



LIFE16 NAT/IT/000589

Final Report
Covering the project activities from 01/09/2017 to 31/03/2022

Reporting Date
30/06/2022

LIFE PROJECT Acronym
LIFE REDUNE

Data Project

Project location:	Veneto, Italy
Project start date:	01/09/2017
Project end date:	31/03/2022
Total budget:	€ 2,005,384
EU contribution:	€ 1,203,230
(%) of eligible costs:	60%

Data Beneficiary

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Package completeness and correctness check	
Obligatory elements	✓ or N/A
Technical report	
The correct latest template for the type of project (e.g. traditional) has been followed and all sections have been filled in, in English <i>In electronic version only</i>	✓
Index of deliverables with short description annexed, in English <i>In electronic version only</i>	✓
<u>Mid-term report</u> : Deliverables due in the reporting period (from project start) annexed <u>Final report</u> : Deliverables not already submitted with the MTR annexed including the Layman's report and after-LIFE plan Deliverables in language(s) other than English include a summary in English <i>In electronic version only</i>	✓
Financial report	
The reporting period in the financial report (consolidated financial statement and financial statement of each Individual Beneficiary) is the same as in the technical report with the exception of any terminated beneficiary for which the end period should be the date of the termination.	✓
Consolidated Financial Statement with all 5 forms duly filled in and signed and dated <i>Electronically Q-signed or if paper submission signed and dated originals* and in electronic version (pdfs of signed sheets + full Excel file)</i>	✓
Financial Statement(s) of the Coordinating Beneficiary, of each Associated Beneficiary and of each affiliate (if involved), with all forms duly filled in (signed and dated). The Financial Statement(s) of Beneficiaries with affiliate(s) include the total cost of each affiliate in 1 line per cost category. <i>In electronic version (pdfs of signed sheets + full Excel files) + in the case of the Final report the overall summary forms of each beneficiary electronically Q-signed or if paper submission, signed and dated originals*</i>	✓
Amounts, names and other data (e.g. bank account) are correct and consistent with the Grant Agreement / across the different forms (e.g. figures from the individual statements are the same as those reported in the consolidated statement)	✓
Mid-term report (for all projects except IPs): the threshold for the second pre-financing payment has been reached	✓
Beneficiary's certificate for Durable Goods included (if required, i.e., beneficiaries claiming 100% cost for durable goods) <i>Electronically Q-signed or if paper submission signed and dated originals* and in electronic version (pdfs of signed sheets)</i>	✓
Certificate on financial statements (if required, i.e. for beneficiaries with EU contribution ≥750,000 € in the budget) <i>Electronically Q-signed or if paper submission signed original and in electronic version (pdf)</i>	N/A
Other checks	
Additional information / clarifications and supporting documents requested in previous letters from the Agency (unless already submitted or not yet due) <i>In electronic version only</i>	✓
This table, page 2 of the Mid-term / Final report, is completed - each tick box is filled in <i>In electronic version only</i>	✓

**signature by a legal or statutory representative of the beneficiary / affiliate concerned*

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2 List of keywords and abbreviations

CS: Coordinatore Scientifico (i.e., *Scientific Coordinator*)

DTM Digital Terrain Model

FR: Final Report

EPC: European Project Consulting, partner beneficiary, partner beneficiary

MEPA: Mercato Elettronico delle Pubbliche Amministrazioni (*Electronic market of the public administration*)

MTR: Mid-Term Report

PA: Assistente di Progetto (*Project Assistant*; formerly RTA)

PM: Project Manager

PO: Project Officer

PR: Progress report

RDO: Request for Offer in MEPA

RTA: Referente Tecnico Amministrativo (*Technical-administrative Representative*)

RV: Regione Veneto, partner beneficiary

SELC: Società Cooperativa Biologia e Geologia applicate (*Cooperative for Biology and Applied Geology*), partner beneficiary

SE: Servizi Ecosistemici (*Ecosystem service*)

SIF: Unità Organizzativa Sistemazione Idraulico Forestali ed Aree Naturalistiche (*Organizational Unit for Hydraulic management, Forestry and Naturalistic Areas*)

UNIVE: Coordinator beneficiary, Ca' Foscari University of Venice

VA: Veneto Agricoltura – Agenzia Veneta per il Settore Primario (*Venetian Agency for the Primary Sector*), partner beneficiary

3 Executive Summary

Project objectives

The overall aim was to re-establish and maintain over time the ecological integrity of habitats 2110/2120, 2130*, 2250* e 2270* and of *Stipa veneta** populations, to guarantee the ecological functioning of the entire coastal dune mosaic, in 4 Natura 2000 sites of the North Adriatic coastline, making use of an ecosystem approach. In detail the project aimed to:

- Restoration of 91.5 ha of five coastal dune habitats of EU interest and doubling of the global population of the priority species *Stipa veneta**;
- Reduction of human impacts inside the Natura 2000 network sites;
- Development of a responsible behaviour towards the dune ecosystems, including the appropriate consideration of their sustainable use, by the key stakeholders; and
- Replication and transfer of the expertise and methods developed within the project to similar contexts.

Achievements

Despite the project had to face two major and tricky events (exceptional storm surge in 2019, and the Covid-19 pandemic), it progressed regularly, and all the planned actions have been completed. The mitigation measures set in place over time, and agreed with EASME/CINEA, were successful and there were no significant deviations from the GA. Covid outbreak caused delay in some actions and, in some cases (Action D and E), the mitigation strategy involved budget changes (see Section 8 for details). The partnership always worked in synergy, successfully completing all tasks. EASME/CINEA always expressed satisfaction with the partnership and the activities undertaken.

Key deliverables obtained

- Updated Standard data Forms of the 4 Natura 2000 sites and of further 2 Nature 2000 sites partially overlapped to project sites
- Quantification of ecosystem services and ecosystem functions
- 4 Guidelines disseminated: Guidelines for containment of *Oenothera stucchii*, Guidelines for the use of drones on beaches, Guidelines for stakeholder engagement and Guidelines for methods to assess coastal dune restoration potential (additional)
- 1 Risk Assessment of *Oenothera stucchii* in coastal dunes
- 1 Handbook for dunal species propagation disseminated
- Guidelines for long-term management of the beaches by the stakeholders
- 1 bilingual website (Ita-Eng) (with 2.500 users) and related Facebook (1.175 followers) and Twitter pages (219 followers)
- 2 trilingual videos (Ita-Eng-De) of 5 and 8 minutes respectively and 35 further short educational videos
- 80.000 bilingual leaflets
- 5 Informative panel layouts
- 1 Dissuasive panel layout
- 1 Laymen's report (1.000 copies)
- After Life Plan

Main outputs produced

- Reconnection of 3.000 m of sandy dunes;
- Restoration of 9.35 ha of shifting and mobile dune habitats, by planting 35 265 plants;

- Restoration of 92.06 ha of fixed dune habitats of which: 28.6 ha of grey dunes habitat by planting 63.490 structural plants, 18.54 ha of coastal dunes with *Juniperus* species by planting 41.500 plants; and 35.57 ha of wooded dunes habitats by managing woods and planting 10.500 plants;
- Restocking of the priority species *Stipa veneta** with 1.630 seedlings;
- Control of *O. stucchii* on 23.6 ha;
- A quantitative database on the ecosystem services provided by sandy coastal dunes;
- Construction of 746 m of boardwalks;
- Erection of 4887 m of fences;
- 25 public outdoor information points, 48 outdoor dissuasive panels, 8 public indoor information points
- 2 overarching Authorities with competencies at supra-municipal level officially adopted the E.3 Guidelines
- 1 Municipality signed the agreement for the adoption Guidelines for long-term management of the beaches
- 2 entities (Capalonga campsite and Caorle Municipality) adopted a beach cleaning management following project guidelines
- 14 Scientific publications
- 85 Educational events for tourists
- 5 Educational events for touristic operators

Deviations

All changes are described in the text of the actions, in sections 6.1 and 6.2 and in the timetable. Changes aimed to fix errors included in the approved LIFE proposal and most importantly to adapt the project to the contingent situations due to both the exceptional storm surge in 2019, and the Covid-19 pandemic. In section 8 we indicate all changes to the budget, which however have already obtained the PO's approval.

Important problems and difficulties met during the project implementation

Main problems and corrective actions implemented are thoroughly described in section 6.2. In summary, the project had to face three major and tricky situations; 1) *Stakeholder engagement*: despite a large number of meetings, stakeholder engagement and active participation in the project were not fully achieved, also because Municipalities and economic stakeholders were distracted by the two major issues arisen during the project, i.e., the exceptional storm surge in 2019 and the subsequent outbreak of Covid-19. However, we succeeded in engaging citizens, environmental groups, volunteer associations, and business stakeholders that now form a critical mass hopefully able to move communities toward responsible stewardship of sand dune ecosystems; 2) *Exceptional storm surge*: in the night of 12/11/2019, the tide reached +187 cm, with wind gusts of up to 100 km/h and resulted in extensive damages to structures and infrastructure (buildings, tourist facilities and beaches). Following the storm surge, we were forced to partially revise the work plan, but budget savings and recycling have allowed almost total recovery of interventions and infrastructures lost to the storm; *Covid-19 outbreak*: it occurred just after the storm surge. It mostly caused delay in some actions; in some cases (Actions D and E), the mitigation strategy involved budget changes (see Section 8). Actions C were not significantly delayed since no activities were scheduled over the summer season, while the lockdown highly affected actions E2 and E5 since both involved international trips, at the time forbidden; we defined substitute activities that both guaranteed coherence with the aims of the actions (knowledge sharing) and allowed us to avoid delaying actions while waiting for possible solutions. However, difficulties have been overcome thanks to a sturdy partnership and corrective actions.

4 Introduction

Overall objective

LIFE REDUNE overall aim was to restore and maintain the ecological integrity of a full set of dune habitats listed in Annex I of the Habitats Directive, and to double the populations of *Stipa veneta**, a plant classified as endangered in the global IUCN Red List, endemic to the dunes of the northeastern Italy, and listed in Annex II of the Directive as a priority species. The Project aimed to assure the ecological restoration of the coastal dunes of four Natura 2000 network sites along the North Adriatic coastline.

Sites involved

A01 – Punta Tagliamento

IT3250033 (SIC) LAGUNA DI CAORLE/FOCE DEL TAGLIAMENTO

IT3250040 (ZPS) FOCE DEL TAGLIAMENTO

Municipality: San Michele al Tagliamento

A02 – Punta Capalonga/A02 – Vallevicchia

IT3250033 (SIC) LAGUNA DI CAORLE/FOCE DEL TAGLIAMENTO

IT3250041 (ZPS) VALLE VECCHIA - ZUMELLE - VALLI DI BIBIONE

Municipality: San Michele al Tagliamento, Caorle

A03 – Laguna del Mort and Pineta di Eraclea

IT3250013 (SIC) LAGUNA DEL MORT AND PINETE DI ERACLEA

Municipality: Jesolo, Eraclea

A04 – Cavallino Treporti, Punta Sabbioni

IT3250003 (SIC/ZPS 5B) PENISOLA DEL CAVALLINO: BIOTOPI LITORANEI

Municipality: Cavallino Treporti

A05 – Bosco Nordio

IT3250032 (SIC/ZPS) BOSCO NORDIO

Municipality: Chioggia

Habitat types and species targeted

Target species: *Stipa veneta**

Target habitat types:

2110 - Embryonic shifting dunes

2120 - Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")

2130* - Fixed coastal dunes with herbaceous vegetation ("grey dunes")

2250* - Coastal dunes with *Juniperus* spp.

2270* - Wooded dunes with *Pinus pinea* and/or *Pinus pinaster*

Specific objectives

To assure the ecological restoration of coastal dunes along the North Adriatic coastline, the project specifically foresaw:

- the restoration and/or duly management of 9.2 ha of shifting dunes using soft engineering nature-based techniques
- the restoration of 82.3 ha of transition and fixed dune habitats (2130*, 2250*, 2270*).

Habitat restoration involved the planting of 151.000 seedlings of native species (including 1.000 seedlings of *Stipa veneta**) and the removal of the invasive alien species *Oenothera stucchii*. To reduce human impacts and promote natural habitat recovery, the project also

foresaw the placement of 746 m of boardwalks and 4.887 m of fences. Networking, replication and communication actions had also been planned to complement the technical actions.

Main conservation issues being targeted (including threats)

Coastal dunes are ecologically relevant ecosystems hosting a highly specialised flora and fauna. They are also crucial for human wellbeing, assuring essential services with substantial socio-economic impacts. They act as a protecting buffer against storm surge, waves, and wind, and also supply intangible cultural services such as relaxation and recreation and educational resource. However, increasing human pressure on coastal areas has led to a competition for space between human activities and the coastal environment and coastal dunes are facing a worrying decline, which is worsened by climate change and increasing frequency of extreme phenomena. Upstream land use changes, dam construction and hard infrastructure building for coastal protection are indirectly affecting remnant dune areas by inducing changes in the hydrodynamics and altering the gradients in sediment transport. In addition, the replacement of coastal dune ecosystems with tourism-oriented settlements, infrastructures, and facilities are directly resulting in dune loss and degradation and ecological impacts that occur at many temporal and spatial scales. This is mostly due to a general lack of awareness of the environmental problems caused by the mismanagement, which include habitat loss, the spread of invasive alien species, loss of dune integrity (i.e., species composition and community structure) and health (i.e., functional processes), as well as of ecosystem services.

Socio-economic context

The dune systems targeted by the project are located in a tourist area and near well-known beach resorts that are heavily frequented during the summer season. For example, in 2019, the number of beach visitors reached over 25 million. As a result, beach management is typically unbalanced on beaches focusing on accommodating tourism and recreation. Mass tourism is undoubtedly one of the most important elements of the regional economic system, but it also represents the greatest threat to the conservation of dune systems, which are exposed to numerous anthropogenic pressures as a direct and indirect consequence of beach tourism: widespread and uncontrolled urbanization, construction of tourist infrastructures, dune crossing by motor vehicles, mechanical cleaning of beaches, trampling of beaches by tourists, solid waste, introduction of exotic plants for ornamental purposes.

In general, local communities and stakeholders are not aware of the ecological and naturalistic implications of unsustainable coastal use and development, that can ultimately compromise not only the natural and ecological value, but also the cultural and ecological heritage of the landscape, which is one of the factors for tourism attractiveness.

Expected longer term results (as anticipated at the start of the project)

Action	proposal	at the end of the project	expected longer term results (5 years)
restoration 2110-2120 (in ha)	9,20	9,35	12,00
restoration 2130* (in ha)	28,50	28,6	31,00
restoration 2270* (in ha)	35,50	35,57	36,00
increase 2250* (in ha)	18,30	18,54	21,00
<i>O. stucchii</i> control (in ha)	15,00	23,6	10,00
increase of populations of <i>Stipa veneta</i> * (n. of seedlings)	1,000	1,749	2,000

5 Administrative part

Project management process and the working method

The Scientific Coordination was headed by the Coordinating Beneficiary, the Ca' Foscari University of Venice, in the person of Prof. Gabriella Buffa, full professor of Botany. The Coordinator was supported by a Project Assistant (Dr. Edy Fantinato); Dr. Serenella Rizzieri (UNIVE) oversaw the administrative management of the project. The Project Management was headed by the EPC Partner Beneficiary.

The Scientific Coordinator, together with the Project Manager and the Project Assistant, coordinated the activities with the Head of External Relations and Communication (EPC), the Head of the nursery centre and the assistant/project manager (VA), the Technical Officer (RV) and the SELC Project Manager (SELC).

The project coordination needed daily work to harmonize all actions and assure their correct flow, keep partners constantly informed about the project progress and share problems and solutions. Thanks to an excellent internal communication, we had an effective workflow that allowed us to respect the deadlines and the needs of all beneficiaries.

Problems encountered

Like any project that involves working with living organisms, the project encountered some minor problems, but they were solved thanks to the skills and experience of the project team. Other problems faced by the project were more related to the socio-economic context in which the project had to be carried out. Main problems encountered by the project are thoroughly described in section 6.2.

The partnerships and their added value

The added value of the partnership between the beneficiaries of the project derived from three main factors, namely, a) synergy and complementarity, since each partner provided skills and realized specific activities that integrated with those of the other partners; b) the spirit of collaboration between the partners and the search for shared solutions were crucial to solve the small contingencies that normally characterize a project regarding the nature and the environment; c) availability: all partners showed willingness to implement not only what was expected but also to make a greater contribution to achieve results greater than those planned in the project.

Communication with the Agency and Monitoring team

The Monitor visited the project 5 times: on 28-29/2/2018, 19-20/3/2019 (with the PO), 4/05/2020 (online), 29-30/04/2021, 9-11/02/2022 (online meetings) and 24-25/02/2022 (in presence, visits to project sites). The feedback from the Commission on the visits always arrived promptly and its advice, both technical and financial, has been always addressed and incorporated into following reports.

The first Project Monitor was Mr Riccardo Scalera until the end of 2019, the second was Ms Sara Luchetti, both of them from the external monitoring agency NEEMO GEIE – Timesis. Regular communication was maintained during the entire Project lifetime, with a fruitful collaboration. For the complete list of communications see Annex to Action F.1.

Changes due to amendments to the Grant Agreement

Not applicable

6 Technical part

6.1 Technical progress, per Action

For each action, the code, title, acronym of the beneficiary responsible for the action, expected start and end dates, actual dates and the current status are indicated. All the planned deliverables are listed in Section 8 and attached to the report. Specifically, we created three distinct folders: a) Due Deliverable (Deliverables since MTR), in which all mandatory deliverables have been included; b) Additional Deliverables, in which supplementary deliverables have been included; c) Annexes to the Actions, in which for some Actions further details have been included.

A1 PLAN OF THE INTERVENTIONS ON THE HABITATS

EPC

Start date: 01/10/2017 End date: 30/09/2018

Actual start date: 01/10/2017 Actual end date: 30/09/2018

Status: completed.

After an initial preparatory phase, planning began with beneficiary visits to the project areas (8/11/2017 Laguna del Mort, 15/11/2017 Vallevicchia and Capalonga, 22/11/2017 Penisola del Cavallino, 15/12/2017 San Michele al Tagliamento, 17/1/2018 Vallevicchia). Various organisational meetings were held at RV offices, e.g., on 1/12/2017, to coordinate the approval process of the project; on 10/1/2018 between all the institutions involved in the approval (including the Interregional Public Works Authority and the Land Protection Sector of the Veneto Region) and the beneficiaries; and on 11/1/2018 with the company [REDACTED], in order to verify the placement of the works planned in Cavallino, adjacent to the compensation measures carried out in the framework of the infrastructure MOSE to protect Venice from the tides. The dialog with the competent authorities allowed to avoid any overlapping and identified synergistic actions. Between January and March 2018, as part of the D.1 actions, EPC made topographic surveys using aerial photogrammetry with drones and GPS instrumentation. The data processing enabled the creation of a three-dimensional DTM with a resolution of 25 cm, and updated photomaps of the working areas with a 5-cm pixel resolution on the ground; these outputs, together with fine-scale habitat maps produced by UNIVE, represented the basis for the detailed design of interventions. On 16/04/2018, project team met at EPC to define the draft plan of interventions. The draft was presented to the municipalities and stakeholders (see the next action) and adapted according to their advice. This work led to the elaboration of the technical blueprint of the project in June 2018, including, among other documents, the general report, time schedule of the works, maps, and detailed costs.

On 6/07/2018, the project received the positive opinion of the Regional Technical Commission and was subsequently forwarded to the other competent bodies (Municipalities, Harbour Authorities, Superintendence), obtaining the competence opinions. On 22/10/2018, with DDR no. 49 the Director published the decree approving the project. After this date, minor changes were made to the project plans concerning the works and planting schedule, to more effectively align them with the execution of the other interventions.

The work has been carried out in compliance with the “Code of public contracts relating to works, services and supplies” (Decree Law No. 163 dated 12/04/2006, and subsequent amendments, and Decree Law No. 50 of 2016 – Law No. 122/2016), and led to the realisation of 22 different project drawings necessary for making the interventions, as well as to the acquirement of related authorisations required by the current legislation, including the one for the landscape protection and the Screening in the different project areas.

Technical deviations: 1) since the interventions were compliant with the provisions of the site conservation measures there was no need to prepare the V.Inc.A; 2) to save time and accelerate the process, we did not prepare the preliminary project (foreseen in the GA) and proceeded to

elaborate the final technical blueprint instead. As already mentioned in the MTR, we had to relocate some interventions initially forecast in a private area due to the owner withdrawing his availability. Seedling plantation was thus used to reinforce small subpopulations found nearby within the same Nature 2000 site.

Problems encountered: None

Deliverable & Milestones since MTR

None.

A2 CONSULTATION WITH THE STAKEHOLDERS		RV
Start date: 01/10/2017	End date: 30/09/2018	
Actual start date: 01/10/2017	Actual end date: 30/11/2018	
Status: completed.		

At the beginning, the action has seen the involvement of the 5 Municipalities interested in the activities, which took part in project areas surveying for the design of the projects (Action A.1). After that, RV contacted the various municipalities to organise meetings that first involved the city administrations, and then the tour operators and non-profit associations. Thirteen meetings were held involving all the territories interested by the project. The meetings started in 2018 and continued throughout the year, with a total participation of 70 people.

On 3/9/2018, the beneficiaries held an internal coordination meeting of the action. All the stakeholders involved demonstrated their interest and gratitude for the project. By contrast, the requests to change certain habits harmful to the dune ecosystem have not always been fully accepted. However, the meetings laid important foundations for the work prosecution in the context of the concrete actions C. On the one hand, they allowed for a shared and participated planning and on the other, they created a working team for the development in particular of the actions E.3 and E.4.

The complete list of meetings, their location, dates, and other details were already reported in the first PR (Prot. 13665 – III / 13 of 11/03/2019) and in the deliverable “Rapporto sul risultato degli incontri di consultazione con gli stakeholders - Azione A2” (annexed to the first PR).

Problems encountered: the completion of the action was extended from 30/09/2018 to 30/11/2018 upon request of some stakeholders of a greater dialog regarding the design of the interventions in specific local situations.

Deliverable & Milestones since MTR

None

C1 INTERVENTIONS TO REDUCE THE ANTHROPIC IMPACT ON THE HABITATS		RV
Start date: 01/10/2018	End date: 31/12/2019	
Actual start date: 01/09/2018	Actual end date: 31/07/2021	
Status: completed.		

The Action C1 aimed at reducing the impact of human disturbance through the realization of two different types of interventions, implemented through the procurement of works by VA and RV and, partially, using the labour of VA. In detail:

1) *punctual interventions* initially included a) installation of 1m x 1m informative panels in forex and their wooden boards; due to the high level of disturbance, we added (thanks to budget savings and partners’ extra-budget): b) installation of A4 size dissuading panels in wood, to discourage diversions from the main paths; c) planting of thorny plant species to close secondary paths and limit trampling; d) the use of trunks and branches resulting from the thinning of the pine forest to further close secondary paths.

2) *interventions with linear development* included: a) construction and placement of fence and boardwalk sections to direct the tourist flows.

The Action was concluded on 31/08/ 2020. However, due to the following adverse weather events, occurred in 11/2020, it was deemed necessary to have some additional anchoring to strengthen the structures of the raised boardwalk at the Laguna del Mort site. RV approved the supplementary variant of the works (Manager’s Decree no. 252 of 19/05/2021). The anchoring works were realized by the Caramori company on 07/2021, concluding de facto the Action C1. The table below, summarizes all works done, including those realized with extra-budget.

	unit	Site A01 P.ta Tagliamento	Site A02 Capalonga	Site A03 Laguna Mort Pinete Eraclea	Site A03 Laguna Mort Pinete Eraclea	Sito A04 P.ta Sabbioni Cavallino	Site A02 Valle Vecchia	Site A05 Bosco Nordio	total at project end	GA	Deviations compared to GA
Creation and installation external panels	n.	2	2	1	3	3 (2*)	4 (6)	(2**)	25	11	227.00%
Creation and installation internal panels	n.	2	/	2	/	1	3	/	8	8	100.00%
Creation and installation dissuading panels	n.	/	2	2	6	5	11 (22***)	/	48	20	240.00%
Paths maintenance and vegetation trimming	m	/	50	/	50	/	/	/	100	100	100.00%
Construction of a lay walkway	m	/	379	/	/	/	50	/	429	429	100.00%
Construction wooden fences, as stretches or continuous	m	/	916	472 ****	2098	986	90	220	4742	4735	100.00%
Construction of a raised walkway	m	/	/	/	317	/	/	/	317	317	100.00%
Fence on dune side	m						100 *****			Not foreseen	100.00%
Construction of wooden fences of the raised walkways	m	/	/	/	45	/	/	/	45	45	100.00%

* Panels realized ad hoc, UNIVE’s extra budget

** Panels realized ad hoc, VA’s extra budget

*** Additional panels A4 *Charadrius alexandrinus* with logo REDUNE

**** Lost in the 2019 storm surge; partially recuperated (SIF) and reused at Cavallino to delimit the H2250*

***** Not foreseen in the GA; VA’s extra budget

All layouts of educational and dissuading panels are and will be freely downloadable from the project website; some Municipalities and associations are still using them to increase the number of panels (e.g., the San Michele al Tagliamento Municipality). Partners responsible for the interventions will assure their periodical control/monitoring. The Guidelines drawn up by Life Redune as part of Action E.3 will be the main tool to be used for this purpose.

Technical deviations: 1) the linear interventions completed in the project sites under the RV responsibility comply in detail with the changes to the GA communicated to the PO on 30/07/2018 and approved by the PO on 5/09/2018 (details also reported in the First Progress Report as per Prot. 13665 – III / 13 of 11/03/2019). 2) as illustrated in the table above, both punctual and linear interventions have been increased in number or length thanks to extra-budget of different partners; please refer to the annexed deliverable for Action C.1 “Final technical report on the state of progress of the works”.

Problems encountered: 1) numerous acts of vandalism entailed additional repair works on uprooted fences, cut ropes and removed dissuading signs, especially in sites A03 Laguna del Mort, A04 Cavallino Treporti and A02 Capalonga; the company in charge of the works promptly restored damage thanks to budget savings; 2) the Action was interrupted following the storm surge on 11/2019 and then between mid-March and mid-May 2020 as adaptation to

Covid-19 pandemic containment measures; 3) an exceptional tide arose on 11/2020 and the raised boardwalk at the Laguna del Mort site had to be anchored with additional interventions, as explained above. All works were concluded by 31 July 2021. Consequently, the deliverable “Final technical report” was completed after the end of works.

Deliverable since MTR

- Title deliverable: Final technical report on the state of progress of the works
Due date: 31/12/2019 Sending date: 06/10/2021

Annex to Action C1: Details of C1 activities

C2 NURSERY PRODUCTION OF THE PLANTS FOR ACTIONS C3, C4 AND C5 VA

Start date: 01/04/2018 End date: 31/12/2021
Actual start date: 01/04/2018 Actual end date: 31/12/2021
Status: completed.

After a planning phase in the first months of the project to define “target species” and potential seed sources (i.e., wild populations), plant production activities involved seed collection at Venetian coastal sites, and nursery operations at VA nursery: seed treatment, sowing, young seedlings growing, treatments on developed plants and pots, e.g., manual weeding. The entire cycle was repeated during the project period from 2018 to 2021 to achieve the planned results. The experiences gained in C.2 were summarized in a manual dedicated to the propagation of dune species (see Action E.2 for details). The two Tables below illustrate the total number of plants produced and planted per habitat (table above), while the second details the lists of the species and the number of seedlings produced per habitat (table below). The final number of seedlings produced and planted exceeded that foreseen in the GA.

Habitat code	Seedling number
2110/2120	35.265
2130*	63.490
2250*	41.500
2270*	10.500
<i>Stipa veneta</i>	1.630
TOTAL NUMBER OF PLANTS	152.385

Habitat code	Species	Quantity per species	Partial total
2110/2120	<i>Ammophila arenaria</i>	15 447	
2110/2120	<i>Calystegia soldanella</i>	1 315	
2110/2120	<i>Echinophora spinosa</i>	3 502	
2110/2120	<i>Elymus farctus</i>	6 782	
2110/2120	<i>Eryngium maritimum</i>	3 926	
2110/2120	<i>Euphorbia paralias</i>	2 365	
2110/2120	<i>Medicago marina</i>	1 928	35 265
2130*	<i>Carex liparocarpos</i>	29	
2130*	<i>Centaurea tommasinii</i>	1 641	
2130*	<i>Chrysopogon grillus</i>	93	
2130*	<i>Fumana procumbens</i>	788	
2130*	<i>Globularia bisnagarica</i>	1 544	
2130*	<i>Helianthemum nummularium ssp. obscurum</i>	10 644	

2130*	<i>Hypochaeris radicata</i>	828	
2130*	<i>Koeleria macrantha</i>	10 436	
2130*	<i>Sanguisorba minor</i>	8 452	
2130*	<i>Scabiosa argentea</i>	3 064	
2130*	<i>Scabiosa triandra</i>	2 770	
2130*	<i>Silene otites</i>	7 088	
2130*	<i>Teucrium chamaedrys</i>	3 656	
2130*	<i>Teucrium polium</i>	9 129	
2130*	<i>Thymus pulegioides</i>	3 328	63 490
<hr/>			
2250*/2270*	<i>Asparagus acutifolius</i>	2119	
2250*/2270*	<i>Berberis vulgaris</i>	7949	
2250*/2270*	<i>Cistus incanus</i>	200	
2250*/2270*	<i>Crataegus monogyna</i>	2986	
2250*/2270*	<i>Juniperus communis</i>	15195	
2250*/2270*	<i>Ligustrum vulgare</i>	1350	
2250*/2270*	<i>Lonicera etrusca</i>	530	
2250*/2270*	<i>Phyllirea angustifolia</i>	11835	
2250*/2270*	<i>Prunus spinosa</i>	1998	
2250*/2270*	<i>Rubia peregrina</i>	1820	
2250*/2270*	<i>Smilax aspera</i>	2130	
2250*/2270*	<i>Viburnum lantana</i>	3888	52 000

Thanks to the skills acquired during the project, the production of dune species has become a routine activity, and VA nursery will be able to produce them for restoration activities on request during the after LIFE. The contribution of VA nursery will be crucial for the success of Objective 1 of the After LIFE Plan (increase in the spatial extension of all Actions devoted to habitat restoration through an agreement to be signed with Regione Veneto - SIF), since the nursery will plan plant production according to SIF regional yearly projects of interventions.

Technical deviations: based on Action D.2 results that showed the need for a) a greater number of plants of habitat 2130* to increase soil shading and limit the recruitment of *O. stucchii* in the habitat; and b) a smaller number of habitat 2250* plants as the fine habitat mapping at 1:500 revealed the presence of fragments of habitat 2250* not perceived before, on 2020, with letter n. 0023919 of 08/05/2020, we proposed a modification of the subdivision of the number of plants by habitat; accepted by the PO on 20/05/2020.

Problems encountered: the problems of low germination rate reported in the MTR for habitat 2110/2120 were solved in the following years, thanks to new production cycles for critical species and the adoption of technical measures developed based on the first experiences.

Milestones since MTR

- Title Milestone: Completion of sowing (supply) of a quarter foreseen plant
Due and reaching date: 30/11/2018
- Title Milestone: Completion of the seed collection
Due date: 30/11/2019 Reaching date: 30/11/2020

C3 RESTORATION OF HABITATS 2110 - 2120	SELC
Start date: 01/10/2018	End date: 31/03/2021
Actual start date: 01/10/2018	Actual end date: 31/12/2021
Status: completed.	

This action, implemented by SELC under the scientific supervision of UNIVE, was accomplished in sites A02 Vallevecchia and A02 Punta Capalonga; the site of Laguna del Mort, forecast in the GA, was cancelled due to heavy effects of storms (see below “Technical deviations” for details). All the activities started in 2018 and finished by October 2021.

In each site, dune reconstruction has been performed thorough a soft-engineering approach with the aims of reconnecting the dune system by fixing foredune notches caused by human trampling, and revegetating gaps to increase dune stability. Reconstruction of the dunes began with site clearing, followed by dune building using a light scraper, and then manually modelling the resulting surfaces. On-site sand was used for dune construction and combined with biological material, i.e., woody debris and biomasses such as marine phanerogams. At site A02 Capalonga, part of the sand was taken from sand stored as a result of the beach cleaning carried out by the Capalonga campsite, thereby allowing to re-use the available native material, facilitate the work of the operating personnel, and use low-impact and low-cost materials. To protect and stabilise the seaward foot of the restored dunes, “ad hoc” produced bundles and poles were laid and anchored in the sand along with wood debris found on the beach. In other cases, the seaward foot of the dunes was protected by using beached materials such as trunks. Sand consolidation was then achieved by planting seedlings of native ecosystem-engineering species (e.g., *Ammophila arenaria*) and other focal species (e.g., *Eryngium maritimum* and *Echinophora spinosa*) supplied by VA. During each intervention, upon request of the PM, the staff used the aprons of the LIFE programme provided by EASME to facilitate their identification and installed explanatory panels regarding the project and the interventions in progress.

The Figures below show the detailed location of interventions in each project site.

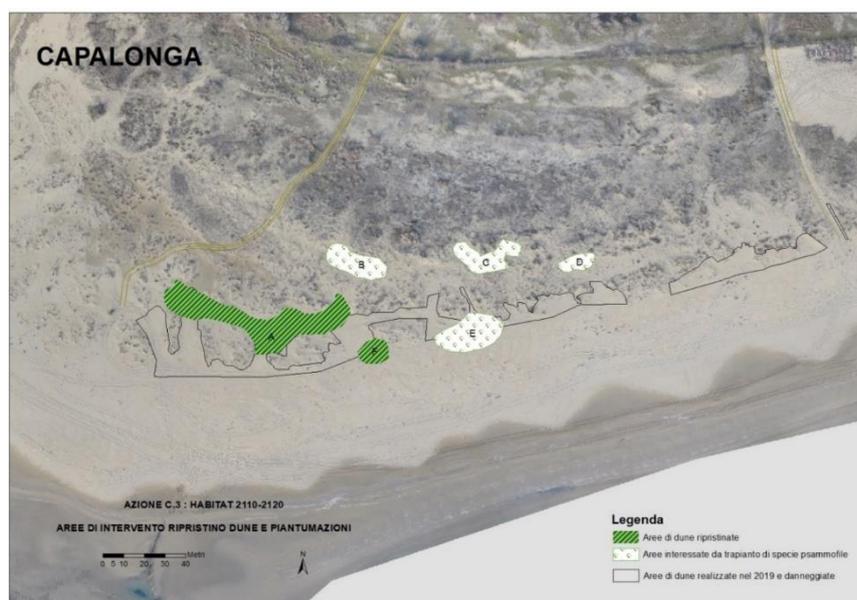


The interventions in Vallevecchia site resulted in the closure of about 1,7 ha of illegal accesses to the beach and the reconnection and restoration of about 7 ha of mobile dunes. Overall, 100 bundles have been produced and fixed in the sand. The species planted and their quantities are reported in the Table below.

VALLEVECCHIA

Species	Quantity 2018	Quantity 2019	Quantity 2020	Quantity 2021 Spring	Quantity 2021 Autumn	TOTAL
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<i>Ammophila arenaria</i>	561	150	3090	1620	957	6378
<i>Medicago marina</i>			240	230		470
<i>Calystegia soldanella</i>			10		198	208
<i>Eryngium maritimum</i>	520		602	387	384	1893
<i>Euophorbia paralias</i>	100		162	173	305	740
<i>Echinophora spinosa</i>	180		1874	448	705	3207
<i>Elymus farctus</i>	47		1485	600	755	2887
TOTAL						15783



The interventions in Capalonga site resulted in the restoration of about 2 ha of mobile dunes. The species planted and their quantities are reported in the Table below.

CAPALONGA

Species	Quantity 2018	Quantity 2019	Quantity 2020	Quantity 2021 Spring	Quantity 2021 Autumn	TOTAL
<i>Ammophila arenaria</i>	-	3019	3245	2805	-	9069
<i>Euphorbia paralias</i>	-	598	232	420	375	1625
<i>Medicago marina</i>	-	376	475	320	287	1458
<i>Calystegia soldanella</i>	-	790	141	-	176	1107
<i>Eryngium maritimum</i>	-	420	1253	-	360	2033
<i>Echinophora spinosa</i>	-	100	20	-	175	295
<i>Elymus farctus</i>	-	605	2095	420	775	3895
TOTAL	0	5908	7461	3965	2148	19482

Creation of large extension of new dunes, planting of more than 35,000 seedlings, closing of many gaps through the natural dunes and installation of 100 bundles were done, reaching the objectives described in the GA.

The Table below shows the comparison of Total area (ha) of the target habitats in 2018 and 2021, as resulting from the 1:500 cartographic analysis (see the annexed deliverable Actions D.2 “Habitat conservation and species population status” for details), and deviations from the GA.

Initial surface	At project end	GA	Deviations compared to GA
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	2018	2021		
TOT 2110/2120	4.83	9.35	9.2	101.60%

Technical skills gained during the project will enable replication in other sites with similar characteristics along the Northern Adriatic coast, which often show the same problems observed in the project sites, such as dune erosion and plant disappearance or reduction due to excessive trampling. In the After LIFE period, SELC will be able to assure crucial collaboration in the transfer of know-how (see Objective 1 of the After LIFE Plan).

Technical deviations: 1) as reported in the MTR, to give greater continuity and ensure a better protective function of the dune system in Vallevicchia some sections were joint together to create a single section; this increased the area interested by the interventions compared to that forecast in the GA; 2) after the storms in 11/2020, the Laguna del Mort area was no longer suitable for the work, as severe erosion phenomena were observed and sediments on site were insufficient. Consequently, we asked to move the activities originally planned in Laguna del Mort to Vallevicchia and Capalonga (Prot. n. 0024008, 07/04/2021) as follows: a) creation of new dunes (2,900 m², corresponding to areas A-B-C in the Figure above) and installation of 20 bundles; b) planting of 6,000 seedlings in Vallevicchia and Capalonga. 3) as already communicated in the first PR, two Milestones were mistakenly scheduled: "Completion of the dunes recreation" due by 30/11/2018 and "Completion of the plants transplantation" due 31/12/2019, as planting had to be done according to the nursery seedling production time (Action C2). Accordingly, the first was achieved at the end of October 2021, while the second one in October 2021.

Problems encountered: 1) storm surge on 12/11/2019 almost destroyed newly created dunes, while most planted seedlings were lost, dragged away by the currents. Following field surveys and evaluation made by SELC, in accordance with the project team, damage was compensated with the following actions, all of them possible using budget-savings: a) Vallevicchia site: creation of new dunes to close 7 gaps (in red in the Figure entitled "Vallevicchia"), for a total surface of about 514 m². Other gaps were closed thanks to an agreement with the SIF; b) Capalonga site: recreation of new dunes in the western sector, the most heavily damaged but which still had some dunes survived to the storm, it was possible to create about 1,316 m² of dunes (A and F in Figure entitled "Capalonga"). Moreover, about 1,500 seedlings were planted in these sites. 2) in spring 2021, nesting of several pairs of Kentish Plover (*Charadrius alexandrinus*) in Vallevicchia required the suspension of field activities, which were postponed and finished in October 2021.

Deliverables and Milestones since MTR

- Title Deliverable: Second report on the action
Due and delivery date: 31/01/2020
- Title Deliverable: Third report on the action
Due and delivery date: 31/01/2021
- Title Milestone: Completion of recreation of the dunes
Due date: 31/03/2020 Reaching date: 31/12/2021
- Title Milestone: Completion of planting
Due and reaching date: 31/12/2021

Annex to Action C3: Details of C3 activities

C4 RESTORATION OF HABITATS 2130* - 2250* - 2270*	RV
Start date: 01/07/2018	End date: 31/03/2021
Actual start date: 01/09/2018	Actual end date: 31/12/2021
Status: completed.	

The interventions implemented in C4 had the aim to improve the conservation status of habitats 2130*, 2250* and 2270* through the recovery of the structure and species composition, and the increase of the species richness. For habitat 2250*, the project also included an increase of surface. The recovery activities concerned all the project sites, in the areas identified and mapped in the ex-ante monitoring phase of Actions D.1 and D.2, according to the technical blueprints (Action A.1) and using the plants reproduced in the nursery (Action C.2). RV managed the technical aspects and tenders for the external assistance works at the sites A01, A02 Capalonga, A03 and A04; while VA executed the interventions at site A05 and A02 Vallevecchia, in part with its own workers and in part with a contractor. All partners collaborated in providing know-how and technical assistance, before and during the execution of the works.

Habitat restoration was achieved through two main activities:

- 1) planting of native structural species (shrubs and small shrubs) and other companion species (mainly perennial herbaceous species), with the aim to recover habitat structure, restore species richness and habitat representativity, trigger the recolonization process, increase genetic variability and species fitness, and increase ground cover thereby increasing habitat resistance against invasions by both alien and ruderal species. To guarantee the maximum survival potential, the location of seedlings was planned based on species ecological requirements; in particular, for the habitat 2130* the use of the different species has been defined according to e.g., the distance from the shoreline, the level of protection from either natural or human disturbance. In areas subject to disturbance, the use of rosette species has also been useful to reduce the germination of the seeds of *O. stucchii* thanks to the shading offered by the basal rosettes. For the number of seedlings per habitat, please see Action C.2.
- 2) selective thinning of woody vegetation; in this case, the aim differed based on the habitat type; in pine woods (habitat 2270*), the activity mostly aimed at increasing the structural heterogeneity and representativity of the habitat; in other cases (habitat 2130* and 2250*), the interventions mostly aimed at preparing sites for species plantations. In many areas, woody material deriving from the selective thinning of pine woods was used to build heaps to close unauthorised paths; their efficacy was also enhanced by planting thorny plants.

Taken together, the C4 activities concurred to recover the structure and the species composition and to increase the specific diversity of the three habitats. The table below summarizes all works done in the Action C4.

		Site A01	Site A02	Site A03	Site A03	Sito A04	Site A02	Site A05			
	unit	Pta Tagliamento	Capalonga	Laguna Mort Pinete Eraclea	Laguna Mort Pinete Eraclea	P.ta Sabbioni Cavallino	Valle Vecchia	Bosco Nordio	total at project end	GA	Deviations compared with C4
2130*											
planting	plants	3534	6238	/	19322	11500	17922	10172	63490	63000	101%
other works	ha	1.31	0.8	/	1.28	4.8	0	1.42	9.61	8.08	119%
2250*											
planting	plants	/	14150	/	4550	14500	7850	450	41500	41500	100%
other works	ha	/	2.6	/	4.11	4.3	5.78	0.6	17.39	18.3	95%
2270*											
planting	plants	0	/	/	2500	500	7500	/	10500	10500	100%
other works	ha	3.85	/	/	1.1	1	9.08	/	15.03	7.2	100%

All the work foreseen by the project for the preparation of the areas before seedling planting were done as scheduled, except in some areas of the Laguna del Mort site where the monitoring highlighted the need for further preliminary interventions. The following Table shows the comparison of Total area (ha) of target habitats in 2018 and 2021, as resulting from the 1:500 cartographic analysis (see the annexed deliverable Actions D.2 “Habitat conservation and species population status” for details), and deviations from the GA.

	Initial surface 2018	At project end 2021	GA	Deviations compared to GA
TOT 2130*	16.83	28.6	28.5	100.30%
TOT 2250*	4.71	18.54	18.3	101.30%
TOT 2270*	29.22	35.57	35.5	100%

Considering also the output of Action C.3, the total restored area corresponds to 92.06 ha, slightly higher than that planned (91.50 ha).

The intervention methods have been already replicated in the areas bordering the sites A04 Cavallino by the SIF workers of VA who are in charge of the ordinary management of the area, thus effectively expanding the intervention aimed at favouring the habitat 2130*. The methods used in Life Redune for habitat restoration have thus become routine activities for VA workers, who can now autonomously apply them in other sites they managed as foreseen by Objective 1 of the After LIFE Plan.

Technical deviations: the action end date and the associated deliverable “Final technical report on the state of progress of the works” were both mistakenly scheduled in the GA and postponed to 31/12/2021 with the letter n. 0024008 of 07/04/2021, approved by PO’s e-mail of 28/05/2021.

Problems encountered: 1) the adverse weather events in 11/2019 delayed the planting activity, especially at the Laguna del Mort and Cavallino sites. Works were resumed in December 2019 by RV and continued until 16/03/2020, until all plants delivered by the nursery for habitats 2130* and 2250* were planted; 2) due to the Covid-19 health emergency, works were officially suspended on 18/03/2020, and formally reactivated on 18/05/2020. However, activities resumed, as scheduled, at the end of September 2020.

Deliverables since MTR

- Title Deliverable: Intermediate technical report on the state of progress of the works
Due and delivery date: 31/3/2020
- Title Deliverable: Final technical report on the state of progress of the works
Due and delivery date: 31/12/2021

Annex to Action C4: Details of C4 activities

C5 STRENGTHENING OF THE STIPA VENETA POPULATIONS	RV
Start date: 01/07/2019	End date: 31/12/2020
Actual start date: 01/07/2019	Actual end date: 31/12/2021
Status: completed.	

The action aimed to strengthen (or restocking) the populations of *Stipa veneta** Moraldo present in the project sites. The aim was to increase the density of existing populations through the plantation of 1.000 seedlings thereby increasing their genetic diversity and vitality.

Despite populations and their location were already known, at the beginning of the Action, dedicated surveys have been done to define the exact locations for seedling plantings according to the situations accurately detected in Action D.2. These allowed us the selection of two areas:

A03 sub area Laguna del Mort and A01 Punta Tagliamento, that, for their specific location seemed more suitable.

As a rule, seedlings have been planted in groups of three, at 30 cm from each other, digging small holes of 15-20 cm. Each group was marked with a bamboo cane with a red mark for further monitoring.

The first lot (1.276 plants) of seedlings was ready in Autumn 2019. However, due to the exceptional storm of 11/2019, only 500 seedlings were picked up by the company in charge of the work, in December 2019, and seedlings were planted on 20/01/2020 at the Laguna del Mort site. The delay was mainly due to the need to clean the area because of the beached material accumulated during the exceptional storm surge. The sub-optimal period of transplantation and an unexpected, longer period in the pots possibly contributed to weaken individuals, thereby influencing their survival. The remaining 776 plants died due to fungal rot.

In the period October-November 2020 other 42 plants of *S veneta** were planted at the Laguna del Mort site. Since the monitoring of seedling survival (Action D.2) evidenced a possible problem of herbivory, these last seedlings were planted near thorny/sclerophyllous plants (e.g., *Juniperus*). Moreover, to test if the high mortality was due to the transplanting stress, on 25/02/2021, we directly sowed about 1.000 seeds always at Laguna del Mort site. Seeds were collected from the densest population of the species (located in Lignano Sabbiadoro) to assure a good germplasm; however, no seed germinated.

In autumn 2021, n. 500 plants of *S veneta** were planted at Punta del Tagliamento site. In addition, since the 2021 production exceeded the planned number of seedlings, we planted a) further 188 seedlings at Laguna del Mort site and b) since Action D.2 identified some small populations at Vallevicchia site, the remaining 400 plants were planted to reinforce those populations.

The Table below shows the number of seedlings for each site and the year of plantation, for a total of 1630 seedlings.

Site code	Site name	Year of plantation		
		2019/2020	2020	2021
Site A03	Laguna Mort Pinete Eraclea	500	42	188
Site A01	P.ta Tagliamento			500
Site A02	Vallevicchia			400

The process of securing *S. veneta** populations needs to be further investigated to understand the high mortality rate. The continuation of monitoring activities in the following years (After LIFE Plan) will be also devoted to a better comprehension of *S. veneta** ecological requirements.

Technical deviations: 1) ss already mentioned in the MTR, we had to relocate some interventions initially forecast in a private area due to the owner withdrawing his availability. Seedling plantation was thus used to reinforce small subpopulations found nearby within the same Nature 2000 site; 2) the delay caused by storm surge in 2019 and the 2020 Covid-19-related lockdown, together with the high mortality of *S. veneta** individuals in the nursery, hampered the possibility to implement the planting as planned in the GA. Therefore, the Action was extended to 31/12/2021 (Prot. n. 0001808 of 13/01/2021 accepted by PO's e-mail on 14/1/2021).

Problems encountered: the problems encountered are linked to the natural uncertainty when dealing with living organisms. In addition, the production cycle of *S. veneta** is rather complex and needs almost two years to be completed (from seed collection to seedling production); in addition, seedling production highly depends on seed viability (that changes from year to year)

and weather conditions. This natural variability influenced seedling supply during the project; however, we eventually produced a higher than planned number of plants that have been reintroduced in nature.

Deliverables since MTR

- Title Deliverable: Intermediate technical report on the state of progress of the works
Due and delivery date: 31/03/2020
- Title Deliverable: Final technical report
Due and delivery date: 31/12/2020

Annex to Action C5: Details of C5 activities

C6 CONTROL OF THE INVASIVE ALIEN SPECIES *OENOTHERA STUCCHII*

RV

Start date: 01/04/2019

End date: 30/09/2021

Actual start date: 01/04/2019

Actual end date: 30/09/2021

Status: completed.

The aim of action C.6 was to control the alien species *Oenothera stucchii* Soldano. The germination niche (strong affinity to sunlight), high seed production and rapid growth guarantee greater competitiveness in disturbed contexts and determine a strong tendency to invasiveness. In the project areas, the species mainly colonises transition dunes and disturbed areas of habitat 2130*, in particular.

As foreseen in the GA, the eradication interventions were done annually for three years, in all project sites. RV was responsible for the activity at the sites A01, A02 Capalonga, A03 and A04; while VA at site A02. In 2020, by VA's own initiative, interventions have been also done in Bosco Nordio.

Considering *O. stucchii* biological and ecological characteristics, we opted for a mechanical control, i.e., physical removing of plants by hand uprooting, followed by the planting of perennial native species. Based on the species life-cycle, mechanical uprooting was scheduled in late spring (May-June) when second-year individuals have reached a height of no more than 40-50 cm. This level of development of the aboveground portion corresponds to a limited taproot development, making uprooting fairly smooth. Since uprooting proved to be highly labour-intensive and caused significant disturbance and massive sand movements due to trampling, in areas of very high density, removal has been done with a string trimmer. In this case, the approach used was rather different and the goal was to hinder the plant's ability to photosynthesize by removing the leafy material. The debris resulted from either hand uprooting or string trimmer, was stored, and taken to a landfill. In both cases, *O. stucchii* physical removal has been followed by the planting of perennial native species seedlings to favour soil stabilization, and enhance the competition by native plants, thereby increasing the ecosystem resilience to future invasions. Specifically, native perennial rosette plants have been preferred since they assure soil shading, thus limiting *O. stucchii* recruitment from seeds in the soil seedbank.

In total, the extent of the *O. stucchii* eradication activities are summarized below.

Site	Treated surface (ha)
A02 – Capalonga	3,85
A02 – Vallevicchia	9,72
A03 – Laguna del Mort e Pinete di Eraclea	4,4
A04 – Punta Sabbioni Cavallino Treporti	5,53
A05 - Bosco Nordio	0,1
Total	23,6

Despite a non-linear trend (possibly linked to climate conditions), the monitoring activity (Action D.2) has shown that the number of individuals of *O. stucchii* has generally decreased, regardless of the site and the type of containment implemented. Compared to the conditions prior to the start of the interventions, in 2021 there was an average reduction in the number of individuals equal to 28.57% in areas subject to manual eradication, and 58.53% in areas subject to intervention by string trimmer.

Technical deviations: 1) in areas of very high density, removal has been done with a string trimmer instead of hand pulling. In both cases, *O. stucchii* physical removal has been followed by the planting of perennial native species seedlings; 2) the start date of the action was erroneously set in the GA and was revised as reported in the MTR: the Action began in April 2019 and ended in September 2021; 3) as communicated in the MTR, the ex-ante monitoring phase led to a revision of the distribution of interventions and specifically: a) reduction of the area to be treated in the A03 Laguna del Mort site from 8.0 ha to 4.4 ha, and b) increase in the area to be treated in the A02 Capalonga sites (from 1.9 ha to 3.85 ha) and A04 Cavallino (from 3.6 ha to 5.53 ha). Overall, the surface treated was increased of 3,28 ha.

Problems encountered: None

Deliverables since MTR

- Title Deliverable: Intermediate technical report on the state of progress of the works
Due and delivery date: 30/09/2020
- Title Deliverable: Final technical report
Due and delivery date: 30/09/2021

Annex to Action C.6: Details of C6 activities

D1 MONITORING OF THE ANTHROPIC THREATS		EPC
Start date: 01/10/2017	End date: 31/03/2022	
Actual start date: 01/10/2017	Actual end date: 31/03/2022	
Status: completed.		

The action aimed at analysing the ex-ante, intermediate and ex-post status of the project areas. The ex-ante phase was also aimed at defining the baseline to inform the drafting of the technical blueprint, while the intermediate and ex-post phases mostly had the aim to verify the effectiveness of actions.

In each phase, activities involved a) preliminary surveys (particularly in the ex-ante phase); b) acquisition of aerial images using a SAPR aircraft (drone), under the responsibility of EPC; c) ground surveys to collect data on vegetation, under the responsibility of UNIVE. For details on the methods used please see annexed Deliverables (Action D.1 “Ex-post technical report on the coastal system structure”).

The processing of data derived from drone flights enabled the creation of three-dimensional DTM with a resolution of 25 cm, and updated photomaps of the working areas at 3 resolutions, i.e., 4, 10 and 25 cm of pixels; these outputs allowed to map the network of paths, walkways, tracks and of the areas with the greatest tourist load, localise the discontinuity in the mobile dunes, and identify rough boundaries of macro-categories of habitat.

The rough map of vegetation units based on physiognomic-structural characteristics represented the operational cartographic base that was subsequently validated in the field. The final maps of habitat types and the attribution to the various habitat types have been done by integrating the information deriving from the fine-scale vegetation surveys (Action D.2).

All maps have been produced on a scale of 1:500. All the information has been included in a geodatabase in the GIS environment (QGIS 2.18 and 3.16 software). The geodatabase, including the attributes of each polygon, was created in accordance with the INSPIRE Directive and Annex A of D.G.R. n. 1066 of April 17, 2007.

By mid-2018, the ex-ante phase had been completed and its outputs were used for the design and planning of the interventions (A.1).

To have consistency between data and comparability of results, personnel, instruments, and methodologies used for data collection and processing were the same in all phases. The intermediate monitoring phase has been realised in 2020, while the ex-post phase in 2021.

Overall, the actions produced 3 DTM, 3 sets of orthophotos and 3 maps of habitats, as foreseen in the GA.

Technical deviations: the Milestone “Final report” to be reached by 11/2021 has been clearly mistakenly written in the GA and should read “Ex-post assessment of the coastal structure system” due by 9/2021; otherwise, we should have produced two identical reports with two different names.

Problems encountered: 1) in the MTR, we requested to postpone the Deliverable “Intermediate map of the habitats 1:500” due by 30/06/2020 because of the exceptional storm surge that occurred on 12/11/2019 and the persistence of adverse weather conditions that prevented the monitoring activities; 2) on 01/04/2020, upon EASME request (Prot. n. 0022062 of 24/04/2020), we sent the Monitor a report on the Covid-19-related delays. On 4/08/2020, we informally asked by e-mail to the Monitor to further postpone the deliverable because of restrictions due to the Covid-19 first and to adverse weather conditions then.

Deliverables and Milestones since MTR

- Title Deliverable: Intermediate map of the habitats 1:500
Due date: 30/06/2020 Sending date: 30/09/2020
- Title Deliverable: Ex-post assessment of the coastal structure system
Due and delivery date: 30/09/2021
- Title Deliverable: No. 1 Ex-post map of the habitats 1:500
Due and delivery date: 30/11/2021
- Title Milestone: Intermediate report on monitoring of threats
Due date: 30/06/2020 Reaching date: 30/09/2020
- Title Milestone: Final report (as stated above, mistakenly written, the correct name is “Ex-post assessment of the coastal structure system”
Due and reaching date: 30/11/2021

D2 MONITORING OF THE HABITATS, STIPA VENETA* AND OENOTHERA STUCCHII UNIVE

Start date: 01/10/2017

End date: 31/03/2022

Actual start date: 01/10/2017

Actual end date: 31/03/2022

Status: completed.

The action provided for monitoring of habitats and populations of target species at all project sites to compare their status in the ex-ante (2018) and ex-post phase (2021). The monitoring included 5 different activities, that also aimed at informing habitat mapping (Action D.1). The thorough description of methods to collect and analyse data, as well as of results are reported in the annexed deliverable (Action D.2 “Habitat conservation and species population status”; as for *S. veneta** see also C.5 “Final technical report on the state of progress of the works”, and for *O. stucchii*, C.6 “Final technical report”); we summarise here major points.

1. Fine-scale survey of vegetation. To record vegetation, we used both georeferenced permanent plots of different size according to habitat type and permanent belt transects arranged perpendicular to the shoreline and extending from the forest line to the non-vegetated beach. For each plot, we recorded the list of species present and their percent cover, as well as total cover and average height of vegetation. During the ex-ante phase, we established 12 transects (consisting of 703 plots in the ex-ante and 727 plots in the ex-post phase) and 111

permanent plots distributed in the project sites. The total number of species recorded was 153 in the ex-ante and 156 in the ex-post phase. Vegetation data collected separately for the ex-ante and ex-post phases were then compiled into a raw matrix (with plots in the column and species in the row; entries were populated with plant species cover data) and analysed to compare the two phases. Although we did not find differences in the number and type of Natura 2000 habitats and CORINE land use categories between the two phases, the number of plots of habitats 2110/2120, 2130*, and 2250* increased by 41, 63, and 32, respectively. Data on the presence, abundance, and distribution of *O. stucchii* obtained from georeferenced plots were used to identify areas where Action C.6 should have been implemented.

2. Detailed mapping and georeferencing (UTM coordinates) of *Stipa veneta** populations. Monitoring resulted in the identification and georeferencing of *S. veneta** populations or subpopulations at project sites. Population data indicated that all but one population had low numbers of individuals (sometimes less than 100). With an average distance between populations of about 8 km, the degree of isolation of *S. veneta** populations is still very high. No new populations have been found at sites that would allow an increase in AOO (Area Of Occupancy) or EOO (Extent Of Occurrence). Considering IUCN Criterion B, *S. veneta* must be still classified as EN.

3. Detailed mapping, georeferencing (UTM coordinates) and quantification of the populations of IAS *O. stucchii*. Data was obtained by the fine-scale survey of vegetation; in addition, we established further 9 transects (not foreseen in the GA) arranged perpendicular to beach accesses. Details on *O. stucchii* presence and abundance were quantified and published in Buffa et al. 2021, Ecological Indicators 125, 107564. To assess the effectiveness of different containment practices (manual eradication or cutting with a string trimmer) we set four test areas with 3 georeferenced permanent plots of 1 m × 1 m each, where we recorded the number of *O. stucchii* individuals in July 2019 (ex-ante), in July 2020 (one year after the first cycle of containment measures), and in July 2021 (one year after the second cycle). For results, please refer to Action C.6 above and to the annexed related deliverable.

4. Evaluation of the biomass of focal species in target habitats. This part was linked to Action D.3 and aimed at assessing carbon storage and sequestration as a proxy of the climate mitigation ES. Aboveground biomass was measured in 2018, by sampling n. 84 25 cm × 25 cm plots while conducting transects. In the lab, the biomass was divided into the different species (n = 27) to determine dry weight. For results, see Action D.3 below and the annexed related deliverable (Action D.3 “Ex post report”).

5. Monitoring of transplanted seedlings. This included tagging seedlings of different species (including *S. veneta**) and collecting mortality and growth data for each seedling. A total of 553 individuals of 24 species were monitored: 193 individuals belonged to habitats 2110/2120, 392 to habitat 2130*, 50 to habitats 2250* and 2270*, and 82 were seedlings of *S. veneta**. For each seedling, we measured several different traits according to their growth form. We also recorded whether the seedlings flowered or bore fruit. Overall, we assessed seedling mortality and traits every month from the time of planting to October 2021, except for some seedlings belonging to habitat 2110/2120 that were destroyed during the exceptional storm in November 2019. For results, please refer to the annexed related deliverable (Action D.2 “Habitat conservation and species population status”).

The planned output and schedule were met according to the GA. All data collected were used to update the Standard Data Forms of project sites. Although at the beginning we had foreseen to update the Standard Data Form of 5 sites, at the end data collected allowed the updating of Standard Data Forms of 6 Nature 2000 sites. Given their importance, monitoring activities will be part of the after-LIFE plan and conducted by UNIVE as part of its research and teaching activities.

Technical deviations: 1) monitoring activities have been delayed due to restrictions measures introduced to contain and manage the Covid-19 pandemic. The uncertain situation at the end of the first lockdown led us to request a budget change of Euro 21,723.34 to be used for the activation of an additional year of co-financed Additional Staff (Prot. n. 0071705 del 02/12/2020); the request was accepted on 02/12/2020 by e-mail communication (Prot. n. 0071786 del 02/12/2020); 2) during the project implementation, we have partially modified the method used to assess carbon storage and sequestration. Originally, we planned to measure both above- and belowground biomass using the harvest method which however requires complete destruction of the specimens. Therefore, we decided to collect aboveground biomass in the field and rely on the literature for belowground biomass and RGR; 3) as already described in the MTR, we added further analyses not foreseen in the GA, at no additional cost: a) experimental monitoring of habitat 2270* using drone technology; b) monitoring of *Rosa rugosa* populations; c) monitoring of the effects of anthropogenic disturbance on pollination networks of coastal dunes (published in Fantinato E. 2019, Biological Conservation 236: 70–78).

Problems encountered: 1) due to storm surge on 12/11/2019, we lost 20 permanent plots for monitoring seedling mortality and growth in newly created dunes at site A02 - Vallevecchia, where we had been collecting data monthly since November 2018. At site A02 - Capalonga, we partially lost 6 permanent plots for monitoring Action C.6; 2) due to the Covid-19 outbreak, and the measures introduced to contain the pandemic, monitoring activities were suspended from mid-March to May 2020.

Deliverables since MTR

- Title Deliverable: Ex-post assessment of state of conservation of habitats and species populations (Final document, revised after the 5th monitoring visit)
Due date: 31/12/2021 Sending date: 30/06/2022
- Title Deliverable: Forms of the 5 Natura 2000 sites to be updated by RegVe
Due date: 31/3/2022 Sending date: 31/3/2022

D3 MONITORING OF THE PROJECT IMPACT ON THE ECOSYSTEMIC FUNCTIONS

UNIVE

Start date: 01/10/2017

End date: 31/03/2022

Actual start date: 01/10/2017

Actual end date: 31/03/2022

Status: completed.

The action aimed at monitoring ecosystem services (ES) before (ex-ante, 2019) and after (ex-post, 2021) the implementation of the project's concrete actions. The ex-post results were compared with the ex-ante ones, to evaluate the impact of the project on the ecosystem functions. The monitoring included four ES: 1) raw materials ('provisioning services' category, according to IPBES), 2) coastal protection and 3) climate regulation ('regulating services'), and 4) recreation and leisure ('cultural services'), that have been quantified in all project sites except for A05 Bosco Nordio.

For a detailed description of methods and results, please refer to the annexed related deliverable (Action D.3 "Ex-post Report"); we summarise here major points.

For ES 1, we assessed the typology and the quantity of organic materials accumulated on the beach, showing that in all the sites the dominant material was wood, which was used for several purposes also inside the project itself (see the example reported in Figure 1 of Annex to Action D.3). ES 2 has been evaluated as the surface of dune habitats 2120, 2130* per unit of coastline length to provide a proxy of the average width of these habitats and thus of their protective capacity. The comparison of the ex-ante and ex-post results highlighted an increase of the surface of these habitats and thus an increase of the coastal protection (Figure 2 of Annex to

Actual start date: 01/10/2017

Actual end date: 31/12/2021

Status: completed.

This action has been implemented in 2 phases.

The first phase was the drafting of the socio-economic monitoring plan. Delivered on March 2018, it defined the three quantitative analyses done in D.4 as: 1) analysis of the economic reality related to tourism; 2) analysis of environmental education activities; 3) analysis of the perception of the territories as naturalistically valuable areas. A purely qualitative survey was also carried out with interviews to stakeholders, as privileged actors and observers of territorial dynamics, to collect their views on the 4) impacts that the project had on the territory. The latter has been only done in the ex-post phase of the project. For each analysis, were used the targets, indicators, methodology and tools foreseen in the “Life Redune project socio-economic monitoring plan”.

The second phase corresponded to data analysis. For each analysis, an ex-ante data collection phase was carried out, in 2018, i.e., prior to the implementation of the activities to promote the acquisition of ecological awareness in local stakeholders (actions E1, E3, E4), and an ex-post collection, in 2021, i.e., following the implementation of concrete and communication and education activities.

The quantitative comparison between the 2018 and the 2021 data led to conclude that the economic reality linked to tourism, both in terms of tourist presences and seasonal employment, suffered from the strong impact of the Covid-19 pandemic, recording a significant contraction of the sector, from 2020 onwards.

However, the analysis of environmental education activities among a sample of tour operators and tourists recorded a significant increase, between 2018 and 2021, in the number of stakeholders who offer or recommend naturalistic activities (mainly represented by guided excursions in natural areas), as well as in the number of visitors who have done naturalistic activities and have indicated them as the main reason for the visit. Noteworthy is the fact that a + 39% was registered among tourists that do naturalistic activities by the dunes and woods. Furthermore, the analysis of the perception of the territories as naturalistically valuable areas highlighted a doubling of the percentage of tour operators and an increase of 40% of tourists who know the Natura 2000 sites. Finally, while the percentage of operators who recognize the importance of dune environments is unchanged, a modest increase was found among tour operators who claim to be able to contribute to the conservation of the environment and of dunes, in particular.

The qualitative analysis, based on the opinion of those local stakeholders who have collaborated the most with the project, revealed the crucial role that the project has in the protection and enhancement of dune environments, in the information and awareness raising activities of all stakeholders, and in the hope that there will be a follow-up to the project.

Overall, the analysis of the socio-economic impact of the project on the territory showed how the actions of the project did not have a macroscopic impact on the economy of the tourism sector of the Veneto coast, while the dissemination and awareness-raising actions of the project had a fundamental role in the dissemination of knowledge of these very important environments and in the promotion of responsible and sustainable tourism, in the project sites.

Technical deviations: None

Problems encountered: None

Deliverables since MTR

- Title Deliverable: Final report on socio-economic impact of the project
Due date: 31/12/2021 Sending date: 31/12/2021

E1 COMMUNICATION

EPC

Start date: 01/10/2017

End date: 31/03/2022

Actual start date: 01/9/2017

Actual end date: 31/03/2022

Status: completed.

Communication activities requested a significant effort to give the project the deserved visibility, and as the project progressed, we changed methods, approaches, and the content of messages to convey, and every opportunity to spread the project, no matter how odd it seemed, was seized. However, thanks to an effective coordination and the cooperation of all the partners all activities were started, implemented, and concluded on schedule.

The communication activity continued steady as a self-standing outreach activity and as a support activity to the other Actions, creating and catching new opportunities and using the channels and tools defined in the Communication Plan. Communication activities were discussed and planned during the MC meetings and informally by EPC and UNIVE via phone or remote meetings (F1). Although EPC coordinated the activities and UNIVE supervised the scientific contents, all beneficiaries were involved in the contents and graphic productions of the communication tools, especially for news, videos, pictures. All beneficiaries contributed, to widespread project initiatives, through their institutional channels (news, website, contact lists). The list of E1 outputs from the beginning of activities to 31/11/2019 was given in the MTR. The complete list of outputs from MTR to FR is presented and attached as “Annex to Action E1”. They are briefly summarized hereafter.

Informative panels: three different layouts (dune, flora and correct behaviour) of 1x1 m indoor and outdoor panels were designed and printed in July 2020.

“Dissuasive” panels: in A4 format were designed and printed by March 2020.

For the total number of panels installed please see Action C.1.

Website and socials: website restructured between in 2021 to: a) increase the visibility for E activities; b) display project results; c) become a repository of the project outputs in the after-life. Socials Facebook and Twitter were used to show the project progress, support E2-E5 activities, promote the Life programme and Nature 2000, and network with other projects and initiatives. The Twitter account reached 219 followers; the Facebook page reached over 1.173 followers and over 90% likes. To mitigate Covid-19-related restrictions, project partners realised 35 short educational videos of their activities constituting the series “Life Redune Friday video” published into YouTube, the social media and in the project website.

Since December 2019 the project organized 2 communication events, one on-line and one in-presence for a total of 178 attendants; and took part in 6 on-line and in-presence events organized by third parties.

Contribution to two artistic performances: 1) the movie “Piccolo corpo”, awarded by the public at the Cannes Festival 2022; the project was acknowledged for all suggestions and information during the shooting in the project areas; 2) collaboration with the European Cultural Center and Green Wise Italy and the architect Tono Mirai, by supplying Life Redune plants for Mirai’s piece of work “Regenerative Forest-Jinen” during the Venice Biennale 2021. On December 1st, at the end of the exposition plants were planted with an intimate ceremony, on Vallevicchia dunes, as a symbol of art-nature regenerative process.

The final video is a 8 min-long film showing the activities done and results reached in the intervention sites. It is in four versions: Ita, Eng, Ita with Ger subtitles, and Eng with Ger subtitles.

The project was also selected as an example of best practice of climate change adaptation for the Adaptation webdoc on the Veneto Region (<https://www.adaptation.it/italia/veneto/i-guardiani-dellacqua/>). The video was shot on 11/03/2022 at Vallevicchia site and illustrates project approach and methods. The webdoc was officially released in June and presented on 8/06 at Ca’ Foscari University.

The *Layman's report* (ITA-ENG) has been printed in 1.000 copies by RV in December 2021 and has been distributed during the final Conference of the project; 100 copies were provided to some stakeholders for their further distribution during their usual activities.

The *final conference* was a day-long event entitled "LIFE REDUNE: RISULTATI E PROSPETTIVE" held at the D. Mainardi Auditorium of UNIVE, on 25/03/2022 as hybrid event on-line and in-presence; also in streaming in the project Facebook page. The event was intended as a formal launch of the Guidelines produced by E.3. Invitations were sent by email to stakeholders, including all City Mayors and Technical officers of the 9 Municipalities of the Veneto coast, and to any Italian coastal city with more than 10.000 inhabitants. The Conference was attended by 100 participants (about 50% (45 people) on-line and 50% (55 people) in presence). Each in presence attendant was given a folder with copy of the program, the signed attendance certificate, a Life Redune-personalized notebook and a pen, and a USB key with copies of the Guidelines and Handbook produced in E2 and E3. The 6 presentations related to E3 Guidelines were elaborated into 6 videos, published in YouTube, social media pages and web site of the project.

Technical deviations: 1) in the MTR we asked to postpone to 31/03/2022 the deadline for the final public event that was mistakenly scheduled for 31/03/2021; 2) in the MTR, we proposed to postpone the delivery date of the 1x1m education panels from 31/03/2020 to 15/5/2020. Due to Covid-19 outbreak, the realisation of the panels further slowed down and panels were printed at the end of August 2020; 3) as explained in the MTR, we decided to produce roll-ups (not foreseen in the GA) upon an explicit request by municipalities involved in the project. To do that we used savings from the advantageous quote to the first public tender; 4) with extra-budget funds UNIVE provided several gadgets with the logos of the project, LIFE and Natura2000: 200 metal water bottles, 200 backpacks and a presentation desk; 5) the website was restructured between March and September 2021 following a budget modification requested (Prot. n. 0016974 of 09/03/2021 n. 0020341 of 22/03/2021), authorized by PO's e-mail (Prot. n. 0020341 of 22/03/2021).

Problems encountered: None

Deliverables and Milestones since MTR

- Title Deliverable: Panels
Due date: 15/5/2020 Delivery date: 31/08/2020
- Title Deliverable: Videos
Due and delivery date: 31/12/2021
- Title Deliverable: Laymen's report
Due and delivery date: 31/12/2021
- Title Milestone: Final public event
Due date: 31/03/2022 Reaching date: 25/03/2022

Annex to Action E1: Details of E1 activities for period 1/12/2019 to 31/03/2022 (from MTR to the project end)

E2 TRANSFER AND REPLICATION

EPC

Start date: 01/10/2019

End date: 31/03/2022

Actual start date: 01/10/2019

Actual end date: 31/03/2022

Status: completed.

The objective of the action was to multiply the impact of the project, through the transfer and replication of good practices and methodologies used by the project, by means of visits to other projects and dissemination of specific Guidelines.

The action started with the drafting of the “Transfer and Replication plan”, that was agreed among the partners and completed in April 2020. It detailed the strategy, methodology and opportunities for the following phases 2 and 3.

Phase 2 led to the drafting of the three Guidelines foreseen in the GA (“Guidelines for the engagement of the tourist economic operators in the management of the coastal dunes”; “Guidelines for the use of drones for beach monitoring” and “Guidelines for the eradication of *Oenothera stucchii*”) plus three other additional documents: 1) “*Oenothera stucchii* Soldano in coastal habitats RISK ASSESSMENT”; 2) “Methods to assess coastal dune restoration potential”; and “Handbook for the propagation of species of the Adriatic dunal environments”, the latter produced in collaboration with LIFE CALLIOPE. All Guidelines and documents are annexed to this Report, as either Due or Additional Deliverables, and have been actively advertised and disseminated through the website and social media pages and a press release to ISPRA (published news: http://liferedune.it/wp-content/uploads/2022/05/reticula_29-1.pdf) and Ecological Transition Ministry (published news <https://www.mite.gov.it/pagina/notizie-life-2021-2027>).

The third phase was dedicated to plan and implement the replication visits to other projects. The call for the selection of two projects was drafted during summer 2020, as per GA timing, but put in hold because of the Covid-19 situation. It was published on 27/01/2021 and disseminated on the website and social media pages, Ecological Transition Ministry, ISPRA, and several other entities involved in environmental-focused projects.

At the call deadline, two projects had applied and were approved by the MC, on 15/4/2021. Prior to the visit we co-organized preparatory webinars with both Life Primed and life Calliope. The workshops and visits calendar were as reported in the Table below.

Activity type	Title/Partner	Date
Webinar	«LIFE REDUNE E LIFE PRIMED: ESPERIENZE A CONFRONTO»	17 May 2021
1 st Replication visit	to LIFE CALLIOPE	14-16 June 2021
2 nd Replication visit	to LIFE PRIMED	13-15 September 2021

Both visits included visits to the project intervention sites and to the plant nursery, the analysis of the situation per each site and overall project, the exchange of good practices to overcome difficulties encountered, and plans for a further collaboration among the teams.

Beside this, the project team also supported some local replication activities realized by third parties by providing the know-how, materials (mostly plants), and concrete support: 1) school “Istituto Comprensivo Chioggia 5”: requalification of a small portion of a residual dune through plantation of 30 plants; 2) Residence Opera Nascimbeni of Cavallino Treporti: replication of eradication of *O. stucchii*, and beach cleaning approach; 3) Camping “Marina di Venezia”: restoration of a dune stretch of about 1 km with 1.600 plants; 4) LIFE FORESTALL: replication of nature-based reconstruction techniques of canals in the Valle Averte WWF oasis of the Venice lagoon; 5) SIF: replication of good practices concerning the selective thinning (in the habitats 2270* and 2130*), control of *O. stucchii*. This will be part of the Objective 1 of the After LIFE Plan.

Technical deviations: 1) in the MTR we asked to postpone to 31/12/2021, the 3 Guidelines to acquire further knowledge and experience and produce more useful and operative guidelines. Request approved; 2) with e-mail communication to the Monitor of 22/12/2021 and to PO of 23/12/2021 we asked to postpone the delivery of the Guidelines on *Oenothera* to beginning 2022; request approved during the monitoring visit of 11/02/2022 and further postpone to 30/06/2022; 3) during the same monitoring visit, it was also agreed that the “Guidelines for the

use of drone on the beach” would have been delivered by mid-March 2022; 4) because of Covid-19-related travel restrictions, we informally asked to modify the Action (Prot. n. 0064262 del 04/11/2020) by a) replacing one replication trip with the additional deliverable “Handbook for the propagation of dune species” in collaboration with LIFE CALLIOPE; b) limit the two replication visits to Italy where travel could hopefully have been easier. On PO’s request we refined the request (Prot. 0076668 of 21/12/2020, approved by PO’s e-mail on 15/01/2021), also clarifying budget changes regarding both Action E.2 and Action E.5. 5) we requested a budget modification (Prot. 0076668 of 21/12/2020, approved by PO’s e-mail on 15/01/2021), to outsource the drafting of the “Guidelines for the involvement of stakeholders” (RV).

Problems encountered: Covid-19 outbreak and the consequent restriction to travelling has delayed the replication visits and hampered the possibility to travel outside Italy. Recovery actions were made as per PO’s approval of 15/1/2021 in response to a request as per protocol n 0076668-2021 of 21/12/2020, as described above.

Deliverables and Milestones since MTR

- Title Deliverable: Guidelines for containment of *Oenothera stucchii*
Due date: 31/12/2021 Sending date: 30/06/2022
- Title Deliverable: Guidelines for the use of drones on the beaches
Due date: 31/12/2021 Sending date: 04/03/2022
- Title Deliverable: Guidelines for the involvement of stakeholders
Due date: 31/12/2021 Sending date: 31/12/2021
- Title Milestone: First transfer and replication tour
Due date: 30/06/2020 Reached date: 14/06/2021
- **(Additional Deliverable)** Title Deliverable: *Oenothera stucchii* Soldano in coastal habitats RISK ASSESSMENT
Due date: n/a Sending date: 30/06/2022
- **(Additional Deliverable)** Title Deliverable: Methods to assess coastal dune restoration potential
Due date: n/a Sending date: 30/06/2022
- **(Additional Deliverable)** Title Deliverable: Handbook for the propagation of dunal species
Due date: n/a Sending date: 04/03/2022

E3 AGREEMENT FOR THE BEACHES LONG-TERM MANAGEMENT		RV
Start date: 01/10/2018	End date: 31/12/2021	
Actual start date: 01/10/2018	Actual end date: 31/03/2022	
Status: completed.		

The meetings held within Action A.2 highlighted a very heterogeneous situation; Municipalities showed very different levels of knowledge and awareness of the importance of a sustainable use of beach-dune systems, and, consequently, a variety of land management approaches.

Thus, in the first two years, we primarily concentrated our effort on E.1 and E.4 activities to increase awareness; we also undertook different activities with the aim of finding a way to integrate the Conservation Measures in extant legislations/regulations.

In the last two years of project, the Action had the double aim to draft the “Guidelines for the long-term management of beaches”; and obtain a formal agreement, as a signed commitment to apply the guidelines, from the municipalities of the Venetian coastline. Project team met several times to elaborate a strategy to overcome the resistance of Municipalities.

Because of the Covid-19-related lockdown, the activities could be resumed only during the summer 2020 with the organization of a meeting, held online on 4 August 2020, in which the rationale and main points of the Guidelines were shared and agreed with the 10 Municipalities of the Veneto coast, which are associated on a “Conference of Mayors of the Veneto Coast”; the meeting was followed by the transmission to the same subjects of the documentation on Life Redune, the Conservation Measures and a summary of topics to be developed in the Guidelines.

In April 2021, RV activated a service assignment to process analytical data and prepare a draft of the Guidelines. During the summer and autumn 2021, the Guidelines were thoroughly revised and finally drafted with contributions of all the partners.

We organized two meetings to share the Guidelines and consult with the Municipalities and economic tourist operators. The in-presence meetings, scheduled for January 2022 and initially endorsed by the Conference of Mayors and the touristic operator’s association “Unionmare Veneto”, had to be postponed to a date to be decided, as expressly requested by the President of the Conference. After several contacts, the Conference President finally agreed to organize, on 25/01/2022, an online meeting with all the Municipalities, to whom UNIVE presented the Guidelines. The subject was largely debated with very contrasting views. In the following days the President sent RV a list of points to address in the Guidelines, which, whenever possible, have been accepted.

In March 2022 RV enforced the guidelines with a deliberative act (D.G.R. n. 261 of 15/03/2022; annexed to this Report) and the Guidelines were officially presented during the final conference on 25/03/2022.

After the RV official endorsement, to overcome the problem of interacting with the Conference of Mayors, where some more powerful Mayors dictated the agenda, we started interacting with each Municipality separately, also taking advantage of personal relationships, also including all other Venetian Municipalities. This approach proved successful, and at the end, Guidelines were officially adopted by two overarching Authorities which competencies have effects at supra-municipal level: the Regional Council of Veneto Region, and the MAB UNESCO Natural Park of the Po Delta. In this way, the overall territory in which Guidelines will be implemented comprises the entire Venetian coast (more than 100 km of coasts). Moreover, although included in the above mentioned territory, 1 Municipality signed the agreement (annexed to this Report as Additional Deliverables to Action E.3). Finally, we can also consider a campsite (Capalonga campsite) and Caorle Municipality that adopted a beach cleaning management following project guidelines.

Contacts with Municipalities to achieved further formal agreements of the Guidelines will be a crucial part of the After LIFE Plan; however, meeting have already started: the first three After-Life meetings were held on 16/05/2022 with the Municipalities of Rosolina, Porto Tolle and Porto Viro and the Director of the MAB UNESCO Natural Park of the Po Delta; on 25/05/2022 with the Municipality of San Michele al Tagliamento and on 26/05/2022 with the municipality of Venice.

Technical deviations: 1) as stated in the GA, the initial goal was the approval by the Regional Council of the updated Natura 2000 sites Conservation Measures and the transmission to the competent Ministry; however, the CM were approved and officially adopted in May 2017, just after Life Redune was approved and funded. It was therefore proposed (already communicated with First PR and MTR) not to modify the existing Measures but rather, to prepare the Guidelines, a document to help managers and stakeholders to put the CM into practice; 2) due to the difficulty to relate to the stakeholders as consequence of the Covid-19 outbreak, we asked to postpone the Action end date to 31/01/2022 and the deadline of its associated deliverable to 30/10/2021 and milestones to 31/01/2022 (letter n. 0024008 of 07/04/2021, accepted by PO’s e-mail of 28/05/2021). We then further requested to postpone the Action end date to 31/03/2022

and associated deliverable to 31/01/2022 and milestone to 15/03/2022 (Prot. n. 0117171 of 28/10/2021, accepted by PO's e-mail of 16/11/2021).

Problems encountered: beside the concrete difficulty in interacting with the stakeholders because of the harsh situation generated by the Covid-19 outbreak, the real problem we had to face was mainly related to the socio-economic context that profoundly influences management decisions; 2) in July 2018 the Regione Veneto recognized the new-born Association of the Conference of Mayors of the Veneto Coast which could have been a unique interlocutor for the project, but its current President in charge has resulted as one of the most hostile toward the Guidelines and the signed approval of the same.

Deliverables and Milestones since MTR

- Title Deliverable: Guidelines for long-term management of the beaches by the stakeholders
Due and delivery date: 31/01/2022
- Title Milestone: Approval of the guidelines by the stakeholders
Due date: 15/03/2022
- **(Additional Deliverable)** Title Deliverable: Regional resolution of the Guidelines for long-term management of the beaches by the stakeholders DGR 261/22
Due date: n/a Sending date: 30/06/2022
- **(Additional Deliverable)** Title Deliverable: Deliberative act of San Michele al Tagliamento
Due date: n/a Sending date: 30/06/2022
- **(Additional Deliverable)** Title Deliverable: Deliberative act of MAB UNESCO Natural Park of the Po Delta
Due date: n/a Sending date: 30/06/2022

Annex to Action E3: Details of E3 activities for period 1/12/2019 to 31/03/2022 (from MTR to the project end)

E4 TOURISTS AND TOURISTIC OPERATORS ENVIRONMENTAL EDUCATION EPC

Start date: 01/04/2019 End date: 31/03/2022
Actual start date: 01/04/2019 Actual end date: 31/03/2022
Status: completed.

The Action included educational events for 1) tourists (Italian and foreign tourists and residents of the areas adjacent to the sites that are the main and repeated user of these beaches, including the school students) and 2) touristic operators (municipalities, touristic economic operators, technicians, naturalistic associations)

The events were organized by EPC and implemented by the researchers of UNIVE, promptly assisted by the other project partners, in particular the RV and VA. To support and promote these activities, project communication channels and information and dissemination materials created as part of the Action E1 were used.

The detailed list of E4 events from the beginning of activities to 31/11/2019 was given in the MTR. The detailed list of E4 events from MTR to FR are presented in the related annexed deliverable (Action E.4 "Report on the environmental education activities") and in "Annex to Action E4"; here we summarise main points.

EVENTS FOR TOURISTIC OPERATORS

In the period 2019-2022, 5 environmental education events for touristic operators were done, for a total of 98 participants (about 3 times more than those foreseen by the GA). In detail:

Events for touristic operators				
Year	N. events planned	N. events cancelled	N. events done	N. participants
2019	3	0	3	65
2020	1	0	1	21
2021	No events because of Covid-19			
2022	3	2	1	12
TOTAL	7	2	5	98

In the years 2020 and 2021, the containment measures of the Covid-19 pandemic greatly impacted on the touristic sector. Consequently, the touristic operators were too distracted by the problems of re-launching their activities to devote time and attention to the issue of the sustainable use of sandy coasts and to the Life Redune project.

The education activities in presence have been resumed at the beginning of 2022 with a joint E3/E4 event with all the Mayors of the Veneto coast, as detailed in E.3.

However, thanks to the E4 activities, a collaboration was established with some associations (Legambiente Veneto Orientale “Circolo Pascutto -Geretto”, Guardia Costiera Ausiliaria Delta Tagliamento, Comitato Riserva naturale Foce del Tagliamento, Ornithologist association, Carabinieri volontari di Jesolo), cooperatives (Cooperativa Aqua Natura e Cultura), municipalities (Comune di Caorle, Cavallino Treporti, Eraclea), authorities (Guardia Costiera di Caorle, Guardia Costiera di Bibione, Carabinieri di Portogruaro) and economic operators (Mete Beach of Eraclea, Capalonga campsite of Bibione, Opera Nascimbeni and Marina di Venezia of Cavallino Treporti), who either applied the Guidelines of the project in the areas of their respective competences, or/and have become instrumental for the organization, promotion and implementation of the environmental education activities aimed at tourists or other touristic operators.

EVENTS FOR TOURISTS

In the period 2018-2021, 85 environmental education events for tourists were done (5 more than foreseen in the GA), of which 8 dedicated to the issues of invasive alien species, for a total of 8,374 participants (about 4 times more than expected by GA). In detail:

Events for tourists					
Year	N. events planned	N. events cancelled	N. events done	Of which on alien species	N. participants
2018	1	0	1		15
2019	22	3	19	2	978
2020	39	10	29	1	4.917
2021	36	0	36	5	2.464
TOTAL	98	13	85	8	8.374

The activities for tourists also led to intercepting school staff and naturalistic-recreational associations who have promoted further initiatives to convey the project's messages also to children and young people. Environmental education activities highly contributed to the

reduction of anthropogenic disturbance, especially in sites where it was possible to guarantee a constant supervision.

Technical deviations: for the reasons explained below in “problems encountered” we could organize 5 instead of 9 formal events with touristic operators, which we “compensated” exceeding with the number of events for tourists.

Problems encountered: as mentioned in Action E.3, despite the impossibility to have the touristic operators attending educational activities in 2020 and in 2021 because of the general harsh situation generated by the Covid-19 outbreak, the real problem is that some Municipalities and many economic operators of the touristic sector are scarcely interested to a sustainable use of the beach.

Deliverable since MTR

- Title Deliverable: Report on the environmental education activities
Due and delivery date: 31/03/2022

Annex to Action E4: Details of E4 activities for period 1/12/2019 to 31/03/2022 (from MTR to the project end)

E5 NETWORKING WITH THE BENEFICIARIES OF OTHER PROJECTS ABOUT THE DUNAL HABITATS UNIVE

Start date: 01/10/2017

End date: 31/03/2022

Actual start date: 01/10/2017

Actual end date: 31/03/2022

Status: completed.

The Action E.5 was dedicated to the networking activities to team up with other projects and initiatives with a synergy of intentions and actions, to demonstrate and disseminate knowledge and good practice.

The networking activity included:

- Initial recognition and identification of Life projects from whose experiences Life Redune could have benefitted;
- Analysis and response to all requests for collaboration;
- Contacts with the technical and scientific representatives of other projects in order to exchange experiences on the actions of the respective projects, also in terms of data and photographic material;
- Participation in thematic conferences to present Life Redune approaches, methods and results;
- Invitation to the LIFE Redune initial and final conference, to present the respective projects and experiences
- Maintenance over time of existing contacts, also creating new opportunities for joint activities on Actions E.1, E.3, E.4;
- Mutual dissemination of the most significant activities and initiatives through the respective social media pages;
- Publication on the project website of a page relating to the other projects and initiatives with which networking has been established: <http://liferedune.it/networking/>;
- 1 workshop, 4 seminars, 2 visits and 2 networking webinars.

The detailed number and typology of networking activities carried out during the project are reported on the related annexed report (Action E.5 “Report on the networking activities”).

During the project, we established interactions with several, different people, projects and entities although apparently not directly linked to our project. This approach aimed to possibly cover all the issues and aspects related to the project implementation (e.g., concrete actions, communication, stakeholder engagement, policy), and revealed to be the best strategy to fully

and successfully implement networking activities. At the end of the project, the number of interactions was higher than expected. The networking activities slowed down between 2020 and 2021 due to Covid-19 outbreak that forced us to change some activities.

The most appealing issues for other projects were connected to the skills regarding a) dune recovery through low-impact interventions and b) plant production.

Technical deviations: 1) as reported in the MTR, the attendance to the networking workshop in Dunkirk was not explicitly foreseen in the GA, UNIVE budget had adequate funds for missions within the EU and used it for this purpose; 2) due to travel restrictions related to Covid-19 pandemic, we asked to replace the third and last networking travel planned for the second half of 2020 with the two webinars organised with Life Calliope (letter n. 0076668 of 21/12/2020, approved by PO's e-mail of 15/1/2021). Although networking travels could not be done, other networking activities (mostly on-line) continued till the end of the Project.

Problems encountered: networking activities involving in presence visits highly suffered from travel restrictions related to Covid-19 pandemic, and some activities had to be replaced by online activities.

Deliverable since MTR

- Title Deliverable: Report on the networking activities
Due and delivery date: 31/03/2022

F1 COORDINATION AND MANAGEMENT OF THE PROJECT		UNIVE
Start date: 01/09/2017	End date: 31/03/2022	
Actual start date: 01/09/2017	Actual end date: 31/03/2022	
Status: completed.		

The Project involved the participation of 5 partners.

The Scientific Coordination was headed by the Coordinating Beneficiary – the Ca' Foscari University of Venice, in the person of Prof. Gabriella Buffa, full professor of Botany. The Scientific coordinator was supported by a Project Assistant (Dr. Edy Fantinato). Dr. Serenella Rizzieri (UNIVE) oversaw the administrative management of the project. The Project Management was headed by the EPC Partner Beneficiary (Dr. Stefano Picchi from 08/2018 to 03/2020; from 03/2020 the role was taken on by Dr. Federica Piccolo).

The Scientific Coordinator, together with the Project Manager and the Project Assistant, coordinated the activities with the Head of External Relations and Communication (EPC), the Head of the nursery centre and the assistant/project manager (VA), the Technical Officer (RV) and the SELC Project Manager (SELC).

The organisation chart illustrating the composition of the partnerships, names, role, and period of activities is annexed in Annex to Action F1: Organisational Chart and List of Communications.

The project management involved many activities which included daily project management; collection and storage of expenses documents, and verification of their compliance with the LIFE administrative rules, requesting additions and changes to the format used by the various bodies when necessary, also as follow up to contacts with the monitor; prompt responses to the beneficiaries' administrative doubts about the reporting process and rules; collaboration in the development of the main procedures for the external assignments, service providers or consultancies to comply with the LIFE regulations, the Italian regulations, the project regulations and the Green procurement standards; organisation of Executive Committee Meetings on 5/09/2017, 19/04/2018, 16/05/2018, 14/9/2018, 19/09/2019, 15/10/2019; 19/11/2019, 20/04/2020, 1/07/2020, 18/11/2020, 24/02/2021, 10/03/2021, 1/10/2021; organisation of the monitoring visit on 28-29/2/2018, 19-20/3/2019 (with the PO), 4/05/2020 (online), 29-30/04/2021, and 9-11/02/2022 (online meetings) and 24-25/02/2022 (in presence,

visits to project sites), drawing up of the documents for the visit and drafting of the relative reports; monitoring of the technical progress of the actions, through continuous contacts with the beneficiaries; preparation and submission of updates to the monitor and conversations with Monitor and PO on proposed changes and requests for some clarifications (the list of communication is annexed in Annex to Action F1: Organisational Chart and List of Communications); drafting and submission of the PRs, MTR and FR; payment to the partner beneficiaries of the second pre-financing received by the UNIVE from the European Commission; organisation of the initial and final meeting.

The outstanding spirit of collaboration between the partners and the search for shared solutions were crucial to solve the small contingencies that normally characterize a project dealing with nature and the environment. Thanks to an excellent internal communication, we had an effective workflow that allowed us to respect the deadlines and the needs of all beneficiaries.

Technical deviations: None

Problems encountered: during the project lifetime several issues arose (e.g., storm surge, Covid-19 pandemic; PM turnover); however, partner collaboration and their willingness to achieve project's goals allowed to solve and overcome problems, thus respecting the deadlines and the needs of all beneficiaries.

Deliverable since MTR

- Title Deliverable: After Life Plan
Due date: 31/03/2022 Sending date: 30/06/2022
- Title Deliverable: Minutes of the meetings of the Executive Committee
Due date: 31/03/2022 Sending date: 30/06/2022

Annex to Action F1: Details on the Organisational Chart and List of Communications

F2 FILLING IN AND UPDATING THE INDICATOR TABLE		UNIVE
Start date: 01/01/2019	End date: 31/03/2022	
Actual start date: 01/01/2018	Actual end date: 31/03/2022	
Status: completed.		

The action requested a quantitative and qualitative measuring and monitoring of the project progress and outcomes.

The first Key Project Indicators table was filled in from January to February 2018 to define the baseline. Afterwards, the KPIs table was updated from January to March 2019, for the MTR in January 2020, and finally in January 2021.

As already mentioned in the MTR, in 2020 we partially modified values indicated at the onset of the project, because at that time we misinterpreted the indicators and their meaning. Specifically, we modified a) the indicator n. 7.3 “Natural and semi-natural habitats” which is intended to monitor 1) Habitat Condition and 2) Habitat Trend, and b) the indicator n. 14.1 “Total project related expenditure during the project period”.

Upon request by CINEA, for the last reporting we modified the structure of the indicators; specifically, we revised the Specific Contexts, identified as 1) Dune Habitat Restoration that includes indicators 1.5, 7.2, 7.3, 7.4 and 7.5, 13, 14.1, 14.2.2 and 14.2.3, 14.3 and 14.4.3; and 2) Increasing awareness that includes indicators 1.6, 10.1.2 and 10.2, 11.1 and 11.2, and 12.1. We also modified some Descriptors and First level descriptor(s).

In section 7 we describe each indicator and explain the values reported in the annexed tables.

Technical deviations: as already mentioned in the MTR, and reported above, in 2020 we partially modified values indicated at the onset of the project, because of a misunderstanding of some indicators. Upon request by CINEA, for this last reporting we revised the Specific Contexts.

Problems encountered: None.

Deliverable since MTR

- Title Deliverable: Table with updated state of progress indicators
Due date: 31/01/2021 Sending date: 30/06/2022
- Title Deliverable: Table with indicators updated at the end of the project
Due date: 31/03/2022 Sending date: 30/06/2022

6.2 Main deviations, problems and corrective actions implemented

The following table summarises the main problems encountered during the implementation of the project, and the mitigation strategies taken by the project team to overcome them.

Problem 1

Changes to location and/or typology of interventions	<p>1) Based on the detailed design, consultations with Municipalities, and first results of Actions D1 and D2, there was a need for a slightly different distribution and typology of the C interventions and works in the four project sites (e.g., less fences than expected was required, boardwalks in some parts needed to be raised and not simply placed on the sand) and consequently of their associated costs.</p> <p>2) Initially, a private area with a significant population of <i>Stipa veneta</i>*, yet subject to human disturbance (trampling and horse riding), was included in the project (both Action C.1 and C.5). We had to relocate interventions due to the owner withdrawing his availability.</p>
Impact on the outcomes	Not relevant
Measures taken to overcome it	<p>1) CB requested technical changes to the actions C1, C4, C6 and the relative expense lines to PO (approved by the PO in the email dated 5/9/2018), without varying the overall budget of the External assistance category or the costs of the three actions.</p> <p>2) The owner himself decided to fence the area, thereby precluding human entry. Owner's intervention properly fit our aim of protecting <i>Stipa veneta</i>*. Seedling plantation was thus used to reinforce small populations found nearby within the same Nature 2000 site.</p>

Problem 2

Engagement of the stakeholders	<p>Given the importance of stakeholder engagement, the project envisaged several opportunities to share the project approach and discuss issues regarding sustainability (e.g., actions A.1, A2, E.3 and E.4). However, despite a high number of meetings, we did not fully succeed in getting the stakeholders to actively share project aims and commit to the project. Contacts (and contacts with Municipalities, in particular) and exchange of ideas have been often difficult. Particularly when dealing with the guidelines for sustainable management of dune systems (Action E.3), we encountered a harsh contrast, a kind of reluctance, because of the prevalence of economic interests in the project area, which strongly influence decisions about land and natural resource management.</p>
Impact on the outcomes	Relevant

Measures taken to overcome it

The *Mitigation Strategy* involved several different approaches:

- 1) we adopted an adaptive approach, modulating our effort upon the local events and situations
- 2) we broaden the interest groups so as to attain a critical mass able to push Municipalities and economic stakeholders to develop a responsible behaviour towards the sand dune ecosystems. Accordingly, besides the stakeholder groups mentioned in the GA, we identified new target groups such as local residents, students, environmental groups, voluntary associations, etc. for which we prepared and diffused specific and additional informative material.
- 3) we devoted much effort to developing positive synergies with local environmental associations and voluntary organisations, strengthening relationships with some tour operators who embraced the project, writing press articles for local newspapers, interviews, roll-ups, handbills for tourists, small boards for tour operators, events about IAS, thereby undertaking a series of activities that were not originally foreseen but proved crucial in the local contexts.
- 4) we changed both the contents of messages conveyed and the modality to convey them, e.g., regarding beach cleaning, since economic interests were overwhelmingly important, rather than concentrate only on e.g., the importance of Kentish plover, we started conveying messages regarding sand loss and erosion, loss of the protection service, and the high landfill costs for the Municipality and/or tourist operators
- 5) for the Action E.3, to overcome the problem of interacting with the “Conference of Mayors of the Veneto Coast”, where some more powerful Mayors dictated the agenda, we started interacting with each Municipality separately, also taking advantage of personal relationships. In addition, we also included all other Venetian Municipalities.

Problem 3**Storm surges**

1) during the night of 12th November 2019, an exceptional storm hit the Province of Venice. The storm surge severely damaged the newly created dunes that were too young to withstand such an exceptional sea storm. At its maximum, the tide reached +187 cm (which is the second highest tide recorded after 1966 (+194cm)), with wind gusts of up to 100 km/h. The high tide and the force of the wind resulted in extensive damages to structures and infrastructure (buildings, tourist facilities and beaches). In some coast stretches, the first dunes on the sea front were eroded for about 5/10 meters. As for the project, the main damages were recorded on the interventions regarding actions: C.1 - fences and boardwalks; C.3 - newly created mobile and shifting dunes that were completely destroyed; C.2 - nursery production of plants. The total amount of work force and materials lost in the storm approximately summed to 81,000.00 €. See annex “Report on the storm damage on the project actions” to the MTR, for details.

	2) less intense storm surge occurred at the end of 2020 making the Laguna del Mort site no more suitable for dune reconstruction (strong erosion, shortage of on-site sediment) (C.3).
Impact on the outcomes	Relevant
Measures taken to overcome it	<p>1) after several surveys to project sites to evaluate damages and verify the suitability of damaged materials/areas to be restored (i.e., erosion, sediment availability, etc.), the project team met at Ca' Foscari University (18/11/2019) and identified a short-term mitigation strategy. <i>Mitigation strategy:</i></p> <p>a) <u>C1</u>: RV budget savings allowed the complete recovery of damages (36 m of boardwalk and 43,7 m of fences); 472 m of fences in Eraclea Mare (site no more suitable) partially recovered and used to delimit a restoration area at Cavallino site (delimitation not foreseen by the project, but deemed necessary);</p> <p>b) <u>C3</u>: with SELC budget savings restoration of about 3,000 sqm of damaged dune; for all other areas, agreement with the SIF to include damaged dunes restoration in the customary regional watershed protection projects.</p> <p>2) in April 2021 (Prot. n. 0024008; 07/04/2021) request to move works (1.65 ha) to Vallevicchia site. Approved.</p>

Problem 4

Covid-19 outbreak	It occurred just after the storm surge of 2019 and caused a suspension of almost all project actions between mid-March and mid-May 2020, as a consequence of the containment measures of the Covid-19 pandemic imposed by the Presidential Decrees and Regional Ordinances.
Impact on the outcomes	Relevant for some actions
Measures taken to overcome it	<p>It mostly caused delay in some actions; in some cases (Actions D and E), the mitigation strategy involved budget changes. <i>Mitigation strategy:</i></p> <p>a) <u>C actions</u> (suspended on 18 March 2020): the actions have not been substantially delayed since no activities were planned during summer: no mitigation strategy needed. Works restarted in May (i.e., seedling plantation in C3; <i>Oenothera stucchii</i> control). C1 interventions completed on the 31st of August 2020</p> <p>b) <u>D actions</u>: action D2 needed a budget recalibration. Due to Covid-related travel restrictions, we lost some monthly monitoring; the high uncertainty about the evolution of the pandemic and the possible further restrictions that could affect the time available for monitoring, led us to activate an additional year of co-financed Additional Staff (Prot. n. 0071705; 02/12/2020) to build work groups working in parallel, thereby reducing the monitoring execution times. Intermediate drone flight (D1) slightly delayed; intermediate report, including the intermediate habitat map, completed in September 2020.</p> <p>c) <u>E actions</u>: almost all E actions suffered from the impossibility to organize in person activities. Action E1 recovered by desk activity (website update, weekly posts on Facebook and Twitter; conception and implementation of the series «I video venerdì di Life Redune»</p>

with 35 environmental education videos made by project partners and posted on YouTube, Facebook and Twitter pages). **Actions E2 and E5** highly impacted since both involved international trips. Substitute activities defined to guarantee coherence with the aims of the actions (knowledge sharing) and avoid delaying actions while waiting for possible solutions: **E2**: a) replacement of first replication trip with the production of a technical Handbook on the propagation of coastal dune species in collaboration with LIFE Calliope (Prot. n. 0076668; 21/12/2020); b) limitation of replication trips to Italy. **E5**: replacement of last networking trip with two webinars in collaboration with LIFE Calliope. Other networking activities continued through website and social networks and any other possible activity as usual (Prot. n. 0076668; 21/12/2020). **E3**: definition of a new roadmap for stakeholder involvement; request (Prot. n. 0024008; 07/04/2021) to postpone the deadlines of the action Deliverable to 31/10/2021 and Milestone to 31/01/2022. Partner RV activated an external assistance (extra budget) to speed up the processing of analytical data useful for drafting the Guidelines for the long-term management of beaches.

Problem 5

Bureaucracy problems

Action D.3 envisaged the construction and implementation of multiparametric control units was for the assessment of ecosystem services.

Due to the complex MEPA procedure, which involved the construction of numerous tenders for the various components, consequent errors, and delays in delivery of the various components by the suppliers, and then the Covid-19 outbreak, it was possible to complete the assembly of the multi-parametric control units only at the beginning of 2021.

Impact on the outcomes

Partially relevant

Measures taken to overcome it

The significant delay did not allow us to complete the ex-ante monitoring phase as planned; however, no mitigation strategies were possible to counteract bureaucracy delays.

In order to simulate the ex-ante monitoring, the multiparameter probes were placed in areas with different vegetation cover (no or low vegetation cover for the ex-ante and higher for the ex-post monitoring).

Problem 6

Vandalism acts

Some interventions of Action C.1 have been the object of vandalism acts toward the fences (4 total vandalism acts at sites A03 sub area Laguna del Mort, and A04 Cavallino Treporti-Punta Sabbioni).

Impact on the outcomes

Partially relevant

Measures taken to overcome it

Mitigation strategy: the company in charge of the works promptly restored what was damaged.

6.3 Evaluation of Project Implementation

Methodology applied

The implementation of project actions was always based on the latest technical approaches and ensuring the uptake of all advice issued by previous projects. This has been achieved through a continuous review process at all project stages. The process entailed a constant monitoring of constraints and risks, as well as of the efficacy of the mitigation strategies identified.

At each review step, we developed mitigation plans explicitly designed to manage, eliminate, or reduce constraints and risks to an acceptable level. Once a plan was implemented, it was continually monitored to assess its efficacy with the aim of revising the course-of-action if needed.

This methodology obviously involved a constant exchange of views among partners and a constant flow of information across partners, to keep everyone informed about the project progress, share problems, and agree solutions. Although demanding, this approach allowed us to overcome the major problems we had to face during the project lifetime, i.e., the exceptional storm surge, the Covid-19 outbreak, and the process of stakeholder engagement.

The project proceeded well, and as reported in the table below, outputs are in line, or better, with what foreseen in the proposal, both in terms of time-schedule and approach.

Action	Foreseen in the revised proposal	Achieved	Evaluation
A.1 Design of the interventions on the habitats	Objective: drafting of the technical blueprint Expected results: 1) involvement of Municipalities and competent Authorities in the project technical blueprint drafting and approval process 2) drafting of the technical blueprint	1) Municipalities have been involved through several meetings 2) Technical blueprint approved by the Regional Technical Commission (DDR no. 49 of 22nd October 2018)	Successfully achieved. The technical blueprint has integrated environmental and biodiversity information collected in the D.1 and D.2 ex-ante phase and, thanks to the several meetings and consultations it succeeded in harmonising all the requests of the stakeholders. Lesson learned: the process for the administrative approval of the projects can be long and consultations with competent authorities should begin as early as possible to obtain the approval in time. We have saved time by not producing the preliminary project as a result of our long and intensive consultation process.
A.2 Consultation with the stakeholders	Objective: stakeholder (Municipalities and economic stakeholders) engagement Expected results: 1) fulfilment of 9 meetings with stakeholders 2) active engagement of stakeholders in the project	1) in total, 13 meetings with local authorities and stakeholders have been realised. As a whole, 70 people participated in the meetings 2) only partially achieved	Partially successful. Despite a higher than planned number of meetings, we did not fully succeed in getting stakeholders to actively share project aims and commit to the project. Please, see below (Effectiveness of the dissemination activities) for further explanation. Lesson learned: do not overlook the socio-economic environment that can heavily influence project implementation.

<p>C.1 Interventions for reducing anthropic impact on the habitats</p>	<p>Objective: reduction of anthropogenic disturbance</p> <p>Expected results: 1) positioning of 4,780 m of fences; 746 m of boardwalks (of which 317 m raised); 2) positioning 15 outdoor educational panels + 26 small outdoor dissuasive panels; 3) positioning 8 indoor educational panels</p>	<p>1) 4,887 m of fences put in place (100 m positioned in Vallevicchia site to protect shifting dunes, not foreseen) 2) 746 m of boardwalks put in place 3) 25 outdoor educational panels + 48 small outdoor dissuasive panels positioned (more than foreseen) + 8 indoor educational panels</p>	<p>Successfully achieved. Materials damaged by the 2019 exceptional storm surge were for the most part reused; thanks to RV budget savings we assured the complete recovery of damages (36 m of boardwalk and 43,7 m of fences); 472 m of fences in Eraclea Mare (site no more suitable) partially recovered and used to delimit a restoration area at Cavallino site (delimitation not foreseen by the project but deemed necessary).</p> <p>Lesson learned: informative and dissuading panels proved their efficacy. For fences, it is recommended to use short-length rope pieces (1.50-2.00 ml) to discourage removal and/or cutting. In particularly critical locations (excessive human impact, e.g., trampling) we suggest recycling driftwood or woody material deriving from the selective thinning to a) seaside: construction of palisades to both consolidate the dune and close the unauthorized access routes, b) inland side: building heaps of woody material to close unauthorised paths and enhance their efficacy by planting thorny plants.</p>
<p>C.2 Nursery production of the plants destined for actions C3, C4 and C5</p>	<p>Objective: seedling production for actions C.3, C.4, C.5</p> <p>Expected result: 1) provision of 151,000 seedlings</p>	<p>1) germplasm collection; 2) seedling production in nursery; 3) provision of 152,385 seedlings of various species (including 1,630 <i>Stipa veneta</i>* seedlings) (more than foreseen)</p>	<p>Successfully achieved. Despite possible problems typical when working with living organisms (e.g., uneven germination, seed viability temporal variation, uncertainty about the factors that determine the success rate of establishment in a particular restoration site), the possibility to produce native species to restore habitats represented a real added value of the project.</p> <p>Lesson learned: relying on an experienced partner in the seedling production process allows to easily overcome problems and ensure success.</p>

<p>C.3 Restoration of habitats 2110 - 2120</p>	<p>Objective: restoration of embryo- and mobile dunes (habitats 2110/2120)</p> <p>Expected results: 1) restoration of 92,000 sqm of mobile dunes; 2) planting of 35,000 seedlings</p>	<p>1) restoration of 9,35 ha of mobile dunes 2) 35,265 seedlings planted (more than foreseen)</p>	<p>Successfully achieved. The methodology we used is sound and well-founded. Interventions are cost-effective and highly replicable outside the project area. This intervention has only a weakness linked to storm surges that can severely damage newly created dunes.</p> <p>Lesson learned: the dune toe reinforcement by means of debris (trunks and other organic materials) increases their resistance against flood. However, such kind of intervention should also include the control of tourist access to the beach and human trampling, and, most important, cogent beach cleaning rules. Contrary to expectations, 2110/2120 plants reacted well after an unavoidable late plantation in May.</p>
<p>C. 4 Restoration of habitats 2130* - 2250* - 2270*</p>	<p>Objective: restoration and/or increase in surface of semi-fixed and fixed dunes (habitats 2130*/2250*/2270*)</p> <p>Expected results: 1) restoration of 28,5 ha of 2130* (planting of 45,000 seedlings); 2) restoration of 18,3 ha of 2250* (planting of 55,000 seedlings); 3) restoration of 35,5 ha of 2270* (planting of 15,000 seedlings);</p>	<p>1) restoration of 28,6 ha of 2130* (planting of 63,490 seedlings); 2) restoration of 18,54 ha of 2250* (planting of 41,500 seedlings); 3) restoration of 35,57 ha of 2270* (planting of 10,500 seedlings); (more than foreseen)</p>	<p>Successfully achieved. Interventions did prove to be effective in improving the conservation status of all target habitats and/or in increasing their surface (e.g., 2250*).</p> <p>Lesson learned: species of different habitats have different behaviour; species of shifting dunes have higher mortality but surviving seedling grow very quickly. Conversely, species of habitat 2130*, 2250* and 2270*, have lower mortality rate, but their growth is very slow and seedlings need time to increase their space occupancy.</p>
<p>C.5 Strengthening the populations of <i>Stipa veneta</i>*</p>	<p>Objective: reinforcing of <i>Stipa veneta</i>*</p> <p>Expected results: 1) planting 1,000 new seedlings</p>	<p>1) 1,630 seedlings delivered and planted (more than foreseen)</p>	<p>Partially successful. Seedlings evidenced a high mortality rate despite we changed the time of plantation and the methodology (seedlings vs. seeds). Herbivory is surely a reason (seedlings planted close to adult, and thorny, plants had higher survival rate)</p> <p>Lesson learned: the species has high intrinsic problems to move</p>

			from the seedling to the adult phase that need to be studied more in depth.
C.6 Control of the invasive alien species <i>Oenothera stucchii</i>	<p>Objective: control/eradication of the IAS <i>Oenothera stucchii</i></p> <p>Expected results: 1) improvement of the conservation status of habitat 2130* through the control of <i>O. stucchii</i> in 150,000 sqm</p>	<p>1) eradication done in 23,6 ha 2) two eradication methods have been tested (more than foreseen)</p>	<p>Successfully achieved. Two different methods of eradication have been tested: manual and using a string trimmer in patches with a very high density, where manual removal proved to be highly labour-intensive and created a significant amount of site disturbance.</p> <p>Lesson learned: human disturbance is crucial in favouring <i>O. stucchii</i> establishment. According to the model developed by Buffa et al. (2021), the most susceptible areas prone to <i>O. stucchii</i> invasion combine: 1) a distance from the beach access lower than 50 m; 2) a height of foredunes lower than 5.5 m; 3) a richness of annual plants higher than 10; 4) a total coverage of vascular plants lower than 40%. The immediate planting of native rosette species proved effective in limiting seedling emergence from the soil seedbank</p>
D.1 Monitoring the anthropic threats	<p>Objective: to establish a fine-scale baseline to support the drafting of technical blueprint and the ex-post evaluation and quantification of the efficacy of interventions</p> <p>Expected results: 1) 3 topographic surveys using aerial photogrammetry (drones and GPS); 2) 3 habitat maps (1:500); 3) GIS implementation</p>	<p>1) 3 topographic surveys using aerial photogrammetry (drones and GPS) done; 2) 3 habitat maps (1:500) supplied; 3) GIS implemented and regularly updated</p>	<p>Successfully achieved. Surveys were used to define the baseline and follow project implementation. They proved to be crucial to both support the drafting of technical blueprint and the step-by-step evaluation and quantification of the efficacy of interventions.</p> <p>Lesson learned: the acquisition of DTM and high definition orthophotos represents a valid support in the first phase of delimitation of macro-categories of vegetation types; however, the correct attribution to the habitat type, the exact delimitation of their spatial extent and the assessment of the conservation status are possible only by means of in field surveys made by expert personnel.</p>

<p>D.2 Monitoring habitats, and <i>Stipa veneta</i>* and <i>Oenothera stucchii</i> populations</p>	<p>Objective: quantitative evaluation of the efficacy of interventions</p> <p>Expected results: 1) establishment of the baseline (ex-ante monitoring), including habitat conservation status, mapping and quantitative evaluation of <i>S. veneta</i>* and <i>O. stucchii</i> populations; 2) evaluation of the intervention efficacy (ex-post monitoring); 3) updating sites' Standard Data Form</p>	<p>All aims have been achieved; other monitoring approaches added.</p>	<p>Successfully achieved. Monitoring activities confirmed as a key part of a project. They certainly allow enhancing knowledge on habitats and species; however, their most important role is in the crucial contribution they give to the adaptive strategy needed in this kind of project.</p> <p>Lesson learned: the use of different methods (e.g., permanent plots vs. belt transects), and different target levels (seedlings vs. habitats/communities vs. landscape), allows to gain a comprehensive picture of the project trend and evolution.</p>
<p>D.3 Monitoring the impact of the project on ecosystem functions</p>	<p>Objective: ecosystem services quantification</p> <p>Expected results: quantification of 4 services: 1) beached material; 2) coastal protection; 3) carbon stock; 4) recreation and spare time</p>	<p>Aims achieved. However, due to the complex MEPA procedure delays in delivery, and the Covid-19 outbreak, it was possible to complete the assembly of the multi-parametric control units only at the beginning of 2021.</p>	<p>Successfully achieved. This part allowed us to collect quantitative data on ecosystem functions and services to be conveyed to stakeholders.</p> <p>Lesson learned: in Italy and for public bodies, always consider the complex MEPA procedure which can cause serious delay. In our case, better rely on already existing tools, although sub optimal, rather than plan the construction and implementation of new tools.</p>
<p>D.4 Monitoring the socio-economic impact of the project</p>	<p>Objectives: evaluation and enhancement of the social and economic impact of the project on the project sites</p> <p>Expected results: 1) drafting of the socio-economic monitoring plan; 2) analysis of the ex-ante situation; 3) analysis of the ex-post situation</p>	<p>The 3 phases of the Action were started, implemented, and concluded on schedule.</p>	<p>Successfully achieved. Although the project did not have an appreciable impact on the tourism sector in economic terms, dissemination and awareness-raising actions of the project had a crucial role in increasing knowledge and promoting responsible and sustainable tourism in the project sites.</p>
<p>E.1 Communication</p>	<p>Objective: engagement of citizens, tourists, and local authorities to stimulate a pro-</p>	<p>The 5 phases of the Action were started, implemented, and concluded on schedule. Thanks to</p>	<p>Successfully achieved. Communication activities requested a significant effort to give the project the deserved visibility.</p>

	<p>environmental behaviour.</p> <p>Expected results: 1) communication plan; 2) website and social media (Facebook and Twitter); 3) 2 videos; 4) 80,000 leaflets; 5) 11 outdoor educational panels + 26 small dissuasive panels; 6) 7 indoor educational panels; 7) 2 public events (opening and closing event); 7) 1,000 copies of Layman’s report</p>	<p>the project team effort, the communication activity continued steady as a self-standing outreach activity and as a support activity to the other E Actions. More materials than planned were produced.</p>	<p>Lesson learned: be always prepared to change methods, approaches and the content of messages to convey, and to grasp any, although apparently odd, opportunity to spread the project.</p>
E.2 Transfer and Replication	<p>Objective: to increase project’s impact through “Tips and tricks” diffusion</p> <p>Expected results: 1) elaboration of a transfer and replication plan; 2) drafting three guidelines (<i>Oenothera stucchii</i> control; Use of drone in habitat monitoring; Stakeholder engagement); 3) identification of and visit to 3 sites (1 in Italy and 2 in southern Europe) for transfer and replication</p>	<p>1) the three guidelines have been produced and spread; 2) one visit for transfer and replication has been replaced by online activities and the production of a Handbook for the propagation of species of the Adriatic dunal environments in collaboration with LIFE CALLIOPE.</p>	<p>Successfully achieved. The Action had to be changed as a consequence of Covid-19 outbreak. However, the mitigation strategy we adopted allowed us to reach project aims.</p>
E.3 Agreement for the long-term management of the beaches	<p>Objectives: stakeholder formal engagement for the sustainable use of beaches and sand dunes</p> <p>Expected results: 1) achievement of 9 meetings with stakeholders (Municipalities; tour operators; campsites, touristic consortia, etc.)</p>	<p>Objectives have been almost achieved. The last two years of the project were actively dedicated to stakeholder engagement at any level, also taking advantage of personal relationships. The Guidelines for the long-term management of</p>	<p>Partially achieved. Action E.3 was the most challenging of all Project actions. Issues related to a sustainable use of sand dune ecosystems and the integration of tourism with the conservation of natural heritage were hardly taken into consideration in the project area until the appearance on the scene of LIFE Redune. However, we believe that our project has significantly</p>

	2) elaboration and sharing of guidelines for a sustainable use of beaches and sand dunes	beaches were produced, officially approved by RV, and shared with the 10 Municipalities of the Veneto coast.	<p>contributed to establish the condition for a new approach to sand dune management.</p> <p>Lesson learned: never overlook the socio-economic context; when economic interests are predominant, they can heavily influence stakeholder attitude and the decision-making process.</p>
E.4 Environmental education for tourists and tour operators	<p>Objective: to develop a pro-environmental behaviour through education activities in tourists, tourist operators, environmental association</p> <p>Expected results: 1) fulfilment of 9 meetings with stakeholders to increase their knowledge 2) fulfilment of 72 educational events with tourists (8 events dedicated to IAS)</p>	Due to the problems related to stakeholder involvement, we could organize only 5 formal events with touristic operators. However, thanks to the great effort of the project team, the project has become a point of reference in the project area.	<p>Successfully achieved.</p> <p>The constant evaluation and review of activities efficacy led us to better understand the environment in which the project was operating. This enabled the project to gain a broad visibility, be appreciated by local, regional and national stakeholders and to become an important hub for aggregating and synergizing very diverse realities: public bodies, research institutions, environmental associations, professionals and enthusiasts, and operators in the tourism sector.</p> <p>Lesson learned: get in touch as early as possible with local environmental associations and volunteers to create synergies. Stakeholder engagement is facilitated by good personal relationships.</p>
E.5 Networking with the beneficiaries of other projects on dune habitats	<p>Objectives: sharing experience and expertise with other LIFE projects</p> <p>Expected results: 1) 3 networking visits</p>	<p>1) 2 networking visits 2) the third networking visit replaced by two online workshops</p>	<p>Successfully achieved.</p> <p>The Action had to be changed because of Covid-19 outbreak. However, the mitigation strategy we adopted allowed us to reach project aims.</p> <p>Lesson learned: activating networking with different realities offers unexpected, although sometimes crucial, opportunities</p>
F.1 Coordination and management of the project	<p>Objectives: Coordination and management of project activities</p> <p>Expected results: 1) project coordination</p>	<p>1) continuous contact between all project partners 2) periodic project meetings</p>	<p>Successfully achieved.</p> <p>The project coordination needed daily work to coordinate all actions and assure their correct flow, keep partners constantly informed about the project progress and share problems and</p>

	2) project management		solutions. Good collaboration between beneficiaries. Lesson learned: Partnership management and working are central to ensuring and possibly improving outcomes
F.2 Filling in and updating the indicator tables	Objectives: Quantitative and qualitative evaluation of project performance Expected results: 1) periodic assessment of KPIs	Updating as scheduled.	Successfully achieved.

Detectability of project results

Given the intrinsic nature of the project, mainly concerning low impact nature-based restoration actions and communication/education activities, most of the project results will only be clearly visible in the future. However, some actions have already produced perceptible results.

Action C.1: Interventions to reduce the anthropic impact on the habitats: The limitation of human trampling has been repeatedly reported as a key measure in reshaping the diversity patterns in the target habitats (and particularly in those occupying the transitional dune sector). This measure did prove to be effective in a short time span and especially where we were able to reorganize the beach access system (e.g., Capalonga and Vallevicchia sites) it significantly contributed to the success of the seedling planting planned in all other C actions. However, its efficacy mostly depends on the level of local tourist flow control and education efforts, namely where sites were overseen by local managers or voluntary associations it proved to be a cost-efficient action.

Action C.3: Restoration of mobile dunes (habitats 2110 – 2120): results of this action have intrinsically an immediate visibility because they involve not only a morphological reshaping but also seedling planting of several native astonishing flowering species, thereby changing the entire landscape of the beach-dune system. The restoration of mobile dunes has notably modified the landscape configuration and composition. This represents a strength of this kind of interventions as, being them immediately visible to people, they can be used for educational purposes.

This kind of intervention has a weakness linked to storm surges that can severely damage works. However, the reinforcement of the dune toe (i.e., the boundary between the backshore limit -commonly around the high spring tide limit, and the seaward edge of the dunes) by means of debris and other organic materials accumulated on the beach can increase their resistance against flood. Despite the problems we had to face during the project, we still believe that the methodology we used remains sound and well-founded. We have to consider that sand dunes are dynamic systems which change in space and time and that strong climatic events, e.g., storm surge, can damage dunes, but this is their role, i.e., storm/flood/erosion protection and regulation. Another weakness regards vegetation, since the process of dune-building species establishment requires time for the plants to develop their belowground part which allows them to spread clonally and increase their coverage and ultimately playing their crucial role in the dune stabilisation.

Action E.2: We produced and disseminated four documents, each of them describing the experiences gained and the good practices developed during the project on four specific topics, with the purpose of providing clear indication for the replication of techniques and lessons learned to other Mediterranean areas. Another document entitled “Methods to assess coastal

dune restoration potential” summarises the approach used by the project to properly plan nature-based dune restoration activities on urban coasts, will add value to project results. Some replication activities have been already locally realized by third parties with the contribution of the project beneficiaries. Particularly significant for the message they sent other economic stakeholder, are the campsites that followed LIFE Redune advice and approach in the habitat restoration.

Effectiveness of the dissemination activities

At the beginning of the project, dissemination activities resulted very difficult because of the scarce collaboration of the Municipalities which did not provide the needed support to publicize the project among citizens and main stakeholders (e.g., tour operators, tourist consortia, non-profit organizations). Therefore, we adopted an adaptive approach, by taking advantage of any event organised by any local association or environmental group with the aim of increasing our visibility in the project sites. An important role in the awareness raising on sand dune conservation was also played by the articles published on regional newspapers and interviews/news broadcasted on regional/national TVs or regional radios. The mass media and social activities were very intensive and represented a valid tool to publicize the project, as demonstrated by the number of likes in the Facebook and Twitter pages that has been significantly increasing throughout the project. Facebook resulted the most effective tool for the immediate communication of the project progress and activities, especially those requiring stakeholders’ participation. The number of website’s visitors remained constant, while the number of downloads steadily increased, confirming its importance and as a repository of all produced documentation.

Beside this and from a general point of view, the main problem we had to face was a very common lack of awareness of issues connected to a sustainable use of the beach-dune systems. When referred to beach visitors, the behaviour mostly derived from the lack of awareness of their impact on the environment; in this case, a simple explanation of the beach-dune system dynamics and its importance for humans quite quickly allowed to correct their mistaken behaviour. The most significant challenge came from local authorities, that is Municipalities, since their decision-making process is largely influenced by economic interests and characterised by a short-term temporal perspective.

The review process, carried out at the end of the second year of the project, led us to partially modify both the messages, the approach to convey them, and the project target audience, by broadening the interest groups. Accordingly, besides the stakeholder groups mentioned in the GA, the new target groups identified were local residents, students, environmental groups, voluntary associations, and similar. Our goal was to nudge a pro-environmental behaviour in residents and support them in improving their knowledge on the value of their residence area (as a Natura 2000 area) as well as the knowledge on and awareness of the importance of sand dune ecosystems in supporting human well-being and the problems originated by their unsustainable use, as well as the economic implications. Thus, the broadening of interest groups aimed at attaining a critical mass able to force Municipalities and economic stakeholders to develop a responsible behaviour towards the sand dune ecosystems and widespread the “good behaviours on the beach” as models for the others. Interesting and positive feedbacks came from the engagement of the Coast Guard Delta Tagliamento NGO, Associazione Nazionale Carabinieri sez. Jesolo and Cavallino (voluntary association of retired carabinieri) and Carabinieri Forestali (a kind of forest rangers). Moreover, at the end of the project we also started actively interacting with Municipalities located outside the project area; these Municipalities have demonstrated a much higher interest in our approach and can represent a fertile ground on which to replicate the actions that were implemented in the project in the years that follow the end of the project.

Policy impact

The project contributed to the following policies:

Habitat 92/43 Directive: the project contributed to the implementation of the Habitat Directive through the safeguard and/or improvement of the conservation status of endangered native plants (*Stipa veneta**, an endemic endangered priority species) and habitats in four Natura 2000 sites. Target habitats of Community interest included 3 priority habitats (2130*; 2250*; 2270*) and have been chosen so as to favour the rehabilitation of the entire typical coastal zonation of North Adriatic Sea. The project had a major impact on increasing local knowledge about the Habitat 92/43 Directive and Natura 2000 network. In this regard, and most important, through Action E.3, the project shed light on the Conservation Measures that must be implemented in the Natura 2000 network as requested by Article 6.1 of the Habitats Directive.

EU 2030 strategy for biodiversity: the European Union has committed to an ambitious biodiversity recovery plan in its Biodiversity Strategy for 2030 and the Green Deal, which aims at achieving a sustainable and carbon-neutral economy by 2050. These policies aim to halt biodiversity loss and move towards sustainable development, focusing on restoring degraded habitats, extending the network of protected areas, and improving the effectiveness of management, governance, and funding. The achievement of conservation goals must be founded on understanding past successes and failures; in this context, LIFE projects are a crucial experimental arena for biological conservation. In this regard, LIFE Redune contributed to some key elements, that is 1) restoration of degraded ecosystems, and in particular those with the most potential to prevent and reduce the impact of natural disasters, such as coastal dunes that influence the timing and magnitude of water runoff, regulate and mitigate floods and provide support to recharging of ground water resources; 2) our project contributed to improve knowledge and monitoring of ecosystems and their services; at the end of the project, we have been able to up-date maps and Natura 2000 - Standard Data Forms of each project site, thereby providing data that more reliably conveys the current conservation status and trends of species and habitats. In addition, we provided data on the climate regulation performed by sand dune habitats thus improving the knowledge and evidence base for Union environment policy.

Integrated Coastal Zone Management: considering the importance of European coastal zones, the project contributed to a strategic approach to their management, based on the protection of the coastal environment; the recognition of the threats posed by climate change; the implementation of nature-based measures of coastal protection; the search of a balance between environment protection, the use of coastal environment for recreational purposes and the economic development of coastal communities. In this regard, LIFE Redune mostly focused on Mediterranean developed coasts where coastal dunes and beaches are mostly managed for recreational purposes, raising the need to solve conflicts between socio-economic interests and the protection of these vulnerable ecosystems.

Regulation on Invasive Alien Species: through the systematic monitoring of *Oenothera stucchii*, the project contributed to a better understanding of its the ecology, distribution, patterns of spread and response to management. The Guidelines for the management of *Oenothera stucchii* Soldano in coastal habitats together with the Risk Assessment of *O. stucchii* in coastal environment provide a strong scientific basis for decision-making and allocation of resources and inform prevention, mitigation, and restoration programmes. Although these documents specifically focus on *O. stucchii*, it is worth recall that this species shares biological and ecological traits with several phylogenetically related species belonging to the sect. *Oenothera* subsect. *Oenothera*; this makes data provided potentially applicable to functionally similar congeners.

Prioritised Action Frameworks (PAF): the knowledge acquired during the implementation of the project has been the bedrock for updating the Prioritised Action Framework of the Natura 2000 Network in the Veneto Region. Specifically, it contributed to the section E of the updated

format, providing data on the current status of habitats and species, informing both horizontal and priority measures and the estimated costs.

Regional/local policies: although difficult, the contacts with local authorities, Municipalities and economic stakeholder are raising awareness on the issues targeted by the project. The continuous efforts in communication and education activities contributed to give raise to a pro-environmental behaviour. Specifically, the "Guidelines for the long-term management of beaches" that gather the best practices experienced by the partners, and the inputs deriving from the project networking activities, and that have been approved by RV with a deliberative act (DGR_n. 261 of 15 March 2022) can actively contribute to the necessary transformative change to better respecting nature in public and business decision-making. This is expected to have a positive effect on both biodiversity and the functioning of the entire coastal ecosystem.

6.4 Analysis of benefits

Environmental benefits

The main environmental benefits coming from the project are related to the improvement of the conservation status of sandy coastal ecosystems in the Northern sector of the Adriatic Sea through restoration activities and habitat management, and the mitigation of human impact.

Project actions were conceived and planned according to the "Ecosystem Approach" and ICZM strategy, that consider both human and natural dimensions as key aspects to achieve an integrated management of the natural resources that promote their long-term conservation and sustainable use. Basically, the five habitats targeted by the project have been chosen among the most important habitats so as to represent the entire typical coastal zonation of the Northern sector of the Adriatic Sea. This means that the impact of the project goes far beyond the requalification of a given habitat type, to encompass the recovering of the entire system and of its functionality, thereby enhancing the delivery of benefits and services to the society.

Although the recovery of species composition will require longer time than the project lifetime, when comparing data between the 2018 and 2021, it emerged that the frequency of some focal species (e.g., *Fumana procumbens* and *Poterium sanguisorba*) produced and planted by the project, has significantly increased. In many cases, seedlings also flowered and produced seeds thus contributing to trigger self-recovery processes. When considering vegetation plots that were classified as "non-habitat" in 2018, 65 showed an improvement in the species composition and structure of the vegetation and it was possible to move them from the CORINE Land Cover 324 category to habitat 2130* (60 plots), 2250* (3 plots), and 2270* (2 plots). The number of plots of the target habitats 2110/2120, 2130* and 2250* increased by 41, 63 and 32, respectively.

Regarding *Stipa veneta** restocking, monitoring resulted in the identification, detailed mapping and georeferencing (UTM coordinates) of *Stipa veneta** populations or subpopulations at project sites, and in a better knowledge of species life history traits. Transplanted seedlings evidenced a high mortality rate despite we changed the approach (e.g., the time of plantation, and the methodology -seedlings vs. seeds). Herbivory is possibly a reason (seedlings planted close to adult thorny plants had higher survival rate). However, the species has high intrinsic problems to move from the seedling to the adult phase that need to be studied more in depth.

As for Action C.6 (Control of the IAS *Oenothera stucchii*), despite a non-linear trend, the monitoring activity (Action D.2) has shown that the number of individuals of *O. stucchii* has generally decreased (with density shifting from 30.000 ind/ha to 15.000 ind/ha), regardless of the site and the type of containment action implemented. Compared to the ex-ante conditions, in 2021 there was an average reduction in the number of individuals equal to 28.57% in areas subject to manual eradication, and 58.53% in areas subject to interventions by grass trimmer.

In the table below, we summarise the main points regarding the actions aimed at the mitigation of the threats originally identified, what has been achieved and what remains to do.

Threats identified	Status	Issues to tackle
Unsustainable tourism	<p>Issues related to a sustainable use of sand dune ecosystems and the integration of tourism with the conservation of natural heritage were hardly taken into consideration in the project area until the appearance on the scene of LIFE Redune.</p> <p>Many project actions were devoted to this issue: location of boardwalks and fences to control the tourist flow represents a first step; Communication/education/stakeholder engagement activities; the drafting of Guidelines for the long-term management of beaches.</p>	<p>In the project area, key threats to biodiversity are driven by economic and social factors that influence land and natural resource management decisions. The impact of tourism needs to be further reduced through communication, education, and engagement activities to modify the beach-dune system use and management practices.</p> <p>Communication, education, and engagement activities proved effective especially with tourists and residents as they have induced behavioural changes on the beach, making them more aware and respectful of the surrounding environment. These activities should continue, also thanks to synergies with environmental associations and volunteers, and be broadened to other Mediterranean coastal stretches (see e.g., the “Carta delle dune” initiative).</p>
Coastal flooding risk	<p>To mitigate the flood risk, the project actively restored mobile dunes which have been proven to effectively reduce the physical exposure of inland areas to natural hazards.</p> <p>The exceptional storm surge, occurred on 12th November 2019, severely damaged the newly created dunes that were too young to resist. However, to some extent the event turned out to be positive since it contributed to raise the stakeholder awareness.</p>	<p>The project contributed to mitigate the flood risk in the project areas. Research conducted during the project evidenced that about 80% of Venetian coast has characteristics that guarantee a high potential to host and maintain over time a dune system.</p> <p>Thus, the aim must be the enlargement of the area interested by interventions similar to those actuated by the project. To this end, the After LIFE Plan envisages an agreement to be signed with Regione Veneto - SIF to include among the regional projects of hydraulic-forestry management, works of reconstitution of mobile dune systems (habitats 2110 and 2120). The project team will ensure collaboration in the drafting of projects and the transfer of know-how, so that the interventions be implemented in the same way as developed by LIFE Redune.</p>
Mechanical beach cleaning	<p>During the project, we increasingly drew attention to the importance of a correct management of the beached materials, also taking advantage of the new law draft approved in the Chamber, which provides that the wooden material is no longer considered as a waste and could be</p>	<p>The issue related to the management of beached material is highly relevant in Italy. Beach cleaning is normally mechanical and indiscriminate (i.e., they do not differentiate between rubbish (plastic), sediment (sand) and organic beached material. This involves loss of sand, loss of the protection service</p>

	<p>then used also for re-naturalizations or left on the spot. Caorle Municipality approved a protocol for beach cleaning in Vallevicchia site, in accordance with VA, as the managing authority of the site. We also included a specific guideline in the Guidelines for the long-term management of beaches.</p> <p>Based on project advice, the Capalonga campsite and Caorle Municipality adopted a sustainable beach cleaning method that can be spread to other realities.</p>	<p>assured by biological beached material, and very high landfill costs for the Municipality.</p> <p>The project must primarily tackle these issues. The best practice adopted by the Capalonga campsite and Caorle Municipality (i.e., 1) selecting the materials (plastic waste vs. debris and other organic materials accumulated on the beach); 2) accumulating the organic materials (at least in part) at the dune toe to reinforce the young dune; 3) gathering the surplus materials in a chosen hidden location to dry and free the sediment they contain; 4) once dry, they can be sent to landfills, and the sand is redistributed on the beach, with significant savings that can be reinvested in other activities) will be spread.</p>
<p>Natural dynamics processes and excessive density of artificial pine woods</p>	<p>In the Veneto Region, the coastal pine woods have been commonly planted for avoiding land erosion after World War II. Pines were usually planted in pure stands at high density. Excessive density determines biodiversity loss of dominated layers (shrub and herbaceous flora, mycological component, meso-and micro-fauna) and decay due to phytopathological causes. A selective thinning is the most effective silvicultural treatment to enhance the ecological value of these stands and to facilitate the transition toward a mixed forest.</p>	<p>An increased specific structural diversity is not always perceived by the general public and stakeholders as positively as expected. People are more used to artificial, one-storied pine woods that are perceived as cleaner and neater than more natural ones.</p> <p>Much effort should be dedicated to this issue in communication and educational activities.</p> <p>We actively transferred knowledge and expertise to the personnel of the SIF, who will adopt the approach in areas outside the project areas.</p>
<p>Presence and spread of Invasive Alien Species</p>	<p>Beside actively working for the control/eradication/management of <i>O. stucchii</i>, we produced a report (Guidelines for the management of <i>Oenothera stucchii</i> Soldano in coastal habitats) that summarises data from research, monitoring and evaluation of interventions carried out during the implementation of the Project LIFE Redune. Although the report specifically focuses on <i>O. stucchii</i>, it is worth recalling that this species shares biological and ecological traits with several phylogenetically related species belonging to the sect. <i>Oenothera</i> subsect. <i>Oenothera</i>; this makes our guidelines potentially applicable to functionally similar congeners.</p>	<p>Data from research and monitoring evidenced that <i>O. stucchii</i> can only establish if vegetation-free gaps are available. The occurrence of <i>O. stucchii</i> was mostly related to the proximity of beach accesses (as a proxy of disturbance and propagule pressure), and foredune morphology, with the probability of presence decreasing with the distance from the nearest beach access and with the height of the foredune. The increased wind and sand inundation due to lower foredune ridges act synergically with human disturbance, in the form of trampling, causing death or severe reduction of native species fitness and the formation of small gaps (bare sand), thereby facilitating the establishment of <i>O. stucchii</i>.</p>

	We also produced a Risk Assessment of the species in Italy as requested by the Regulation on Invasive Alien Species No 1143/2014.	This means that the control of <i>O. stucchii</i> can be assured only with a correct management of the systems (i.e., reduction of human trampling, active restoration of mobile and shifting dunes; active restoration of native communities).
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Economic benefits

The main economic benefit of the project could lie in the lower cost of recreation and maintenance of the dunes, compared to the use of other coastal management and protection techniques such as beach nourishment and the installation of sea barriers to curb erosion.

Other economic benefits could derive from the savings coming from the beach organic waste recycling we suggested, allowing Municipalities and economic operators to economize on landfilling.

Number of Full-Time equivalent jobs created: 4, qualified.

Social benefits

The project provided several social benefits, in part described by the KPI indicators, to the following categories:

- Visitors to the project area: tourists, local residents, students, etc. who visited project areas were able to take advantage of events organised by the project team. Most important, the events dedicated to technicians and voluntary associations contributed to knowledge transfer that can currently be used by operators
- Personnel of the Regional SIF: they were involved in field surveys to transfer them the know-how and technical tips regarding, specifically, the selective thinning (in habitats 2130* and 2270*), and the control of *O. stucchii*; with a positive effect on their professional knowledge
- Privates for profit: stakeholders related to tourist facilities have been involved in project activities with increase of their knowledge and consequent competitive ability: Camping Capalonga - Bibione; Centro Vacanze Nascimbeni – Cavallino Treporti; Mete Beach – Eraclea.
- NGOs: the environmental associations, such as Legambiente Onlus and LIPU which helped us in educational activities, and volunteer associations involved in surveillance activities, such as the Associazione Nazionale Carabinieri section of Jesolo and Cavallino (national voluntary association of retired carabinieri) and the Coast Guard Delta Tagliamento; in this case the benefits relate to increased personal satisfaction and motivation in participating in such an important project.

Replicability, transferability, cooperation

The approach we used in the project has a high replicability potential, since the measures we adopted proved to be cost-effective, and able to simultaneously supply diverse benefits.

At a local (regional) scale, the After LIFE Plan envisages the increase in the spatial extension of all Actions devoted to habitat restoration through an agreement to be signed with Regione Veneto - SIF to include among the regional projects of hydraulic-forestry management, works of reconstitution of mobile dune systems (habitats 2110 and 2120), and restoration of transition (habitat 2130*) and fixed dunes (habitats 2250* and 2270*). The project team will ensure collaboration in the drafting of projects and the transfer of know-how, so that the interventions be implemented following our approach. The design of the interventions will be based on the evaluation of indicators and indices, developed during the project and summarised in the document “Methods to assess coastal dune restoration potential”. The plants to be used for the restoration will be provided by the nursery of VA, whose production will be planned on the basis of the interventions envisaged in the regional projects. Personnel of the SIF have already

been involved during the project and already acquired know-how and technical skills regarding, in particular, the selective thinning (in habitats 2270* and 2130*), and the control of *O. stucchii*.

At larger scale, two main points caught the attention, namely, shifting dune reconstruction and the native plant production. The experience acquired during the project has been respectively summarised in the Guidelines for a sustainable use of coastal dunes, and in the Handbook for the propagation of dunal species. The latter, in particular, provides key advice for the successful use of native seed.

Another crucial action that can be replicated regards beach cleaning modalities. The modality we proposed does not constitute a novelty, but it is normally opposed by municipalities and operators because it requires greater attention. The method involves 1) selecting the materials (plastic waste vs. debris and other organic materials accumulated on the beach); 2) accumulating the organic materials (at least in part) at the dune toe to reinforce the young dune; 3) gathering the surplus materials in a chosen hidden location to dry and free the sediment they contain; 4) once dry, they can be sent to landfills, and the sand is redistributed on the beach.

Best Practice lessons

The closure of particularly critical (high damage to habitats and species due to excessive human impact, e.g., trampling) unauthorized accesses to the beach has been made also by recycling driftwood or woody material deriving from the selective thinning of pine woods; specifically a) seaside: driftwood was used to build palisades to both consolidate the dune and close the unauthorized access routes, b) inland side: woody material deriving from the selective thinning of pine woods was used to build heaps to close the access; their efficacy was enhanced by planting thorny plants.

Actions C1, C4, C5, and C6: the strategy we followed for the call for tenders concerning all the works planned in the actions C1, C4, C5, and C6 represents another good example of best practice. RV prepared the procedure before the technical blueprint was finalised. This allowed the publication of the market survey immediately after the final plan approval. Moreover, the selection procedure was promoted on the project website, RV institutional website, social networks, allowing us to receive a very high number (63) of expressions of interest and to select the best company and guarantee the effectiveness of the project actions.

Innovation and demonstration value

Shifting dune restoration: to recreate and/or reconnect shifting dunes we used a sustainable and cost-effective approach. Dune profiling was achieved by using sediment collected in-site with a small excavator. Sand was then manually redeployed to create more natural landforms. Besides being a cost-effective approach compared to the use of sediments dredged from open sea borrow-sites, this approach also allows to use nourishment sand of known provenance and with grain size similar to that of extant dunes. To trigger the dune building, we chose a multispecies planting, including not only the two classical dune-forming perennial grasses, i.e., marram grass (*Ammophila arenaria*) and sand couchgrass (*Elymus farctus*), but also other species which contribute to increase the success in accumulating sand, providing good plant cover and, at the same time, increasing biodiversity. The protection of newly created dunes was increased by recycling marine debris, such as driftwoods and wracks, and piling it up at the seaward edge of the dunes. This strategy has two main outcomes. Firstly, from a naturalistic view, it provides a unique combination of intermediate stability and high structural complexity. Secondly, from a policy view, it appears as a profitable example of beach organic waste recycling, allowing Municipalities to economize on landfilling.

Selective thinning in the habitat 2270*: we adopted a recycling approach which in this case involves the use of small dimension timber, supplied by the thinning operations, to close the most critical unauthorised paths. This strategy simultaneously allows to increase the fence efficacy, and to economize on landfilling.

Control of the IAS *Oenothera stucchii*: to our knowledge, in Europe, the eradication interventions have mainly targeted perennial, often woody, species which are to a certain extent easier to eradicate due to their biological cycle and life-strategy. Short-cycle species (annual or biennial) adopt a ruderal strategy (with the production of numerous propagules -fruits and seeds), adapted to the severe disturbance which sandy dune ecosystems are subject to. We produced Guidelines that summarise data from research, monitoring and evaluation of interventions carried out during the implementation of the project.

Native plant production: many nature conservation or mitigation projects are hindered by the lack of availability of a suitable soil seed bank or nearby source area for re-colonisation by native plant species. As more and more restoration projects are being conducted, there is a rising demand for seeds of native species. The Bonn Challenge, which seeks to restore 350 million ha of deforested and degraded land by 2030, may require million tons of seeds. Wild harvest of high quantity of material is unsustainable; thus, we need both a) to multiply native seed through cultivation from wild-collected seed on specialised farms and b) to understand the biology and ecology of seeds, the potential pre-treatments to enhance germination and the factors that are key in establishing and persisting in a community. The “Handbook for the propagation of species of the Adriatic dunal environments” can serve this purpose. It is based on the experience of three LIFE Projects (LIFE CALLIOPE, LIFE Redune and LIFE MAESTRALE) and aims to provide technical and practical information for efficient and easily replicable plant production.

Policy implications

The project played a major role in shedding light on Conservation Measures in the Natura 2000 network. Despite being approved in 2017, they were neither known nor put in action.

This situation derived from the fact that the Municipalities were genuinely unaware of them; however, we cannot neglect the socio-economic context in which the project operated, namely a Region where tourism registered 25 million visitors in 2019 and represents one of the main economic incomes of the region, raising conflicts between socio-economic interests and the protection of vulnerable ecosystems. The deliberative act (D.G.R._n. 261 of 15 March 2022) in which Veneto Region officially approved the “Guidelines for the long-term management of beaches” can stimulate the necessary transformative change in public and business decision-making.

However, we have to highlight one major weakness, common to all coastal areas, that concerns the management jurisdiction. Given that coastal ecosystems lay between terrestrial and marine environments, management jurisdictions often start or end at the shoreline, and multiple agencies at different levels of government often have overlapping roles. Different authorities issue laws and regulations mostly working independently from each other, and often with conflicting management goals or priorities. In this regard, for example, the Conservation Measures only represented another of the several laws and regulations regarding coastal areas. The wide variety of laws, regulations, management agencies, and stakeholders made it extremely difficult to identify a privileged, unique representative and be effective in engaging it. Similarly, although many laws exist that relate to different components of coastal areas, a diversity of organisations are responsible for their implementation and often lack the authority to address factors that occur outside their jurisdictions.

In such a situation, we conclude that a successful large-scale implementation of these measures requires extensive coordination in multi-level governance and a combination of reforms regarding institutional arrangements.

7 Key Project-level Indicators

The table below illustrates the main outcomes and some explanations to facilitate the comprehension of the values reported in the annexes and in the online KPI database. Values reported are, however, consistent with the environmental, economic and social benefits reported in the previous sections.

Indicator	Descriptor	First level descriptor(s)	Project end
1.5	Project area	Conservation or improvement of the status of an area or segment	The project foresaw to improve the conservation status of 91,5 ha of target habitats within the project sites both through the improvement of species composition and structure (representativity), and the increase in surface (mostly habitat 2250*). At the end of the project, the total surface is slightly higher than expected, amounting to 92,06 ha.
1.6	Humans (to be) influenced by the project	1) Persons who changed their behaviour or practices due to the project actions 2) Persons who may have been influenced via dissemination or awareness raising project-actions (reaching)	The two First level descriptors have been calculated as follows: 1) Persons who changed their behaviour...: we specifically refer to stakeholders (municipalities, campsites, bathing facilities, tourist consortia) that committed to the project by adopting the Guidelines for a sustainable management of coastal sites produced in action E.3. The project expected the five Municipalities that had signed the form A.8 to also sign the agreement and adopt the Guidelines. At the end, Guidelines were officially adopted by two overarching Authorities which competencies have effects at supra-municipal level: the Regional Council of Veneto Region, and the MAB UNESCO Natural Park of the Po Delta. In this way, the overall territory in which Guidelines will be implemented comprises the entire Venetian coast (more than 100 km of coasts). Moreover, although included in the above mentioned territory, 1 Municipality signed the agreement. Finally, we also counted here a campsite (Capalonga campsite) and Caorle Municipality that adopted a beach cleaning management following project guidelines. 2) Persons who may have been influenced...: we refer to the cumulative number of tourists, residents, students, etc. who visited project areas taking advantage of events organised by the project team and were possibly influenced. At the end of the project the persons who have been possibly influenced amount to 8,374, much higher than those foreseen at the beginning (5,000).
7.2	Ecosystem services assessment	1) Ecosystem Service Trend 2) Ecosystem Service Condition As second level descriptors we chose: 1) Total sequestered carbon; 2) Beached materials; 3) Naturalistic activities	At the onset of the project no data regarding coastal dune ecosystem services were available. The measurements done during the first two years thus represented the baseline. This allowed us to assess both Condition and Trend. Since ES conditions and trends depend on habitat conditions, at the beginning of the project, we set them either unknown (condition) or deteriorating (trend) as the trend of habitat

			<p>conservation status was declining. Following habitat improvement as a result of project actions, we set them respectively as “moderate” and “some improvement”.</p> <p>As for the second level descriptors, they have been calculated as follows: 1) Total sequestered carbon: quantification of primary production of dune habitats, and estimation of corresponding amount of carbon removed from the atmosphere, based on total habitat surface (Bosco Nordio site excluded); 2) Beached materials: proportion of beach surface covered by organic materials (wood, algae); 3) Naturalistic activities: number of environmental education activities offered by local stakeholders (data derived from questionnaires of action D.4)</p> <p>1) Results suggest that primary production and the associated removal of atmospheric carbon of dune habitats are comparable in magnitude with that of habitats well known for their carbon sequestration capacity (e.g., salt marshes) and could play a role in climate change mitigation. The increasing in vegetation cover, coupled with the increase in total surface of habitats determined a rise of the overall primary production and therefore of the capacity to remove CO2 from the atmosphere.</p> <p>2) Results are somewhat discouraging, since the percentage of beached material left on the beach decreased. Nevertheless, it must be considered that the quantity of beached material is subjected to different variables such as the intensity of weather events and human activities along river courses, that are difficult to control. The project demonstrated the utility of beach material and gave advice for their correct management. <u>Two stakeholders (Caorle Municipality and the Campsite Capalonga) changed beach cleaning management practices.</u></p> <p>3) Compared to the ex-ante results, a growing number of tourist operators recognizes the importance of dune habitats and offers naturalistic activities to visitors.</p>
7.3	Natural and semi-natural habitats	<p>1) Habitat Condition 2) Habitat Trend</p>	<p>The descriptors refer to the 4 habitat types targeted by the project: 2110/2120; 2130*; 2250*; 2270*.</p> <p>Quantitative values have been conceived as follows: 1) habitats 2110/2120, 2130* and 2270*: the project foresaw the improvement of the conservation status, thus the “start value” corresponds to the surface of a given habitat that had to be restored, and “at the end value” refers to the surface actually restored; 2) in the case of habitat 2250*, for which the project foresaw an increase in surface, the “start value” corresponds to the surface (in ha) occupied by the habitat at regional level and “at the end value” refers to the surface actually created by project actions.</p> <p>The implementation of nature-based interventions (e.g., selective thinning; seedlings plantation; dune reconstruction) proved to be effective in reaching project goals in terms of</p>

			<p>species composition restoration as well as surface increase. In some cases, at the end surfaces slightly exceed those expected. We have to be more cautious regarding trends and conditions. The efficacy of interventions in reversing the negative conditions and trends needs longer time than the project lifetime to be detected. It must be considered that <u>if changes in ecosystem structure are quite immediately detectable, ecosystem processes that derive from restoration activities need longer time to develop.</u></p>
7.4	Wildlife species	<p>1) Annex II Habitats Directive species (<i>Stipa veneta</i>*); two units: a) n. of individuals b) surface in ha 2) Species Status 3) Species Trend</p>	<p>This indicator specifically regards the priority species <i>Stipa veneta</i>*. Since the largest population was excluded from the project areas, our start value dropped to 161 individuals, subdivided into 2 populations: 1 population with 50 individuals (Laguna del Mort site) and the second (Punta Tagliamento site) with 111 ind.</p> <p>The project foresaw the restocking of populations through the introduction of 1,000 new seedlings (500 each population). Since seedlings were produced from seeds, we expected to increase genetic diversity thereby reducing problems of inbreeding depression.</p> <p>At the end of the project, 1,630 new seedlings had been planted (more than planned). Thus, the end value corresponds to the sum of individuals already present (161), and the seedlings introduced by the project (1,630). Our choice derives from some consideration: a) the high mortality rate of the first 542 seedlings could be due to the delay in planting because of 2019 storm surge; b) the majority of seedlings (1,088) has been planted in 2021 and we do not have data yet; c) the 1,088 seedlings have been planted in different sites and locations and results of mortality rate could possibly be different; d) population dynamics occur over several generations; therefore, the positive effects linked to the increase of genetic diversity require longer time to be detected. Considering IUCN Criterion B, <i>S. veneta</i> must still be classified as EN.</p>
7.5.1	Invasive Alien Species	<p>1) <i>Oenothera stucchii</i>; two units: a) density (n. of individuals/ha) b) surface in ha</p>	<p>The second level descriptor refers to the IAS <i>Oenothera stucchii</i>. In this case, the “start value” corresponds to the surface, within the project area, affected by <i>O. stucchii</i> invasion (35 ha). The project foresaw the control of the species in 15 ha and a decrease of the n. of individuals/ha.</p> <p>At the end of the project, thanks to project efforts, the area treated amounted to 23,6 ha, and the population density dropped to 15,000/ha. Results are encouraging; however, given the life history traits of the species, the interventions need to be monitored in the next years to evaluate their efficacy and interventions have possibly to be redone. Analogously, the density needs to be monitored on the next growing seasons due to possible</p>

			effects of increasing temperature that seem to stimulate seed germination.
10.1.2	Supervisory /enforcement bodies involved	1) Regional authorities	The indicator refers to public bodies that voluntarily and actively supported the project. The Forest, Environmental and Agri-food Unit of Forest Rangers, and the Coast Guard were involved in surveillance activities. The SIF, which is a regional body responsible for the drafting of annual projects of land restoration, was involved in field surveys to transfer them the know-how and technical tips regarding, specifically, the selective thinning (in habitats 2130* and 2270*), and the control of <i>O. stucchii</i>.
10.2	Effect/impact of involving non-governmental organisations (NGOs) and other stakeholders in project activities	1) Private for profit 2) NGO	1) Private for profit: this category includes private companies or trade associations that supported the project. The “start value” corresponded to the 4 entities that had signed the Form A8. At the end of the project, the overall number of entities was 7; which included all the former entities, plus two newly involved entities (Campsite Marina di Venezia; Campsite Capalonga, Centro Vacanze Opera Nascimbeni). 2) NGO: this category includes volunteer associations that actively supported the project. The “start value” corresponded to the entity that had signed the Form A8. At the end of the project, the overall number of entities was 6; we have been able to positively interact with the Associazione Nazionale Carabinieri section of Jesolo and Cavallino (national voluntary association of retired carabinieri) involved in surveillance activities; and the Coast Guard Delta Tagliamento; Legambiente Onlus, LIPU, Acqua Natura e Cultura cooperative, Ornithologist association and Comitato Riserva naturale Foce del Tagliamento that were involved in both surveillance and educational activities.
11.1	Website (mandatory)	1) Average visit duration (min) 2) No. of unique visits 3) No. of individuals 4) No. Downloads	This indicator aims at detecting the helpfulness of the project website in reaching out people with project information, updates, and documentation. Despite much effort in promoting and populating our website, the number of visitors did not reach the expected outputs neither in the number of visits/individuals nor in the duration of the visit. Conversely, <u>the number of downloads steadily increased during the project, confirming the importance of the website as a repository of all produced documentation.</u>
11.2	Other tools for reaching/raising awareness of the general public	1) Events/exhibitions 2) Publications/reports 3) Print media 4) Other media (video/broadcast) 5) Displayed information (poster, information boards) 6) Hotline/information centre	First level descriptors have been calculated as follows: 1) Events/exhibitions: <u>cumulative number</u> of events or exhibition organized or attended by the project team (e.g., project public presentation conference, congresses, or workshops and any other educational activities organised by the team).

			<p>2) Publications/reports: <u>cumulative number</u> of scientific papers and educational publications published by project team.</p> <p>3) Print media: <u>cumulative number</u> of articles published in newspapers and magazines.</p> <p>4) Other media (video/broadcast): <u>cumulative number</u> of any materials (leaflets, A3 posters, handbills, etc.) printed by the project.</p> <p>5) Displayed information (poster, information boards): <u>cumulative number</u> of outdoor and indoor information boards, “dissuading” panels, Kentish Plover boards.</p> <p>6) Hotline/information centre: number of permanent information centres either created during the project, or already existing to which the project provided educational boards and printed materials.</p> <p>The tools listed above have been much more effective than the website in reaching out people. Overall, at the end of the project, the real final values were higher than what expected also thank to budget savings and partners effort (extra budget)</p>
12.1	Networking (mandatory)	1) Others	<p>This indicator refers the cumulative number of individuals that have been included or participated in any networking activities. It includes people attending the networking visits, and all workshops regarding dune ecosystems that the project team participated in.</p> <p>During the project we established interactions with several, different people, projects, and entities to possibly cover all the issues and aspects related to the project implementation (e.g., concrete actions, communication, stakeholder engagement, policy). This approach revealed to be the best strategy to fully and successfully implement networking activities. And, at the end of the project, the number of interactions was higher than expected. The networking activities only slowed down between 2020 and 2021 due to Covid-19 outbreak that forced us to change some activities.</p>
13	Jobs	1) Jobs	<p>This indicator refers to the number of project related jobs expressed in full-time equivalents (FTE). The “at the end value” is the sum of all people who have been involved in the project by the project team.</p> <p>Over the project, we hired 9 additional staff. The activities that mostly catalysed the creation of new jobs were related to communication, monitoring and project management activities. Moreover, we might expect that beyond the project, private companies that participated in the project and thus enhanced their business profile and competitiveness will be able to access to new business opportunities that can further foster new green job creation.</p>
14.1	Total project related	1) Running cost/operating costs during the project	<p>The first level descriptor refers to the total project-related expenditure during the project period. Thus, the start had been set at 0,00€ and the “at the end</p>

	expenditure during the project period		<p>value” corresponds to the total project related expenditure from the beginning to the end of the project. It comprises both budgeted and not-budgeted costs.</p> <p>Overall, the total expenditure is coherent with the activities foreseen in the project. And 98% of the forecast project budget has been spent. Major differences between the forecast and actual budget occurred with reference to cost categories “Travel and subsistence” and “Other costs”. Savings in “Travel and subsistence” costs are related first of all to the Covid-19 restrictions, which greatly limited travels in person in the networking and replication activities, as well as the attendance to national and international conferences, with savings also in the linked “other costs”. Moreover, monitoring activities were planned with car sharing solutions. Specifically, when possible, field activities of different actions were planned in the same day and at same project sites to facilitate car sharing. Moreover, since project sites were often quite isolated, project staff used to bring food from home instead of having lunch at the restaurant, further saving “Travel and subsistence” related budget. Regarding “Other costs” cost category, when applied, public tenders allowed to select best value for money products. Moreover, the use of partner internal expertise to carry out project related activities formerly included under the cost category “Other costs” allowed to accumulate savings.</p>
14.2.2	Operating expenses expected in case of continuation/replication/transfer after the project end	Operating expenses expected in case of continuation/replication/transfer after the project period	<p>The indicator value is expressed as annual costs. The estimated costs for continuation/replication/transfer after the project period amounts to 250,000.00 €/year. Estimated costs include both the ordinary maintenance of structures and infrastructures and habitat/species monitoring, and the replication/transfer to other areas along the Veneto coastal stretches.</p>
14.2.3	Revenue expected in case of continuation/replication/transfer after the project end	Revenue expected in case of continuation/replication/transfer after the project end	<p>The indicator value is expressed as annual revenue. The estimated revenue for continuation/replication/transfer after the project period amounts to 100,000.00 €/year. This indicator has been filled in considering that 1) in case of public bodies, no direct revenue is expected; replication and transfer will be part of the institutional activity; 2) on the contrary, private companies that participated in the project and thus enhanced their business profile and competitiveness will be able to access new business opportunities</p>
14.3	Future funding	Beneficiaries’ own contribution	<p>The indicator value expresses the annual rough estimate of funds needed to continue the actions as for page 82 of the proposal. The estimated future funding amounts to 100,000.00 €/year.</p>

			This indicator has been filled in considering that 1) possible funding can only come from public bodies; 2) among public bodies, Universities can only contribute by valorising personnel time; 3) political-administrative Institutions and their Agencies can contribute by including project actions in their ordinary activities, through personnel time valorisation and funds allocation.
14.4.3	Entry into new geographical areas	ITALIA (ITALY)	Coastal dunes are facing a worrying decline worldwide; however, Mediterranean developed sandy coasts are subjected to intense tourism exploitation and more in need to solve conflicts between socio-economic interests and the protection of these vulnerable ecosystems.

a.1 Project Timetable

N.	Action title	2017		2018				2019				2020				2021				2022			
		3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2		
	Reports foreseen: P=Progress, M=Mid Term, F=Final Actions: foreseen = X, realized = O Mistakenly scheduled = ✕ Requested changes = C Action Delay (Exceptional storm/Covid-19) = D							P				P				P						F	
A.1	Designing and planning of the interventions	X	X	X	X																		
		O	O	O	O																		
A.2	Consultation with stakeholders	X	X	X	X																		
		O	O	O	O																		
C.1	Impact reducing interventions						X	X	X	X	X												
							O	O	O	O	O	D	D	D									
C.2	Production of plants for Actions C3, C4 and C5			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
				O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O			
C.3	Restoring of habitats 2110-2120					X	X			X	X			C	C								
						O	O			O	O			O	O	D	D						
C.4	Restoring of habitats 2130*, 2250*, 2270*				X	X	X		X	X	X		X	X	X	C	C	C					
					O	O	O		O	O	O		O	O	O	O	O	O					
C.5	Reinforcing the <i>Stipa veneta</i> * populations								X	X			X	X	C	C	C	C					
									O	O			O	O	O	O	O	O					
C.6	Containment of <i>Oenothera stucchii</i>			✕	✕			X	X			X	X		C	C							
								O	O			O	O		O	O							
D.1	Monitoring anthropic threats	X	X	X	C	C	C	C	C	C	X	X	X	X	X	C	X	X	X				
		O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O				
D.2	Monitoring <i>Stipa</i> , <i>Oenothera</i> , and habitats	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
		O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
D.3	Monitoring ecosystem functions	X	X	X	X		C	C	C	C	C	C	C	C	C	X	X	X	X				
		O	O	O	O		O	O	O	O	O	O	O	O	O	O	O	O	O				
D.4	Monitoring socio-economic impact	X	X	X	X	X										X	X	X	X				
		O	O	O	O	O										O	O	O	O				
E.1	Dissemination	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
		O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
E.2	Transfer and replication									X	X	X	X	X	X	X	X	X	X	X	X	X	
										O	O	O	O	O	O	O	O	O	O	O	O	O	
E.3	Beach management agreement					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C		
						O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
E.4	Environmental education							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
								O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
E.5	Networking	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
		O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
F.1	Coordination and management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
		O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
F.2	Filling in the indicators			C			X			X			X								X		
				O			O			O			O								O		

a.2 Deliverables and Milestones

The tables show the progress of due deliverables and milestones as well as the modifications to some of the deadlines (C6 postponement was agreed to by the desk officer in e-mail dated 5/09/2018). The ones proposed with the progress report, which are indicated in red, are described in the corresponding action.

Deliverables

Ac.N.	B. Resp.	Deliverable name	Already delivered	Annexed to the FR
A1	EPC	Final – technical blueprint	X	
A1	EPC	Preliminary project	Not needed	
A1	EPC	Drafting of the VINCA	Not needed	
A2	RV	Report on the result of the consultation meetings with stakeholders	X	
C1	RV	Final report on the works		X
C3	SELC	First report on the action	X	
C3	SELC	Second report on the action		X
C3	SELC	Third report on the action		X
C4	RV	Intermediate technical report on the state of progress of the works (10 pages)		X
C4	RV	Final technical report (20 pages)		X
C5	RV	Intermediate technical report on the state of progress of the works (10 pages)		X
C5	RV	Final technical report (20 pages)		X
C6	RV	Intermediate technical report on the state of progress of the works (10 pages)		X
C6	RV	Final technical report (20 pages)		X
D1	EPC	No. 1 ex-ante assessment of the coastal structure system with identification of most suitable sites for withdrawing seeds and defining list of species & composition planting interventions	X	
D1	EPC	No. 1 ex-ante map of the habitats 1:500	X	
D1	EPC	No. 1 intermediate map of the habitats 1:500		X
D1	EPC	No. 1 ex-post assessment of the coastal structure system		X
D1	EPC	No. 1 ex-post map of the habitats 1:500		X
D2	UNIVE	Forms of the 5 Natura 2000 sites to be updated by RegVe		X
D2	UNIVE	Ex-ante assessment of state of conservation of habitats and species populations	X	
D2	UNIVE	Ex-post assessment of state of conservation of habitats and species populations		X

D3	UNIVE	Ex-ante report	X	
D3	UNIVE	Ex-post report		X
D4	EPC	Socio-economic monitoring plan of the project	X	
D4	EPC	Final report on socio-economic impact of the project		X
E1	EPC	Laymen's report		X
E1	EPC	Videos		X
E1	EPC	Panels		X
E1	EPC	Website and social network pages	Online	Online
E1	EPC	Brochures	X	
E1	EPC	Communication plan	X	
E2	EPC	Guidelines for replication on <i>Oenothera</i> , use of drones, involvement of stakeholders		X
E3	RV	Guidelines for long-term management of the beaches by the stakeholders		X
E4	EPC	Report on the environmental education activities		X
E5	UNIVE	Report on the networking activities		X
F1	UNIVE	After Life Plan		X
F1	UNIVE	Minutes of the meetings of the Executive Committee		X
F2	UNIVE	Table with indicators updated to the ex-ante situation	Online	
F2	UNIVE	Table with updated state of progress indicators (2019)	X (.xls)	
F2	UNIVE	Table with updated state of progress indicators (2020)	X (.xls)	
F2	UNIVE	Table with updated state of progress indicators (2021)		X
F2	UNIVE	Table with indicators updated at the end of the project		Online and .xls

Milestone

Ac. N.	B. Resp.	Milestone name	Foreseen deadline	new date proposed in PRs/MTR	Achieved as scheduled
A1	EPC	Consultation of printouts with local entities and acquisition of formal authorising opinions	01/08/2018	01/08/2018	X
A1	EPC	VINCA approval	01/04/2018		Not needed
A2	RV	Start of meetings with stakeholders	31/01/2018	15/12/2017	X
C1	RV	Defining of bids for tender	31/12/2018	11/09/2018	X

C2	VA	Completion of sowing (supply) of a quarter of the foreseen plants	30/11/2018	30/11/2018	X
C2	VA	Completion of the seed collection	30/11/2019		30/11/2020
C2	VA	Completion of the total supply of plants foreseen	30/11/2021		X
C3	SELC	Completion of planting	31/12/2019	31/12/2021	X
C3	SELC	Completion of recreation of the dunes	30/11/2018	30/11/2020	30/11/2021
C4	RV	Start of planting of herbaceous and wood species for the habitats 2130*, 2250* and 2270*	01/10/2018	10/09/2018	X
D1	EPC	Drafting of no. 1 final report	30/11/2021		X
D1	EPC	Drafting of no. 1 intermediate report on monitoring of threats	30/11/2019	30/06/2020	X
D1	EPC	Drafting of no. 1 ex-ante report including information for the final design	30/06/2018	30/06/2018	X
D2	UNIVE	Start of monitoring of planting of species and representativeness of habitats	30/09/2018	30/09/2018	X
D4	EPC	Collection of ex-ante questionnaires filled in by the 2 focus groups	30/09/2018	30/09/2018	X
E1	EPC	Final public event	31/03/2021	31/03/2022	X
E1	EPC	Public presentation event	20/12/2017	23/2/2018	X
E2	EPC	First transfer and replication tour	30/06/2020		30/06/2021
E3	RV	Approval of the guidelines by the stakeholders	30/10/2021		30/06/2022
E4	EPC	Start of guided tours	01/07/2019	01/06/2019	X
E5	UNIVE	First networking journey	01/07/2018	20/04/2018	X