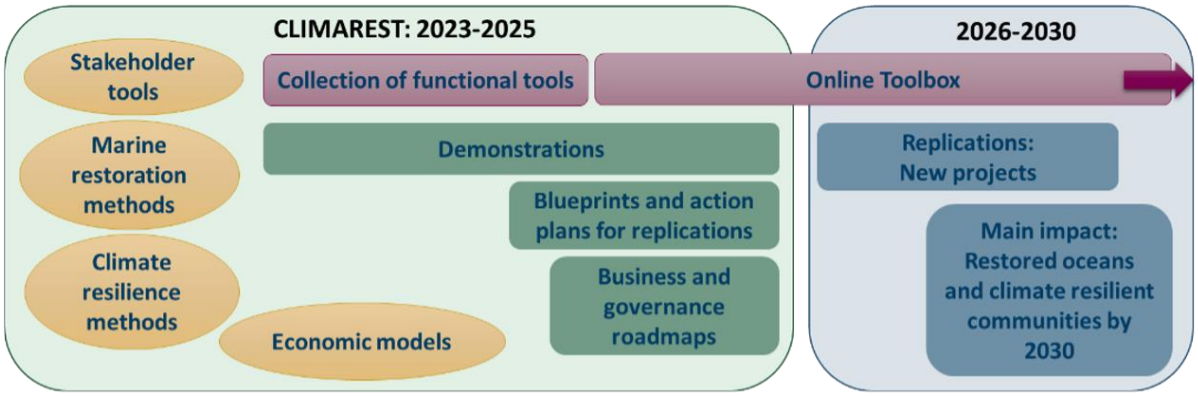

Figure 26: Overview of the CLIMAREST project (Green box) in the context of the timeline of the EU Mission Ocean (credit: Climarest, 2023)

8 A-AAGORA Tromsø

Project Overview

History and Background

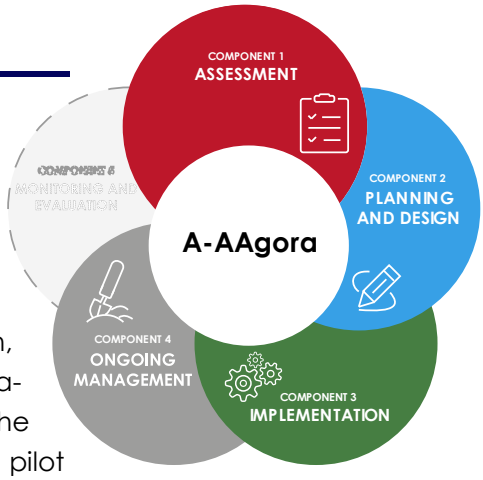

Figure 27: A-AAGORA has reached component four of the SER Framework

The Atlantic-Arctic Agora (A-AAGORA) is a Horizon Europe funded project, structured to support Mission Ocean, through regional engagement and cooperation and area-based "lighthouses," demonstration sites for the development, deployment and study of Mission-aligned pilot projects and activities. A-AAGORA stands as a beacon for preservation and restoration of ecosystems and biodiversity along the Arctic and Atlantic coastlines, applying principles of innovation, ecosystem-based management (EBM) and nature-based solutions (NbS) for sustainable change in both coastal ecosystems and the communities that depend on them. The aim of A-AAGORA is to make a blueprint that can be applied in other coastal areas in the Arctic and Atlantic areas on how to restore marine and coastal ecosystems, increase climate change resilience and mitigate impacts. The project features three case studies at demo sites in distinct regions; on the west coast of Portugal; in Cork, Ireland; and in Northern Norway (Figure 28). The developed blueprints will be based on experiences and results from the case studies at the demo sites and replicated in other sites across the EU.

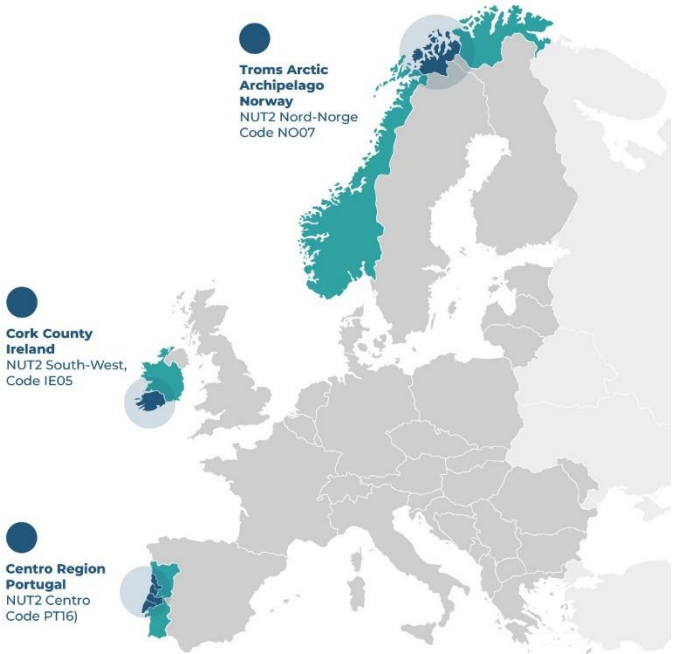

Figure 28: The three A-AAGORA demo sites (credit: A-AAGORA)

The focus of this chapter is the Norwegian lighthouse, in the Arctic region in Northern Norway, in a small coastal community, Karlsøy. The activities in this lighthouse include restoration of the kelp forest, development of a sustainable ecotourism destination, the development of an ecosystem-based management plan, and working with fishermen to find sustainable solutions for fisheries. These efforts are broadly driven by the intent to protect ecosystems and contribute to NbS both inside and outside marine protected areas. The project applies a quintuple helix approach, using a living lab methodology, to iteratively identifies solutions and measures in collaboration with business, administration, organisations, and citizens through the duration of the project. As a result, a critical element of the project is ensuring that it operates on the premises of local community involvement at all stages. The project began in spring 2023 and will conclude in spring 2026. At the time of writing, the project management

team in Karlsøy has prioritised piloting and testing the kelp restoration initiative over the other focus areas such as ecotourism and the development of an ecosystem-based management plan and monitoring. However, since the project is ongoing until spring 2026, the focus is expected to balance out across all the thematic activities planned for Karlsøy over time.

Geographic Context

Karlsøy boasts a subpolar oceanic climate and hosts 11 conservation areas covering almost 50 km of coastline. These areas are all rich in biodiversity, and some of them house large bird colonies, with over 40 registered bird species, including puffins, auks, and Northern Europe's largest colony of White-tailed eagle. Over 2000 inhabitants live in this coastal community, where fishing has long been a tradition and primary source of income. The community relies on functioning, healthy ecosystems to sustain robust fish population essential for their livelihoods. However, in recent decades, experiencing a decline in fish populations in the fjords, fishermen have found it necessary to fish further out in the sea to catch fish. Furthermore, locals have observed that the kelp forest has been grazed down to barren ground by high density of sea urchins. This decline in fish density in the fjords is believed to be linked to the loss of the kelp forest caused by overfishing of sea urchin predators, such as the wolffish.

In Northern Norway, the green sea urchins (*Strongylocentrotus droebachiensis*) have grazed down the kelp forest since the 1970s to a barren ground. This ecological imbalance is a consequence of several factors; overfishing of sea urchin predators (such as the wolffish), increasing nutrient and organic pollution from aquaculture, and changes in water conditions (warmer, darker, and more acidic) (Hynes et al., 2021). Scientific research indicates that removing the sea urchins alone can lead to the recovery of the kelp forest in the area (Remøe, 2024). However, a critical aspect of successful restoration is to prevent the re-establishing of the sea urchins after removal. Fortunately, this natural balance is believed to be maintained by sea urchin predators, which include the wolffish. Wolffish are also an important species for fisheries. Therefore, restoration activities need to be sustained by fisheries management approaches that maintain populations of species that prey on sea urchins.

Figure 119: NIVA's field survey of sea urchins in Dåfjorden. (credit: Janne Gitmark).

The project activities are implemented both within and outside the conservation areas in Karlsøy. Additionally, a kelp restoration project is incorporated into the A-AAGORA, located outside Karlsøy, in Tromsø, the largest city in Northern Norway. On the north side of the Tromsø

island, is an organization called The Guardians of the Kelp, which has been running a volunteer initiative to crush sea urchins regularly.

Governance structure

A-AAGORA is structured into seven work packages (Figure 30). Innovative measures across work packages will be developed and implemented at demo sites, according to local context and conditions, there will also be opportunities to replicate these solutions in other sites. There are smaller working groups focusing on kelp restoration, monitoring, ecotourism, and other topic areas, where collaboration between partners is essential.

The project partners for the Karlsøy case include the Norwegian Institute for Water Research (NIVA), the Norwegian Institute for Nature Research (NINA), the Arctic University of Norway (UiT), Pukka Travels (an ecotourism company), Nordkvaløya-Rebbenesøya landskapsvernområde (The board for conservancy areas in Karlsøy), Karlsøy Kommune (The municipality) and the European Union. These partners represent a diverse group from universities, research institutes, industry, and government sectors. The project leader works for UiT, while the project coordinator works for the municipality and resides in Karlsøy. Each partner has specific responsibilities and focus areas, but they all work closely together.

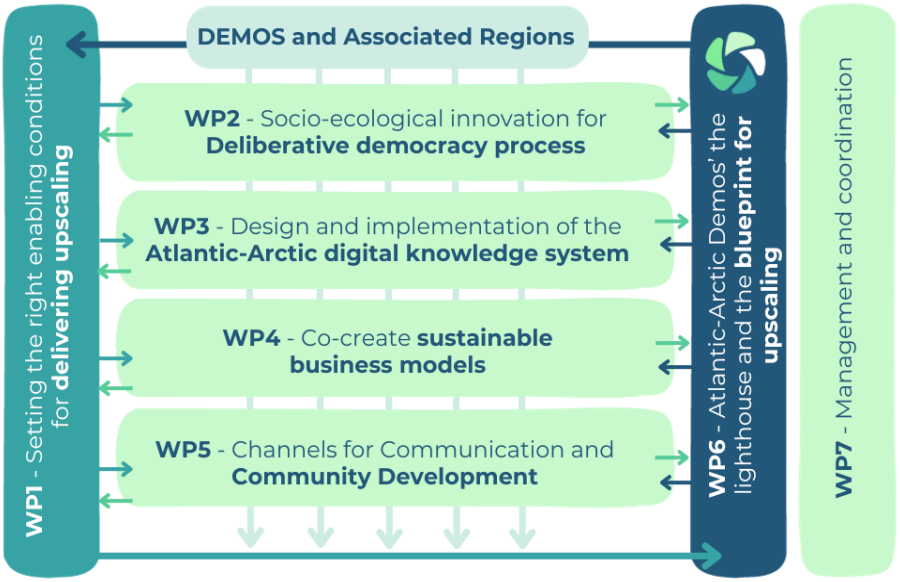

Figure 30: Seven Complementary Work Packages of the A-AAGORA Project (credit: A-AAGORA. 2024)

Evaluation of A-AAGORA under SER Framework

Assessment

The four linked themes that comprise the A-AAGORA demonstration site in Karlsøy (ecosystem-based management, ecotourism, kelp restoration, and sustainable fisheries) were decided upon by the project partners when they applied for funding. However, information about the specific context of the area that would then inform which method to develop, and pilot were clarified during the assessment phase. For example, the locals suggested to the project partners that otters in the area eat wolffish, which has cascading ecosystem effects on the kelp forest. This informed the project's decision to incorporate Master's and PhD student research on the effect of otters on the wolffish population as a component of the project.

Planning and design

Development of the project description

The four components of the project: ecosystem-based management, ecotourism, kelp restoration, and sustainable fisheries were decided by the project partners when applying for funding. Upon receiving funding, these were then introduced as broad open-ended themes to the stakeholders and locals at a municipal government meeting and through interviews, where they provided more information and suggestions on the types of solutions to test in the area. Some of these meetings or interviews focused on just one of the components, while others focused on more than one. Through this process, and particularly with involvement of local fishermen, the community played a key role in shaping the projects design, activities and setting its goals. This is achieved through collaboration with researchers, local authorities, and residents, particularly fishermen, who have extensive knowledge of long-term ecosystem change. The project coordinator, "the Bridge Builder", stationed in Karlsøy, plays an important role in ongoing and iterative stakeholder involvement and engagement which is present across all components via the application of the living lab approach, which allows for flexibility and adaptations based on ongoing feedback and collaboration with the partners.

Gold Nugget: The Bridge Builder

The project has benefited from having a project coordinator who relocated to the Karlsøy municipality where the project efforts and activities take place. This move has been crucial in bridging the gap between partners and establishing the foundation for a long-term restoration and management with the potential for expansion of activities. Scepticism towards research activities from outside institutes in small local communities can be substantial. Although the project coordinator is a natural scientist by training, this aspect has not been the focus when engaging with the local community. The success of high level of local involvement in the project are attributed to effective communication, relationship-building, and the project coordinator's integration into the community. It has been important to have a bridge between academia, the locals, and the municipality. Respecting and utilizing local knowledge have been vital not only for implementing activities but also for forming the foundation of further research on different aspects in the marine ecosystem.

Implementation

As of this writing, neither a large-scale restoration project nor a preservation initiative has been implemented. Innovative measures will be piloted and implemented at demo sites, with the goal of developing a blueprint rather than implementing a large-scale project. Rather than implementation, the planning process for sustainable fisheries, kelp restoration and ecosystem-based management is underway. Specifically, the project team is exploring the legal protection of wolffish, who can control the sea urchin population and therefore help maintain

kelp restoration efforts. At the same time, different monitoring methods, such as using drones and GPS tracking have been tested with locals and tourists, and if these prove successful, they can be scaled up.

Many of the solutions this project develops will be implemented in the municipality's own "municipal plan for biodiversity", which will be prepared over the next two years. This will be a tangible management tool for the municipality and to ensure that solutions are implemented.

Stakeholder Engagement

Respecting and utilising local knowledge has been essential for implementing activities and has formed the basis for further research, such as on ecosystem degradation and restoration possibilities. An example of collaboration with the local community is the research projects conducted by Master's and PhD students from the university in Tromsø. The results of this research, much of which is based on input of local knowledge, suggest that otters and seals may exert high pressure on the wolffish population by preying on them. Consequently, the students will investigate the diet of seals and otters in the area, looking for traces of wolffish in their feces, using environmental DNA (eDNA) analysis, which may inform future restoration activities.

Ongoing Management

Through the methodology of the living lab, this project is designed to be open to changes and adaptations based on feedback from the locals. Therefore, involvement of the local community is highly important, and it shapes the project's principles, goals, and management. The municipality, through the project, has arranged and plans to arrange meeting to provide information about the project and invite community input. These meetings focus on opportunities and favorable conditions for building a society based on sustainable and nature-based solutions. Additionally, workshops will be organized to address challenges collaboratively, and interviews conducted to gather local knowledge to build on the project's activities.

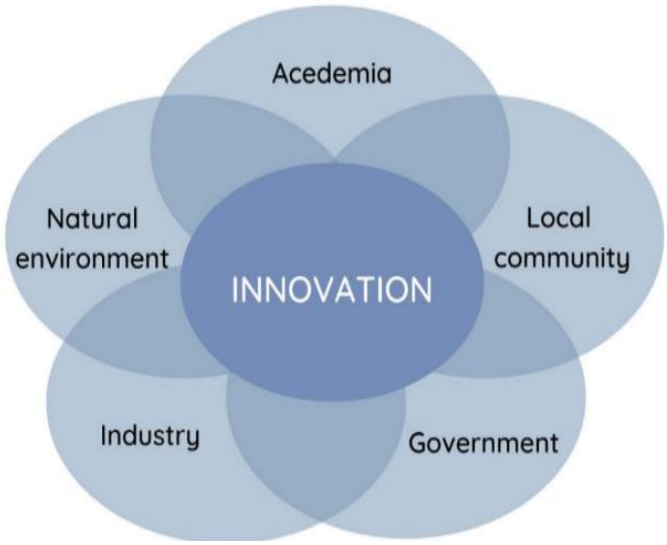

Figure 31: Quintuple Helix Model (credit: A-AAGORA, n.d.)

Gold Nugget: The Living Lab

The project has used a living lab approach where business, administration, organisations and citizens are brought together through the duration of the project to identify solutions and measures, based on new developments and research findings. In this project this is an ongoing collaborative approach between research institutes, the municipality, the board for conservancy areas, the local community, voluntary organisations, industry, and university. Measures identified by the living lab collaboration are then tested and monitored at the demo site and can be changed during the project period. This ensures that the management of the project is an adaptive process with the possibility to change course throughout based on input.

Reporting Regime

The Karlsøy project group holds monthly meetings to discuss activities and update team members. Additionally, the team participates in A-AAGORA meetings once a month where all Norwegian partners are represented along with other member countries (Ireland and Portugal) and the EU. During these meetings, results and experiences are reported to higher levels in the project (EU) and connections are established across the work package teams.

Innovations developed within the A-AAGORA project will be tested in areas outside the project, with these sites reporting their outcomes to help develop the blueprint and provide important insight for future replication and scalability. In addition, the local community members are also invited to meetings throughout the project to share knowledge, thoughts, and ideas, keeping them updated.

Future Activities

How to address the decline in the wolffish population, which is one of the main predators on sea urchins, is one emerging challenge that the project aims to address through stakeholder engagement. Local fishermen and the tourist fishery industry, together with A-AAGORA are exploring solutions to this issue, including looking at legal protections and by encouraging fishers to avoid fishing wolffish in certain areas.

The A-AAGORA project team will develop an ecosystem-based management plan through this project, together with various partners, the municipality, and the board for conservancy areas in Karlsøy. This plan will be developed based on distribution models of various marine biota from related to important areas for preservation, such as kelp forest, sea bird colonies, and marine mammals. These critical habitats are monitored under different activities.

Monitoring and Evaluation

The success of the project will be determined by whether it has provided valuable insights and best practices for implementing a restoration project and in collaboration with the partners and the local community, ecotourism solutions, solutions for fisheries and for ecosystem-based management. The project does not aim for specific results but seeks to test different methods, using different approaches and innovations. These collaboration initiatives will help identify what works and what doesn't, resulting in a comprehensive blueprint.

As part of A-AAGORA, new methods to strengthen local monitoring using artificial intelligence and machine learning to analyze images from drones, satellites, GPS tracking and social media will be tested. The project is also exploring various ways for the local community, tourists (ecotourism), students, and volunteers to contribute to the monitoring of different areas of the ecosystem. Findings from these efforts will be incorporated into the ecosystem-based management plan (mentioned above).

Data

All the partners have access to the data. The data and experiences collected during this project are shared among the partners and are available in a common cloud storage.

Opportunities for scalability and replication

The project encompasses various activities, each with different opportunities for scalability.
To successfully upscale kelp restoration in this area, there is a need for improved profitable technologies for large-scale sea urchin harvesting, addressing transportation challenges (e.g. long transport distance to Karlsøy from where the tourists stay), developing methods for utilising harvested sea urchins, and securing funding for restoration. Upscaling kelp restoration in this area requires large industry activities and funding opportunities, for example through carbon and biodiversity credits, for restoration efforts. Additionally, introducing more sustainable fisheries by establishing no-fishing areas for wolffish in collaboration with local fishermen and the tourist fishery industry could be feasible. This approach has the potential for upscaling and could encompass other species and areas if further studies and results show positive effects on fish populations and sea urchin density.

Ecotourism initiatives have been tested but have not yet proven to be an effective approach for sea urchin crushing/harvesting due to long boat trips from harbor to restoration sites, leading to limited time in the water for actual work. Initiatives like having tourist or companies harvest sea urchins with free divers or traps are positive but currently insufficient for large-scale restoration. However, the ecotourism industry has the potential for scalability. The ecotourism industry in the area is developing and testing activities that attract and encourage tourists to stay in the municipality longer, which would not only support restoration and monitoring initiatives but also lead to increased tourist spending and job creation.

9 Synthesis of Gold Nuggets

Across each component of the SER Framework, several gold nuggets were identified, and are synthesized below. These are not the only or the most important best practices and key takeaways for these projects, many of which have or will in the future publish comprehensive syntheses of best practices and lessons learned, but rather a selection of best practices identified by the projects themselves, as well as the authors of this report, that can be replicated in future restoration projects or programs to achieve the EU Mission.

Assessment

- **Gap analysis –** review literature and exisiting research landscape for project area to understand what your project can contribute to your sector
- **Pilot site assessmenst –** invite site experts to participate in interviews or self-assessments to identify strategic opportunities to and barriers to engagement of pilot sites
- **Collaboration –** work with project partners, target stakeholders, and identified problem owners from the assessment stage to identify which problems and actions are most suitable to implement

Benefits of these gold nuggets: relationship building, trust earning, complementing ongoing work rather than duplicating, ensuring that restoration activities do not isolate stakeholders who may otherwise be concerned that they (e.g. fishers).

Planning and Design

- **Embedded research –** For projects in remote places or with low trust in external scientists and research institutes, anchoring a project within the community from the planning stage can build trust and ensure stakeholder perspectives are included in planning and design.
- **Interdisciplinarity by design –** For large projects aiming to provide cross-cutting sectoral-level solutions to restoration, embedding interdisciplinarity into your project from the beginning can help to consolidate your project's goals and amplify your results to a wider audience

Benefits of these gold nuggets: relationship building, trust earning, consolidate project goals, amplify results to a wider audience, foster collaboration, and develop young leaders.

Implementation

- **Communications –** In addition to regular engagement with included and interested stakeholders who have an investment in the site, conduct broad outreach via social media, national media, and other media to engage a wider audience
- **Sustain relationships –** To establish and maintain long term relationships (which may be more useful for longer term projects/projects that don't have an end date and rely on volunteers), invest in training programs for stakeholders so that they have skills, experience, and buy-in to effectively use their time as stakeholders
- **Local government –** Local governments can be key to the successful implementation of restoration activities – projects should partner with, rather than consult, local governments at implementation stage when appropriate

Benefits of these gold nuggets: many stakeholders, including local government has up to date information and can provide input easily, foster more relationships beyond initial network, broad media attention demonstrates importance of the work and leads to more awareness and publicity.

Ongoing Management

- **Outcomes –** As a part of adaptive management, develop outcome-oriented approaches focused more on project goals, which lead to sustainable solutions over outputs (e.g. reports, policy briefs)
- **Demonstration –** Regularly demonstrate the outcomes and value of ongoing restoration work to funders, partners, and potential future replication sites
- **Quintuple helix –** Use the living lab, or quintuple helix approach, to learn about and adapt to unintended outvomes, changes, and new information gained during the duration of the project.

Benefits of these gold nuggets: maintained and sustained collaborative relationships, ability to adapt to goals set, ability to incorporate new information and feedback productively.

Monitoring and Evaluation

- **Planning for evaluation –** plan for evaluation of restoration outcomes in the Assessment or Planning & Design phase of your project to ensure that adequate resources are ringfenced early in the project
- **'Hard' and 'soft' stakeholder data –** collect and exploit data on people engaged to foster long-term relationships and engagement with stakeholders

Benefits of these gold nuggets: monitoring methods are tested and tailored for specific contexts, can collect baseline data, ensure monitoring is linked to project objectives, can determine trends in how to achieve long-term stakeholder engagement.

10 Conclusion

Key takeaways across components

There are many lessons to be learned from the six case studies explored throughout this report. To begin with, it is important to recognise that the **motivations for restoration differ** significantly across projects, and this will impact on the governance structure chosen for the project. In the case of Thames21, for example, the charity aims to create long-lasting community structures in the form of River Action Groups which can independently implement restoration actions in local communities. As such, its governance structure reflects this goal, and the fact that it is a chairty, through the support structures provided for the RAGs. In contrast, 3DPARE was a research project which focused on the technological development of 3D-printed reefs – its governance structure reflected this much tighter focus and time-limited scope.

Another key theme which emerged across multiple case studies (Thames21, CLIMAREST, RESTORESEAS, REST-COAST, & A-AAGORA) is the **importance of early engagement** with key stakeholders. Various success stories have been identified throughout this report (e.g., RESTORESEAS's early engagement with fishers; REST-COAST's and CLIMAREST's partnership with local government) which point to an increasing demand for empowerment of stakeholders, and the role of research projects in helping stakeholders achieve their desired outcomes. Key stakeholders to engage in restoration projects include local rights holders, scientists, universities, NGOs, local community groups, the private sector and local government bodies, as well as others that are relevant for the specific project context.

Reflecting on the above points, a key lesson from certain case studies (particularly Thames21, REST-COAST, & CLIMAREST) is the **importance of partnership** in project governance (i.e. the training course offered by Thames21, the 'platforms' created under REST-COAST, co-design with stakeholders in CLIMAREST). In this context, partnership with local stakeholders instills in them a sense of **empowerment and agency**. This may allow the restoration activity to scale or continue after the project has ceased.

Embracing **different forms of engagement** is another key lesson for future restoration projects. The abundance of virtual platforms for online engagement with stakeholders (such as Microsoft Teams, Zoom, Slido, Mintimeter, etc.) has made stakeholder engagement much more accessible across borders and has allowed for restoration actions to be planned, implemented, and disseminated remotely. However, in**-person communication and engagement cannot be replaced by technology**. Workshops, surveys, assemblies, trainings, news & media, and long-term approaches such as co-creation and living labs are all creative ways to engage with stakeholders in a meaningful way. In addition to stakeholders, engagement with project partners, research institutions, and similar projects across the region, through project meetings, builds networks and enables the sharing of lessons learned and best practices.

Finally, it is very important for restoration projects to **implement adaptive management** in their work. For example, the challenges posed by the COVID-19 pandemic highlighted the importance of flexibility in restoration governance (this is exemplified in 3DPARE). Project coordinators and managers should be flexible in their approach to restoration activity design and implementation, and allow time for sudden changes.

Considerations for replication and scaling

The six restoration projects or programmes evaluated in this report have either considered or are actively pursuing the expansion of their initial work. In addition, some of the projects are replications or expansions, building on previous work (e.g., RESTORESEAS). Expansion can be achieved through replication in other sites or scaling beyond the initial restoration area or project type. In doing so, these projects can apply lessons learned and best practices, both from their own projects as well as others, to develop and implement increasingly successful and beneficial restoration projects. Across the six projects, the researchers identified certain common enabling conditions for replication and scaling, defined below.

Identify financing. Because most projects have a specific budget and timeline, there is often a need to secure longer term financing to replicate and scale projects after the completion of a restoration project. Some projects explored securing financing in innovative ways, including embedding restoration activities as part of ecotourism operations, selling biodiversity (or other) credits from restoration activities, or using restoration within offset programs.

Explore synergies and build mutually beneficial relationships. In addition to financing the scaling of restoration, there are ways to reduce costs by finding synergies in relationships with different actors. For example, companies with 3D-printing capacities are better suited to print 3D-printed reefs at scale compared to an academic institution. In other situations, partnering with fishermen or recreational divers to collect data or harvest certain species can help reduce costs and allow for more stakeholders to be bought into the restoration project.

Embed replication and scaling into the project design. Several of the projects evaluated, particularly those linked to the EU Mission, have mandates within their project life to identify opportunities for scaling and sites for replication. As a result, much of the restoration project was developed with an intention to support scaling and replication. For example, projects developed and tested monitoring methods or restoration approaches that could be adapted to other sites and opened calls to select replication sites. Moving forward, such an approach, where feasible, can ensure scalability and replication after a project's life.

Define and identify shifting roles and responsibilities. Some of the restoration projects assessed in this report were designed specifically as research or pilot projects. This may mean that the institutions responsible for carrying out those projects, often academic institutions, do not have the resources, technical capacity, or aligned motivation to implement a scaled or replicated restoration project. In these instances, new actors or partners with appropriate and relevant upscaling technologies, including from the private sector, will need to be identified and given the responsibility for developing and implementing new projects. Previous project owners can continue to play a different role, such as research and development, rather than implementation.

Lastly, the best practices identified can be incorporated into scaled and replicated projects to further ensure effective outcomes.

Limitations

There were several methodological limitations associated with the development of this report, some of which have been discussed elsewhere. Namely with limited time, researchers were unable to conduct comprehensive analyses of the projects, some of which have been ongoing for decades. The researchers also chose to conduct interviews with a limited number of restoration practitioners associated with each project. There are other actors whose perspectives may be missing, including community members or governments who were invested in or affected by project implementation. Also, the decision to focus primarily on best practices using the SER Framework limited the researchers ability to collect more information on challenges, pitfalls, and interactions between projects and broader governance structures.

Some of these topics, particularly related to governance and legal structures are adressed in BlueMIssion AA Deliverable 1.2.

As a result, it is possible that this report doesn't capture all relevant information. For example, the Assessment component in Thames21 is not included, as that project was initiated over two decades ago and there was limited information on this stage both in interviews and published literature. The researchers attempted to correct for this, in part, by asking the interviewees to review the completed case studies to determine if it was well captured. Four of the six projects provided comments at this stage.

Another limitation is that few of the projects evaluated have had long term monitoring in place to determine success of projects. In many cases, projects were sharing their best practices or researchers were identifying them through their information gathering. However, without robust monitoring, it may be difficult to demonstrate causality between certain restoration decisions and outcomes.

Lastly, this report tested the use of the SER Framework to evaluate the restoration projects according to their components. The researchers find that while the framework is very useful, some of the case studies are about restoration projects that are either part of broader, often regional, restoration programs or have multiple components, some of which are not restoration (e.g. developing an ecosystem-based management plan). These other initiatives do not necessarily have the same set of components. Consequently, the authors occasionally struggled in deciding whether to focus their analysis on a specific restoration project or the broader structure, and ultimately chose to do a combination to capture the diversity of projects.

Future directions and next steps

This area of research is ripe with future opportunities for further work. The governance aspect of restoration projects is an area which can provide significant learnings for future restoration work, and valuable insights for project managers, coordinators, designers, researchers, and stakeholders. The limitations of the SER Framework point to the need for further investigation in this area, particularly around its applicability for long-term multi-decadal projects and the development of standardized key performance indicators to assess diverse projects and programmes. Additionally, further investigation into the relationship between national governance structures and policies and local restoration activities would be beneficial. Finally, future work could build on this investigation with the use of different frameworks, standards, and different case studies to test the findings of this study.

11 References

3DPARE. (2020) Reef Deployment in Santander Bay. Retrieved June 24, 2024, from https://www.giteco.unican.es/proyectos/3dpare/news/12.html
A-AAGORA (n.d.). Blueprint For Atlantic-Arctic Agora On Cross-Sectoral Cooperation For Restoration Of Marine And Coastal Ecosystems And Increased Climate Resilience Through Transformative Innovation. Available at: https://drive.google.com/file/d/15Ue5-p7Jhon902XlHs3v44lWTppXz_OY/view

Abelson, A., Reed, D. C., Edgar, G. J., Smith, C. S., Kendrick, G. A., Orth, R. J., ... & Nelson, P. (2020). Challenges for restoration of coastal marine ecosystems in the Anthropocene. Frontiers in Marine Science, 7, 544105.

Aljinović, B. (2022). D5.1 Report mapping the governance status quo in pilot sites. REST-COAST project. Retrieved June 24, 2024, from https://rest-coast.eu/storage/app/uploads/public/653/b9b/315/653b9b315514a536253725.pdf

BlueMissionAA – Building a coordination hub to support the mission implementation in the Atlantic and Arctic Basin. (n.d.). Retrieved June 19, 2024, from https://bluemissionaa.eu/

Bournemouth University. (2023). 3DPARE project: Revisiting 3D-printed artificial reefs. Retrieved June 24, 2024, from https://www.youtube.com/watch?v=X7eEAaCo1EE

Bournemouth University. (2023). Scientists at BU release juvenile lobsters to help protect and preserve sustainable environments. Retrieved June 24, 2024, from https://www.youtube.com/watch?v=Hynct_Z9YIQ

Bouremouth University (n.d.). 3DPARE (3D Printing Artificial Reefs in the Atlantic). Retrieved June 24, 2024, from https://www.bournemouth.ac.uk/research/projects/3dpare-3d-printing-artificial-reefs-atlantic

Burke, M. (2023). Preparing the market for statutory biodiversity credits. Retrieved June 24, 2024, from https://naturalengland.blog.gov.uk/2023/07/28/preparing-the-market-for-statutory-biodiversity-credits/

Climarest. (n.d.). Retrieved June 19, 2024, from https://climarest.eu/

Daniel Hering et al. (2023). Securing success for the Nature Restoration Law. Science 382,1248-1250. DOI:10.1126/science.adk1658

Dannevig, H., Søreide, J. E., Sveinsdóttir, A. G., Olsen, J., Hovelsrud, G. K., Rusdal, T., & Dale, R. F. (2023). Coping with rapid and cascading changes in Svalbard: The case of nature-based tourism in Svalbard. Frontiers in Human Dynamics, 5, 1178264. n

DEFRA. (2023). Understanding biodiversity net gain. Retrieved June 24, 2024, from https://www.gov.uk/guidance/understanding-biodiversity-net-gain

Environment Agency. (n.d.). Thames River Basin District. Retrieved June 24, 2024, from https://environment.data.gov.uk/catchment-planning/RiverBasinDistrict/6

European Commission, Directorate-General for Research and Innovation, (2023). EU Missions assessment report : Mission Restore our Ocean and Waters, Publications Office of the European Union. https://data.europa.eu/doi/10.2777/95171

European Commission. (2024) Restore our Ocean and Waters. https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/restore-our-ocean-and-waters_en

European Environment Agency (2023). The importance of restoring nature in Europe. (2023.). Briefing no. 09/2023 Retrieved June 19, 2024, from https://www.eea.europa.eu/publications/importance-of-restoring-nature/the-importance-of-restoring-nature

Feld, Christian & Gutiérrez-Cánovas, Tano & Ormerod, Steve & Fernandes, M. Rosario & Ferreira, Maria & Kaandorp, Vince & Louw, Perry & Kuijper, Marijn & Bloomfield, John & Molina-Navarro, Eugenio & Andersen, Hans & Borja, Angel & Chifflet, Marina & Chust, Guillem & del Campo, Andrea & Pouso, Sarai & Uyarra, Maria C. & Noges, Tiina & Haberman, Juta & Hering, Daniel. (2017). MARS Deliverable 4.2: Manuscripts on stressor effects at the river basin level.

Hynes, S., Chen, W., Vondolia, K., Armstrong, C., & O'Connor, E. (2021). Valuing the ecosystem service benefits from kelp forest restoration: A choice experiment from Norway. Ecological Economics, 179, 10.1016/j.ecolecon.2020. https://doi.org/10.1016/j.ecolecon.2020.106833

Jones, B. L., Cullen-Unsworth, L. C., la Torre-Castro, D., Nordlund, L. M., Unsworth, R. K., & Eklöf, J. S. (2022). Unintended consequences of sustainable development initiatives: risks and opportunities in seagrass social-ecological systems. Ecology & Society, 27(2).

MEDSEA. (2024). REST COAST, at the annual meeting in Groningen, demonstrates the effectiveness of natural restoration of aquatic systems. Retrieved June 24, 2024, from https://www.medseafoundation.org/index.php/en/news-eng/862-rest-coast-in-groningen

Moraes, R. P., Reguero, B. G., Mazarrasa, I., Ricker, M., & Juanes, J. A. (2022). Nature-based solutions in coastal and estuarine areas of Europe. Frontiers in Environmental Science, 10, 829526.

Nelson, C.R., Hallett, J.G., Romero Montoya, A.E., Andrade, A., Besacier, C., Boerger, V., Bouazza, K., Chazdon, R., Cohen-Shacham, E., Danano, D., Diederichsen, A., Fernandez, Y., Gann, G.D., Gonzales, E.K., Gruca, M., Guariguata, M.R., Gutierrez, V., Hancock, B., Innecken, P., Katz, S.M., McCormick, R., Moraes, L.F.D., Murcia, C., Nagabhatla, N., Pouaty Nzembialela, D., Rosado-May, F.J., Shaw, K., Swiderska, K., Vasseur, L., Venkataraman, R., Walder, B., Wang, Z., & Weidlich, E.W.A. 2024. Standards of practice to guide ecosystem restoration – A contribution to the UnitedNations Decade on Ecosystem Restoration 2021-2030. Rome, FAO, Washington, DC, SER & Gland, Switzerland, IUCN CEM. https://doi.org/10.4060/cc9106en

Neumann, J., Arnal, L., Magnusson, L. & Cloke, H. (2018). The 2013/14 Thames Basin Floods: Do Improved Meteorological Forecasts Lead to More Skillful Hydrological Forecasts at Seasonal Time Scales?. Journal of Hydrometeorology. 19. 10.1175/JHM-D-17-0182.1.

OECD. (n.d.). Biodiversity Offsets Effective design and implementation. Retrieved June 24, 2024, from https://www.oecd.org/environment/resources/Policy-Highlights-Biodiversity-Offsets-web.pdf

Paprotny, D., Terefenko, P., Giza, A., Czapliński, P., & Vousdoukas, M. I. (2021). Future losses of ecosystem services due to coastal erosion in Europe. Science of the Total Environment, 760, 144310.

Remøe, I. B. (2024). Motivations and Effects of Volunteer Divers Restoring Norwegian Kelp Forests. [Master's thesis]. UiT The Arctic University of Norway

REST-COAST. (n.d.). Pilot sites. Retrieved June 24, 2024, from https://rest-coast.eu/pilots

Richardson, M. & Soloviev, M. (2021). The Thames: Arresting Ecosystem Decline and Building Back Better. Sustainability. 13(11):6045. https://doi.org/10.3390/su13116045

Sanchez-Arcilla, A., Ibañez, C., Gracia, V., Garrote, L., Caceres, I., Lopez, D., De La Peña, J.M., Caiola, N., Munne, A., Espanya, A., Iglesias, A., Rovira, A., Marco, D.G., & Grassa, J.M. (2023). Nature Based Solutions for Sediment Starved Deltas. The Ebro Case in the Spanish Mediterranean Coast. Coastal Sediments. March 2023, 2307-2320.

Sewell, A., Bouma, J., and van der Esch, S (2016) Investigating the challenges and opportunities for scaling up Ecosystem Restoration, The Hague: PBL Netherlands Environmental Assessment Agency

Society for Ecological Restoration Science and Policy Working Group (2002) The SER primer on ecological restoration. Society for Ecological Restoration, www.ser.org/

Stilwell, A. (2024). Marine Forests Festival comes to Sagres. Portugal Resident. Retrieved June 24, 2024, from https://www.portugalresident.com/marine-forest-festival-comes-to-sagres/

Stronza, A. L., C. A. Hunt, and L. A. Fitzgerald. 2019.Ecotourism for conservation? Annual Review of Environmentand Resources 44:229-253. https://doi.org/10.1146%2Fannurev-environ-101718-033046

Søreide, J. E., Pitusi, V., Vader, A., Damsgård, B., Nilsen, F., Skogseth, R., ... & Węsławski, J. M. (2020). Environmental status of Svalbard coastal waters: Coastscapes and focal ecosystem components.

Thames21. (2023). Thames21's Five Year Plan. Retrieved June 24, 2024, from https://www.thames21.org.uk/thames21_five_year_plan/

Thames21. (n.d.). Catchment Partnerships. Retrieved June 24, 2024, from https://www.thames21.org.uk/catchment-partnerships/

United Nations General Assembly (UNGA) United Nations Decade on Ecosystem Restoration (2021–2030). UN Doc A/Res/73/284

United Nations United Nations Environment Assembly of the United Nations Environment Programme (2022) Resolution adopted by the United Nations Environment Assembly on 2 March 2022 5/5. Nature-based solutions for supporting sustainable development). UNEP/E.A.5s/Res. 5

Węsławski, J. M., & Urbański, J. A. (2024). Forty years of warming: Environmental change in marine coastal habitats on Svalbard between 1981 and 2022. Polish Polar Research.

What is Ecosystem Restoration? (n.d.). UN Decade on Restoration. Retrieved June 19, 2024, from http://www.decadeonrestoration.org/what-ecosystem-restoration
Whitehead P. G., Crossman J., Balana B. B., Futter M. N., Comber S., Jin L., Skuras D., Wade A. J., Bowes M. J. and Read D. S. (2013). A cost-effectiveness analysis of water security and water quality: impacts of climate and land-use change on the River Thames system. Phil. Trans. R. Soc. https://doi.org/10.1098/rsta.2012.0413

Appendix 1. Interview Template According to SER Framework

SER Component	Questions
Assessment	1. What is the problem definition? Where did the project begin/what is the project trying to address? 2. Who decided on the problem definition? Who was involved in the conceptual stages? 3. How did you engage initially with the existing local environment (local stakeholders, rightsholders, etc)?
Planning & Design	4. What is the governance structure of the project? 5. Who decided on / what groups decided on the vision for the restoration project? What is this vision based on? 6. Who decided on the objectives for the restoration project? What are the objectives based on? 7. What different parties were involved in the planning and design of the project? 8. How was the project initially financed (if different from ongoing funding)?
Implementation	9. Who is the decision making body for the implementation project? 10. Where to the decision making powers sit within the project and what is the scope of the decision making powers? 11. What reporting regime is there and to whom is the reporting done? 12. What are the consequences (if any) if targets are not met? 13. Who holds the information for the project? 14. Who has access to the information on the project? Where is this made available? 15. How do participants know objectives are being met? 16. How does the wider public know the objectives are being met? 17. What stakeholder engagement was there on the vision and objectives? 18. What involvement so stakeholders have on the daily implementation of the project? 19. How are stakeholders engaged with / involved in periodic processes?

Ongoing Management	20. Who is responsible for the ongoing management of the project? 21. Who is funding the ongoing implementation of the project? Is funding subject to any conditions? 22. What is the long terms funding model? 23. What do funders get for their input? 24. What adaptive management / feedback loops are in place for the project? 25. What compliance / enforcement is in place for the project? 26. What legal status does this compliance / enforcement regime have?
Monitoring & Evaluation	27. What is being determined as success for the project? Is this qualitative or quantitative? Who decides the project has been successful? 28. What is the monitoring regime for the project? 29. Is there an enforcement?
Additional Questions (Time permitting)	30. Does the project relate to any specific international / domestic or local policies? 31. What regulations / legal requirements are in place for this work? Who sets these? 32. What format/type of guidance document/toolkit would have helped you when your project first started? 33. Broadly: what challenges did you face?

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