



# TRAIN#ER DEMO SITES

Examples towards a future European Network of Demonstration Sites on Ecological Restoration Training



Funded by the European Union

## TRAIN#ER Examples towards a future European Network of Demonstration Sites on Ecological Restoration Training – February 2023

### ERASMUS+ TRAIN#ER project:



### Funded by Erasmus+, Small-scale Partnerships

**Project code:** 2021-2-BE02-KA210-VET-000049240

**Duration:** 03/2022 - 02/2023.

[TRAIN#ER at the Erasmus+ Project Results Platform](#)

[TRAIN#ER webpage](#)

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<https://chapter.ser.org/europe/trainer/>.

## INTRODUCTION

Every project partner representing one country added one example demonstration site to the Society for Ecological Restoration (SER Global) Restoration Resource Centre database (<https://www.ser-rrc.org/project-database/>) by January 2023. The database contains restoration projects from around the world and is intended to serve as a resource for practitioners, researchers, educators, students, and the general public. The example entry will include the keyword “demonstration” to show that these sites are available for excursions, teaching activities, etc.

Database structure: Fields marked with **red asterisks** are mandatory. Fields **highlighted in yellow** were agreed to be included during the workshop. **In blue** is the example entry of each country.

## NEAR-NATURAL RESTORATION OF URBAN SITES: BEST PRACTICE EXAMPLES IN THE CAMPUS OF THE UNIVERSITY OF SOUTH BOHEMIA IN ČESKÉ BUDĚJOVICE, CZECH REPUBLIC

### Project Name \*

*Provide a descriptive name for the case study including the geographic location.*

Near-natural restoration of urban sites: Best practice examples in the campus of the University of South Bohemia in České Budějovice, Czech Republic

### Project Overview \*(limit 200 words)

*Provide a short summary of the project, including the geographic location, the ecological and social context, the restoration goals and activities, and key outcomes and lessons learned.*

**Overview:** The campus of the University of South Bohemia hosts several experimental sites supporting the biodiversity of higher plants, insects, and other groups of organisms in the urban environment, serving educative and research purposes, and increasing the aesthetical value. These experimental sites include the Faculty Garden sand dune, flowering strips, extensively mown grasslands, and a meadow newly established from a regional seed mixture.

**Background:** The historical landscape was composed of a mosaic of various types of habitats. The impact of large-scale and intensive landscape management changed the landscape structure affecting not only the abundance of endangered species but also other species relatively common in the past. Attempts to increase biodiversity have been previously conducted in agricultural as well as other human-made landscapes.

**Keywords:** demonstration, training, regional seed mixture

**Target group:** vocational education and training + further education

**Orientation:** urban ecology

**Practical information:**

- Accessibility: freely accessible
- Guide needed: no
- Best season for visit: May – September

- Regular field trips: yearly monitoring (contact: Klára Řehouňková, klara.rehounekova@gmail.com; Anna Müllerová, polarni.badatel@seznam.cz)

Training value: Regular monitoring of the sites allows to evaluate and recommend appropriate management. The sites represent best practice examples to enhance biodiversity in the urban environment.

### Project Location

*If possible, please click the map to drop a pin on the map to indicate the project location.*

University of South Bohemia, České Budějovice, Czech Republic

Geographic Region \*(select)

Europe

Country or territory \*(select)

Czech Republic

Biome \*(select)

Temperate forest

Ecosystem \*(select)

Grasslands & Savannas - temperate

Project area \*(select)

<20 ha

Project Lead \*

- Please indicate the entity that is primarily responsible for implementing the restoration activities.  
Restoration Ecology group, Department of Botany, Faculty of Science, University of South Bohemia
- What type of organization is the lead entity? (select)  
University/Academic Institution

Key Partners \*

*List the key organizations involved in the project.*

Faculty of Science, University of South Bohemia

Project Stage \*(select)

Monitoring and Evaluation

Project Duration \*

- Project Start Date  
*When did planning and design begin? In YYYY-MM format, please.*  
2014-04
- Project End Date  
*When did implementation of restoration activities/treatments conclude, or when is it expected to conclude?  
In YYYY-MM format, please.*  
2022-03

Primary Causes of Degradation \*(select all that apply)

- Agriculture & Livestock
- Climate Change
- Contamination (biological, chemical, physical or radiological)

- Dams & Hydrology
- Deforestation
- Fire & Weather Events
- Fisheries & Aquaculture
- Fragmentation
- Invasive Species (native or non-native pests, pathogens or plants)
- Mining & Resource Extraction
- X** Urbanization, Transportation & Industry
- Other

## Project Goals \*

*What are the project's primary goals, both ecological and socio-economic?*

The primary goal was to improve the nature conservation potential and aesthetical value of the urban environment. The campus serves to increase the biodiversity of higher plants, insects, and other groups of organisms and creates a resting area for students and university staff. At the same time, it is serving as an example of a highly structured "wilderness" providing habitat for animals and plants, useful for teaching purposes as a best practice, oriented to achieve near-natural restoration of urban sites.

## Key Lessons Learned

*Describe key lessons learned, including mid-course corrections or adaptive management actions to address unforeseen challenges.*

Transferring biomass from well-preserved dry grasslands can be a successful approach for the restoration of psammophytic habitats.

Site preparation of the plots for the sowing of regional seed mixtures is crucial to avoid the expansion of undesirable plant species.

The type of material used for re-grassing (threshed material vs. seed biomass) may influence the success of grassland restoration.

## Long-Term Management

*What plans exist for post-implementation monitoring and long-term maintenance of the restored ecosystem? Who is responsible for each of these activities? What plans exist for the ongoing involvement of stakeholders? What other strategies are planned for future management of the site?*

The sites are regularly (selectively, mosaic) mown in connection with monitoring. The sand dune is regularly intentionally disturbed, and the woody species and undesirable expansive species are removed to keep the site partly open.

## Related Research

- Is the project part of any ongoing research or peer-reviewed study? (Y/N)  
YES
- If not, are you interested in connecting with a researcher to collect data on the project? (Y/N)

## Other Resources

*Direct readers to more information about your project by providing a link to the project website or to relevant reports/publications.*

Restoration Ecology Group: <http://www.restoration-ecology.eu/>

Guidelines to establish flower-rich structures in urban and rural areas:

[http://restoration-ecology.eu/common\\_files/uploads/Guidelines\\_flower-rich%20structures%20FINAL.PDF](http://restoration-ecology.eu/common_files/uploads/Guidelines_flower-rich%20structures%20FINAL.PDF)

Link to leaflets:



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the European Union

- Faculty garden  
[http://www.restoration-ecology.eu/common\\_files/uploads/leaflets\\_projects/Faculty-garden\\_sand-dune.pdf](http://www.restoration-ecology.eu/common_files/uploads/leaflets_projects/Faculty-garden_sand-dune.pdf)
- Flowering strips  
[https://www.restoration-ecology.eu/common\\_files/uploads/leaflets\\_projects/Flowering-strips\\_Urban-grasslands.pdf](https://www.restoration-ecology.eu/common_files/uploads/leaflets_projects/Flowering-strips_Urban-grasslands.pdf)
- Regional seed mixtures  
[https://www.restoration-ecology.eu/common\\_files/uploads/leaflets\\_projects/Regional-seed-mix.pdf](https://www.restoration-ecology.eu/common_files/uploads/leaflets_projects/Regional-seed-mix.pdf)

Faculty garden twitter: <https://twitter.com/fakzahr>

#### Primary Contact/Project Manager

*If possible, provide an individual contact for the project (i.e. primary project manager or principal investigator) as well as an organizational contact.*

Name Klára Řehouňková

Affiliation University of South Bohemia, Faculty of Science

City České Budějovice

State/province

Email [klara.rehounkova@gmail.com](mailto:klara.rehounkova@gmail.com)

Phone

Country [Czech Republic](#)

#### Project Photos

*We highly encourage you to submit at least one project photo that we can feature. Photos can include: before/after sequences showing the extent of recovery; use of the restored site by native species; people conducting restoration activities; or the connection between the project and local communities. Upload your photo(s) below, and use the space provided to specify a short caption and appropriate photo credits for each. By submitting your photos, you give SER permission to use them in SER communications (electronic, print) with proper attribution.*



*Fig.1: Flowering strips - establishment (2016) ©Kamila Vítovcová*



*Fig.2: Flowering strips after 2 years (2018) © Jiří Řehounek*

# Species abundance

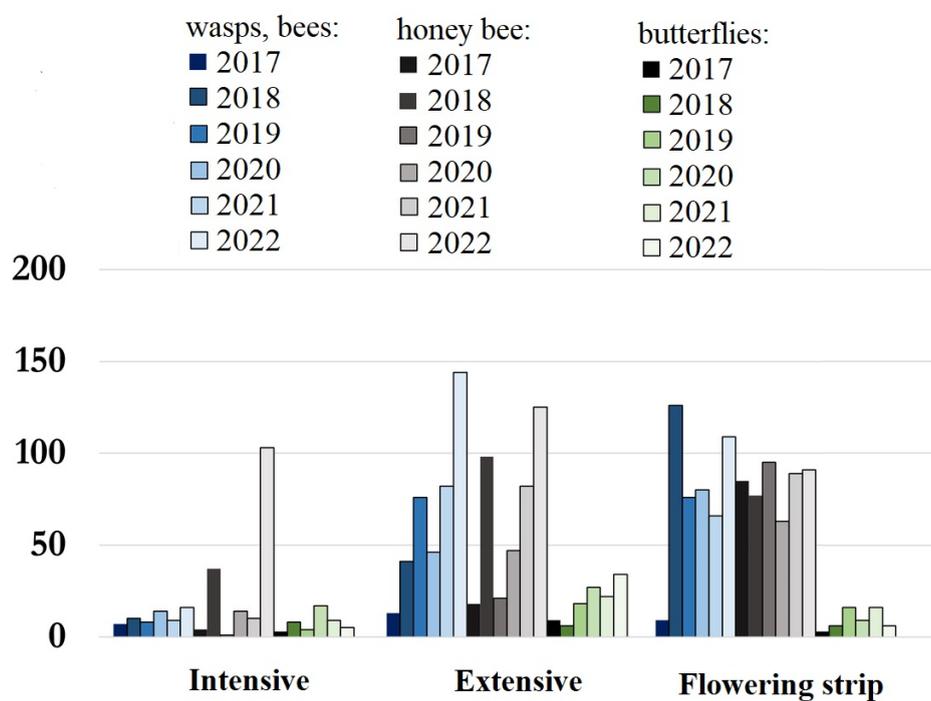


Fig.3: Results of the long-term monitoring (2017-2022) of selected groups of invertebrate species (solitary wasps, bees and butterflies) in flowering strips, and nearby extensively and intensively managed lawns.



*Fig.4: Sand dune at the faculty garden with transferred biomass for establishment of psammophytic dry grasslands (2015). ©Klára Řehouňková*



*Fig.5: Faculty garden – current state. ©Jiří Řehounek*



Fig.6: Regional seed mixture – sampling 1<sup>st</sup> season (2022) © Jiří Řehounek

**Your Contact Info**

Name [Lenka Šebelíková](#)  
 Affiliation [University of South Bohemia, Faculty of Science](#)  
 Email [lsebelikova@jcu.cz](mailto:lsebelikova@jcu.cz)  
 City [České Budějovice](#)  
 Country (select) [Czech Republic](#)

## **RESTORATION OF SPECIES-RICH FIELD MARGINS: BEST PRACTICE EXAMPLES AT THE CAMPUS OF THE ANHALT UNIVERSITY OF APPLIED SCIENCES, BERNBURG, GERMANY**

**Project Name \***

*Provide a descriptive name for the case study including the geographic location.*

[Restoration of species-rich field margins: Best practice examples at the campus of the Anhalt University of Applied Sciences, Bernburg, Germany](#)

**Project Overview \*(limit 200 words)**

*Provide a short summary of the project, including the geographic location, the ecological and social context, the restoration goals and activities, and key outcomes and lessons learned.*

Overview: The campus of the Anhalt University of Applied Sciences hosts several experimental sites supporting the biodiversity of higher plants, insects, and other organism groups in intensively used agricultural landscapes, serving educative and research purposes, and increasing the aesthetical value. These experimental sites include several species-rich field margins established from a regional seed mixture.

Background: The historical landscape was composed of a mosaic of various types of habitats. The impact of large-scale and intensive agriculture changed the landscape structure affecting not only the abundance of endangered species but also other species relatively common in the past. Field enlargements and inappropriate management led to the loss in quantity and quality of field margin sites. Attempts to increase biodiversity have been previously conducted in agricultural as well as other human-made landscapes.

Keywords: demonstration, training, regional seed mixture, biodiversity, agricultural landscapes

Target group: vocational education and training + further education

Orientation: agriculture

Practical information:

- Accessibility: freely accessible
- Guide needed: no
- Best season for visit: May – September
- Regular field trips: yearly monitoring (contact: Anita Kirmer, [anita.kirmer@hs-anhalt.de](mailto:anita.kirmer@hs-anhalt.de))

Training value: Regular monitoring of the sites allows an assessment of different cutting times on vegetation development since 2010/11. The sites are best practice examples for the promotion of biodiversity in field margins of intensively used agricultural landscapes.

### Project Location

*If possible, please click the map to drop a pin on the map to indicate the project location.*

Anhalt University of Applied Sciences, Bernburg, Germany

Geographic Region \*(select)

Europe

Country or territory \*(select)

Germany

Biome \*(select)

Temperate Forest

Ecosystem \*(select)

Grasslands & Savannas - temperate

Project area \*(select)

<20 ha

Project Lead \*

- Please indicate the entity that is primarily responsible for implementing the restoration activities.  
Nature Conservation working group, Department of Agriculture, Ecotrophology and Landscape Development, Anhalt University of Applied Sciences
- What type of organization is the lead entity? (select)  
University/Academic Institution

Key Partners \*

*List the key organizations involved in the project.*

Department of Agriculture, Ecotrophology and Landscape Development, Anhalt University of Applied Sciences

Saxony-Anhalt State Institute for Agriculture and Horticulture, German Agricultural Society,

Project Stage \*(select)

Monitoring and Evaluation

Project Duration \*

- Project Start Date  
*When did planning and design begin? In YYYY-MM format, please.*  
2010-08
- Project End Date  
*When did implementation of restoration activities/treatments conclude, or when is it expected to conclude? In YYYY-MM format, please.*  
2011-04

Primary Causes of Degradation \*(select all that apply)

- Agriculture & Livestock
- Climate Change

- Contamination (biological, chemical, physical or radiological)
- Dams & Hydrology
- Deforestation
- Fire & Weather Events
- Fisheries & Aquaculture
- Fragmentation
- Invasive Species (native or non-native pests, pathogens or plants)
- Mining & Resource Extraction
- Urbanization, Transportation & Industry
- Other

## Project Goals \*

*What are the project's primary goals, both ecological and socio-economic?*

The primary goal was to improve biodiversity and aesthetical value in intensively used agricultural landscapes by providing habitats for higher plants, insects, and other groups of organisms. In addition, they are used in teaching activities as well as in workshops and field trips as best practice examples.

## Key Lessons Learned

*Describe key lessons learned, including mid-course corrections or adaptive management actions to address unforeseen challenges.*

Sowing of a highly diverse seed mixture of wild plants for regional origin is very successful to establish species-rich field margins and flower strips.

Site preparation before sowing of regional seed mixtures is crucial to ensure the establishment of sown target species.

Regular management (mowing and biomass removal) is essential to maintain species richness in the long term.

Mowing in early summer led to a lower grass cover than mowing in September and the flowering aspect of September-mown variants was lower during summer compared to variants mown in May and June.

Precipitation after mowing was decisive for regrowth and in very dry years, mowing in May better ensured flowering aspects in July compared to variants mowing in June.

## Long-Term Management

*What plans exist for post-implementation monitoring and long-term maintenance of the restored ecosystem? Who is responsible for each of these activities? What plans exist for the ongoing involvement of stakeholders? What other strategies are planned for future management of the site?*

All sites are regularly mown once a year.

## Related Research

- Is the project part of any ongoing research or peer-reviewed study? (Y/N)  
YES
- If not, are you interested in connecting with a researcher to collect data on the project? (Y/N)

## Other Resources

*Direct readers to more information about your project by providing a link to the project website or to relevant reports/publications.*

Nature Conservation Working Group: <https://www.offenlandinfo.de/en/working-groups>

Guidelines to establish flower-rich structures in urban and rural areas:

[https://www.offenlandinfo.de/fileadmin/user\\_upload/Publikationen/Guidelines\\_flower-rich\\_structures\\_FL\\_NAL.pdf](https://www.offenlandinfo.de/fileadmin/user_upload/Publikationen/Guidelines_flower-rich_structures_FL_NAL.pdf)

Link to several leaflets (in German):

<https://www.offenlandinfo.de/themen/saeume-feldraine-und-bluehstreifen>

Offenlandinfo twitter: <https://twitter.com/offenlandinfo>

### Primary Contact/Project Manager

*If possible, provide an individual contact for the project (i.e. primary project manager or principal investigator) as well as an organizational contact.*

Name **Anita Kirmer**

Affiliation **Anhalt University of Applied Sciences, Department of Agriculture, Ecotrophology and Landscape Development**

City **Bernburg**

State/province **Saxony-Anhalt**

Email **[anita.kirmer@hs-anhalt.de](mailto:anita.kirmer@hs-anhalt.de)**

Phone

Country **Germany**

### Project Photos

*We highly encourage you to submit at least one project photo that we can feature. Photos can include: before/after sequences showing the extent of recovery; use of the restored site by native species; people conducting restoration activities; or the connection between the project and local communities. Upload your photo(s) below, and use the space provided to specify a short caption and appropriate photo credits for each. By submitting your photos, you give SER permission to use them in SER communications (electronic, print) with proper attribution.*



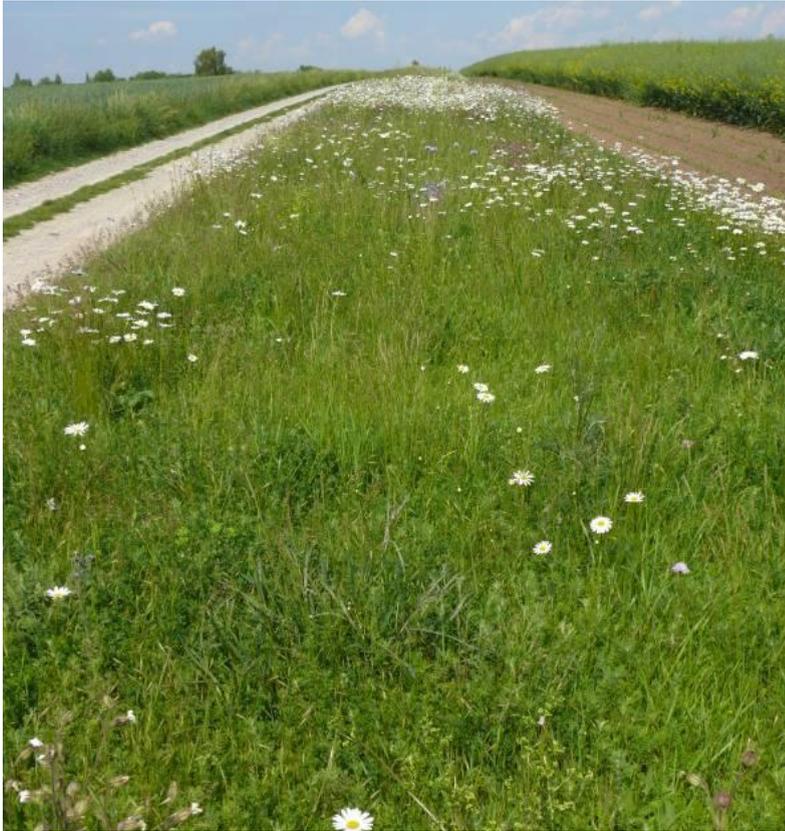
*Fig. 1. Grass-dominated field margin before site preparation and sowing in August 2010. ©Matthias Necker*



*Fig. 2. Site preparation on species-poor grass margins in September 2010 before sowing begin of October 2010.  
©Matthias Necker.*



*Fig. 3. Field margin sown with 49 wild plant species begin of October 2010. **Flowering aspect end of May 2014.**  
June-mown variant. ©Anita Kirmer.*



*Fig. 4. Field margin sown with 49 wild plant species begin of October 2010. Flowering aspect end of May 2014. September-mown variant. ©Anita Kirmer.*



*Fig. 5. Field margin sown with 49 wild plant species begin of October 2010. Flowering aspect end of May 2021. June-mown variant. ©Anita Kirmer.*



*Fig. 6. Field margin sown with 49 wild plant species begin of October 2010. Flowering aspect end of May 2021. September-mown variant. ©Anita Kirmer.*



*Fig. 7. Field margin sown with 49 wild plant species begin of April 2011. Flowering aspect mid-July 2021. May-mown variant. Precipitation 2021: May 46mm, June 74mm. ©Anita Kirmer.*



*Fig. 8. Field margin sown with 49 wild plant species begin of April 2011. **Flowering aspect mid-July 2022.** May-mown variant. Precipitation 2022: May 34mm, June 26mm. ©Anita Kirmer.*



*Fig. 9. Field margin sown with 49 wild plant species begin of April 2011. Flowering aspect mid-July 2021. June-mown variant. ©Anita Kirmer.*



*Fig. 10. Field margin sown with 49 wild plant species begin of April 2011. Flowering aspect mid-July 2021. September-mown variant. ©Anita Kirmer.*

#### Your Contact Info

Name Anita Kirmer

Affiliation Anhalt University of Applied Sciences, Department of Agriculture, Ecotrophology and Landscape Development

Email [anita.kirmer@hs-anhalt.de](mailto:anita.kirmer@hs-anhalt.de)

City Bernburg

Country (select) Germany

# ACTIONS TO RESTORE HABITATS OF COMMUNITY INTEREST IN THE MUELA DE CORTES Y EL CAROCHE, SPAIN

## Project Name \*

*Provide a descriptive name for the case study including the geographic location.*

Actions to restore habitats of community interest in the SAC Muela de Cortes y El Caroché

## Project Overview \*(limit 200 words)

*Provide a short summary of the project, including the geographic location, the ecological and social context, the restoration goals*

*and activities, and key outcomes and lessons learned.*

SAC Muela de Cortes y El Caroché is a hotspot of biodiversity and provides a wide range of ecosystem services, as it is one of the most extensive semi-natural areas of the Valencian Community. However, this area has experienced recurrent wildfires in recent decades, including large wildfires. Rural abandonment has also contributed to landscape homogenization, and the dominance of woody communities. This project aims to develop a mosaic landscape with shrub formations, dry grasslands, and grasslands to allow the recovery of ecological interactions, ecosystem functionality and biodiversity, and protect habitats of interest. The wide diversity of actions planned aim to (i) reduce the continuity of vegetation to prevent large fires, increasing forest resistance and resilience to forest fires, (ii) increase ecosystem resistance and resilience to climate change and drought, (iii) increase the surface area of suitable habitat for large wild herbivores, (iv) meet specific objectives in relation to biodiversity, fire prevention, recovery of agricultural uses and hunting. The mosaic will also contribute to soil stabilization, regulate the hydrological cycle, stabilize carbon and nutrients, protect biodiversity, including pollinators, and increase the extent of quality pastures for wild ungulates.

## Project Location

*If possible, please click the map to drop a pin on the map to indicate the project location.*

Zona de Especial Conservación Muela de Cortes (X 684.455,67 m, Y 4.339.690,61 m)

Location of Zona de Especial Conservación (SAC) Muela de Cortes y El Caroché (green spot in the inset map of the Iberian Peninsula). Red polygon: Forest MUP V143 Muela de Cortes. Green polygon: SAC Muela de Cortes y el Caroché. Orange polygon: Valencian Hunting Reserve Muela de Cortes. From: García-Pereira, R., Deltoro, V., Pascual, C. (2019). Actuaciones de restauración de hábitats de interés comunitario en el ZEC Muela de Cortes y el Caroché. VAERSA (unpubl.)

## Geographic Region \*(select)

Europe

## Country or territory \*(select)

Spain (Community of Valencia)

## Biome \*(select)

Grassland/Savanna

## Ecosystem \*(select)

Grasslands & Savannas - temperate

Project area \*(select)

501-1,000 hectares

What is the area of the site that is being restored?

Actions dispersed over 972 ha covering the SAC.

Project Lead \*

- Please indicate the entity that is primarily responsible for implementing the restoration activities.  
 Empresa Pública Valenciana de Aprovechamiento de Residuos S.A. (VAERSA). Project design and supervision.  
 TRAGSA. Project implementation.
- What type of organization is the lead entity? (select)  
 Other (Public companies)

Key Partners \*

List the key organizations involved in the project.

Empresa Pública Valenciana de Aprovechamiento de Residuos S.A. (VAERSA).

TRAGSA (Execution).

Unión Europea – Fondo Europeo de Desarrollo Regional (FEDER).

Fundación Centro de Estudios Ambientales del Mediterráneo (CEAM).

Universidad de Alicante.

Centro de Investigaciones sobre Desertificación (CIDE).

WWF España.

Project Stage \*(select)

Monitoring & Evaluation (Design completed. Implementation completed.)

Project Duration \*

- Project Start Date  
 When did planning and design begin? In YYYY-MM format, please.  
 2020
- Project End Date  
 When did implementation of restoration activities/treatments conclude, or when is it expected to conclude? In YYYY-MM format, please.  
 2022

Primary Causes of Degradation \*(select all that apply)

- Agriculture & Livestock
- Climate Change
- Contamination (biological, chemical, physical or radiological)
- Dams & Hydrology
- Deforestation
- Fire & Weather Events
- Fisheries & Aquaculture
- Fragmentation
- Invasive Species (native or non-native pests, pathogens or plants)
- Mining & Resource Extraction

- Urbanization, Transportation & Industry
- Other

### Degradation Description

*Briefly describe both the cause(s) and degree of degradation, including its effect on ecosystem structure and function and its impact on local biodiversity. Include a discussion of any landscape-scale issues or socio-economic/political factors contributing to, or resulting from, the degradation.*

#### Agriculture, forestry, and livestock husbandry:

Rural depopulation and abandonment of traditional agricultural uses have caused a loss of the mosaic of habitats characteristic of this territory, and an increase in of forest extent and continuity. Environmental homogenization, together with other factors, such as the increase in temperature and changes in the rainfall patterns in a context of climate change, increase vulnerability to wildfires, and the loss of relevant ecosystem services in the region, such as melliferous potential, habitat for some plant species, especially grassland species, or a deterioration of the quality of the habitat for large mammals fauna (which are hunted; especially ibex and mouflon).

#### Wildfires:

In the last decades of the 20<sup>th</sup> century, the severity and recurrence of forest wildfires have substantially changed, including the occurrence of large forest fires (>500 ha). Over the last fifty years, five major fires +10,000 ha each have occurred in the area, increasing landscape homogenization, affecting biodiversity, decreasing the supply of ecosystem services, and raising social concern.

### Project Goals \*

*What are the project's primary goals, both ecological and socio-economic?*

The area is located in the Caroig massif (Valencia, Spain). The dominant soil types are calcareous fluvisols, eutric regosols, calcaric regosols, leptosols, calcium kastanozems, calcium cambisols and chromic luvisols. The Caroig massif is a large reservoir of groundwater due to the abundance of limestone and dolomite favoring infiltration, and the presence of underlying less permeable Keuper clays. The area is integrated in the Natura 2000 Network (SAC Muela de Cortes y el Caroché; ES5233040), which highlights its high environmental value. In addition, it has a very high landscape quality, according to PATFOR, and houses various Habitats of Community Interest, species protected by the Valencian Catalogue of Threatened Flora Species and wild herbivores represented by ibex, mouflon, deer, fallow deer and roe deer.

The non-wooded stratum is the most abundant, and is dominated by homogeneous high thickets of garrigue, and shrublands dominated by rosemary and rockroses. Low thickets are dominated by thyme and chamomile. Trees occupy 30% of the area, with *Pinus halepensis* being the most abundant species. Adult pine forests are usually accompanied by a shrubby and regenerated layer of very dense pine forest, which increases biomass vertical and horizontal continuity and the risk of frequent and severe wildfires. Young pine forests, recruited after previous wildfires, are very dense, favouring fire propagation and severity, compromising regeneration after further disturbances as the probability to reach maturity is low under increasing wildfire frequency, and increase competition for soil resources.

Vast expanses of continuous and uniform vegetation are prone to sustaining large wildfires, and scarcely resilient to climate change. In addition, landscape homogenization is made at the expense of habitats for large herbivores, beta biodiversity and the provision of ecosystem services.

The Operational Program of the European Regional Development Fund (ERDF) of the Valencian Community establishes, as one of its general objectives, to finance actions that improve and guarantee the

conservation status of habitats of community interest. Large areas of the SAC present a successional blockade, due to the degradation of their habitats caused by recent changes in land use and recurrent wildfires. This limits ecosystems' ability to adapt to climate change, and decreases their resilience to new wildfires, and puts the conservation of habitats of community interest at risk.

The project integrates the perception of a wide range of stakeholders, including local people, through the development of three complementary activities:

1. Participatory process carried out within the framework of the Terecova research project ([www.recuperandonuestrospaisajes.org](http://www.recuperandonuestrospaisajes.org)) to identify restoration priorities, weigh ecosystem services and plan restoration actions in Enguera Forest Management Unit.
2. Participatory workshop held at Bicorp (Valencia), where stakeholders discussed restoration priorities and ecosystem services supplied by the local landscape. Work developed by the CEAM Foundation and the University of Alicante within the framework of the COSTERA project.
3. Review of the project. The draft project was reviewed by a stakeholder platform. They analysed its contents and suggested modifications. Recommendations that the drafting team considered feasible were included in the final version of the proposal.

This project is part of the strategy defined by the Forest Territorial Action Plan of the Valencian Community (PATFOR; <https://agroambient.gva.es/va/web/medio-natural/patfor>). The objectives of the action are founded on different environmental strategies:

- Considering the environmental value of this natural area of the Natura 2000 Network SAC Muela de Cortes y El Carroche (ES5233040), and the relevance of this landscape (it has been ranked as Very High Quality, according to the technical assessment of the landscape carried out under PATFOR), it was deemed necessary to restore the area to guaranteeing the conservation status of Habitats of Community Interest.
- For the definition of the objectives of the intervention, active management measures included in the norm of the ZEC Muela de Cortes and El Carroche were considered: B.1 (Forest fire prevention) and B.2 (Sustainable management of forests in the Valencian Hunting Reserve of La Muela de Cortes). Also, the Forest Fire Prevention Plan of the Muela de Cortes Valencian Reserve, as well as the advice of the fire-fighting services and the managers of the Reserve.
- As a result of a participatory process carried out prior to the onset of the restoration project, within the framework of projects Terecova and COSTERA (University of Alicante, with support from Ministry of Economy, Industry and Competitiveness and Ministry of Science, Innovation and Universities of the Government of Spain and Regional Development Funds of the EU ERDF, projects CGL2014-52714-C2-1-R and RTI2018-095954-B-I00), the restoration priorities and ecosystem services most valued by the different stakeholder groups were identified. Stakeholders emphasised the importance of giving highest priority to the restoration of key areas to reduce wildfire risk (as estimated by modelling), and areas suffering recurrent fires.
- Generate a mosaic landscape with shrub formations, dry grasslands and grasslands to recover ecological interactions and functionality and protect biodiversity. To guarantee the conservation status of thermo-Mediterranean and pre-steppe scrub (habitat 5330), karst calcareous meadows (habitat 6110) and substeppic areas of grasses and annual plants (habitat 6220), through the improvement of their structure, which should translate into an increase in species diversity, in the mid-term.

- Reduce the continuity of vegetation (fuel) to prevent large fires, increasing the resistance and resilience of the forest mass to wildfires, through the establishment of mosaics of less flammable plant formations, allowing wildfires of lower intensity and propagation speed. These interventions will facilitate fire extinction, while creating safety zones for professional and voluntary fire-fighters.
- Increase ecosystems resilience and resilience to climate change, particularly extreme temperatures, and prolonged and intense drought.
- Increase the extent of suitable habitat for wild herbivores.
- Finally, specific objectives have been established in relation to biodiversity, fire prevention, recovery of agricultural uses and hunting.

As for the reference ecosystems, it is a mosaic of three habitat types: habitat 6220\*, grasslands with or without scattered pine and holm oak trees (up to 100 specimens/ha), habitat 6110\*, dry grasslands with 60-70% cover and up to 30 cm in height, and habitat 5330, scrub with and without holm oak, Aleppo pine or rodeno pine trees (*Pinus halepensis* and *Pinus pinaster*). These habitats develop depending on the type of substrate and the disturbance regime. The mosaic generated is expected to contribute to soil stabilisation and the prevention of erosive processes, the regulation of the hydrological cycle, carbon fixation, nutrient mobilisation, the promotion of biodiversity, pollination, and the proportion of quality grasses for wild ungulates.

The aim is to gradually restore natural ecosystems, considering historical land uses, current population demands, and climate change and wildfire regime scenarios, with the ultimate goal of restoring them completely. The objectives are therefore fully framed in the ecological restoration step of SER restorative continuum.

### Key Lessons Learned

*Describe key lessons learned, including mid-course corrections or adaptive management actions to address unforeseen challenges.*

The action was planned on 972 ha of the ZEC, between the beginning of 2021 and the first quarter of 2022, although no action was taken on the entire surface.

Restoration actions included:

- Recovery of abandoned crop fields and establishment of grasslands and pastures: carrying out silvicultural treatments (selecting the main stems in multi-stem oak stumps, thinning, and pruning pines). In old plantations, leaving a final density of 100 trees/ha. Sowing of native forage plants with local certified seeds.
- Modifying forest structure to avoid vertical and horizontal continuity. Thinning and selective clearings of weakened pines and those close to shrub species of interest, until reaching densities adapted to the potential of the area.
- Creation of Strategic Management Zones. Clearing in key areas to modify the most dangerous fuel models and reduce the impact of wildfires.
- Creation of natural corridors. Clearing between the areas managed to favour the transit of large herbivores, the subsequent maintenance of the actions and access to the staff of the Reserve.

Actions had an immediate impact on the landscape and wildfire vulnerability. Medium to long-term effects will be monitored in future years.

### Long-Term Management

*What plans exist for post-implementation monitoring and long-term maintenance of the restored ecosystem? Who is responsible for each of these activities? What plans exist for the ongoing involvement of stakeholders? What other strategies are planned for future management of the site?*

The design phase of this project was audited, with favourable results, by NEPCON as a pilot project that meets the "WWF Standards for the Certification of Forest Ecosystem Restoration Projects" (2019), a certification system applicable to forest ecosystem restoration projects promoted by WWF Spain with the support of the Biodiversity Foundation.

Link to the document that accredits it:

<https://agroambient.gva.es/documents/91061501/172912286/Est%C3%A1ndares+WWF+para+la+certificaci%C3%B3n+de+proyectos+de+restauraci%C3%B3n+de+ecosistemas+forestales.pdf/89ddf41e-1863-42cf-9c60-893f5b4b05a7?t=1611837177996>

The implementation phase of the project has been recently audited.

The project Monitoring Plan details a verifier, an indicator and a methodology for each of the specific objectives. Thus, the impact of the proposed restoration actions and the deviations produced will be quantified. Main indicators: number of ha with characteristic species of habitats 6110\* and 6220\*, area of recovered abandoned fields, fuel models, species richness, contagion rate, probabilistic simulation to check the probability of fires, and forage units.

No long-term management plan has been included.

## Related Research

- Is the project part of any ongoing research or peer-reviewed study? (Y/N)  
YES
- If not, are you interested in connecting with a researcher to collect data on the project? (Y/N)  
YES

## Other Resources

*Direct readers to more information about your project by providing a link to the project website or to relevant reports/publications.*

Proyecto - Actuaciones de restauración de hábitats de interés comunitario en el ZEC Muela de Cortes y el Carоче.

<https://agroambient.gva.es/documents/91061501/172880601/2020+Proyecto+de+restauraci%C3%B3n+de+h%C3%A1bitats+ZEC+Muela+de+Cortes+y+el+Caroche.pdf/129f27a0-4b47-4697-9b78-de8011667fca?t=1651223654597>

Anónimo (2013). Memoria Técnica de la Norma de Gestión de los Espacios Protegidos de la Red Natura 2000 del Macizo del Caroig: Zonas Especiales de Conservación "Sierras de Martés y El Ave", "Muela de Cortes y El Carоче", "Valle de Ayora y Sierra del Boquerón", "Serra D'Enguera", "Sierra de Malacara", y Zonas de Especial Protección para las Aves "Sierras de Martés-Muela de Cortes", "Sierra de Malacara". Conselleria d'Infraestructures, Territori i Medi Ambient, Generalitat Valenciana.

Escrig del Valle, A., López Martínez, C., Catalá Miñana, F., Ruiz Álvarez, M. (2013). Plan de prevención de Incendios forestales de la RV de Caza de la Muela de Cortes. Conselleria de Infraestructuras, Territori i Medi Ambient y Conselleria de Gobernación, Generalitat Valenciana, VAERSA.

<https://www.researchgate.net/publication/285591746> Plan de Prevención de Incendios Forestales de la Reserva Valenciana de Caza de la Muela de Cortes

Carabassa Closa, V., Colomina Pérez, D., Cortina Segarra, J., García Pereira, R., Melero de Blas, M., Oliet Palá, J.A. y Rey Benayas, J.M. (2022). Estándares para la certificación de proyectos de restauración de ecosistemas forestales mediterráneos. 8º Congreso Forestal Español.

<https://8cfe.congresoforestal.es/sites/default/files/actas/8CFE-668.pdf>

García, R., Fos, S. Andrés, C., Deltoro, V. y Jiménez, J. (2019). Fondos europeos y restauración de hábitats en la Comunidad Valenciana. Una oportunidad para la red natura 2000. Revista Quercus nº402.

<https://agroambient.gva.es/documents/91061501/172887620/2019+Art%C3%ADculo+revista+Quercus+n%C2%BA+402+Restauraci%C3%B3n+de+h%C3%A1bitats+valencianos+con++fondos+FEDER.pdf/9a41f20c-95be-45d9-8364-6eaded98c72f?t=1611745864754>

### Primary Contact/Project Manager

*If possible, provide an individual contact for the project (i.e. primary project manager or principal investigator) as well as an*

*organizational contact.*

Name **Ramón García-Pereira**

Affiliation **VAERSA**

City

State/province

Email **garcia.ram@vaersa.org**

Phone

Country **Spain**

### Project Photos

*We highly encourage you to submit at least one project photo that we can feature. Photos can include: before/after sequences showing the extent of recovery; use of the restored site by native species; people conducting restoration activities; or the connection between the project and local communities. Upload your photo(s) below, and use the space provided to specify a short caption and appropriate photo credits for each. By submitting your photos, you give SER permission to use them in SER communications (electronic, print) with proper attribution.*



*Figure 1. Cleared shrubland in Muela de Cortes y El Carroche ZEC. Only a few shrubs and tree patches have been left to promote grasslands and create fuelbreaks, while creating refugia for small fauna. Trees in the foreground are thinned and pruned Holm oaks.*



*Figure 2. This abandoned farmland was ploughed to favour grasslands and create fuelbreaks.*



*Figure 3. Park like forests ('bosques adehesados') were promoted in some areas by clearing the dense shrubland, and thinning and pruning trees. Chain brush cutter mowers were used when feasible to clear the shrubland and ground felled branches.*



*Figure 4. Park-like forest. This forest structure reduces forest vulnerability to wildfire and drought, while protecting the soil and creating suitable habitats for fauna and flora of interest.*

## Your Contact Info

Name **Jordi Cortina-Segarra**

Affiliation **Department of Ecology/IMEM, University of Alicante**

Email **jordi@ua.es**

City **Alicante**

Country (select) **Spain**

# HJERKINN PRO, RESTORATION OF A MILITARY TRAINING AREA IN NORWAY INTO A NATIONAL PARK, NORWAY

## Project Name \*

*Provide a descriptive name for the case study including the geographic location.*

Hjerkinn PRO: restoration of a military training area in Norway into a National Park, Norway

## Project Overview \*(limit 200 words)

*Provide a short summary of the project, including the geographic location, the ecological and social context, the restoration goals and activities, and key outcomes and lessons learned.*

The Hjerkinn military training area at Dovrefjell, Norway, used to be the largest military training facility in southern Norway, 165 km<sup>2</sup>. Soldiers from Norway and allied countries used the area for training and testing of equipment and ammunition until 2008. In 1999 The Norwegian Parliament decided to closed down the existing military training area and an overall goal of restoring the area. The large scale restoration project started in 2008 and was completed in 2021.

The outcome from the restoration is reported according to the overall goal, and four subgoals:

1. Considerable nature benefit, 2. Nature protection, 3. Civilian use, and 4. Restore back to natural state.

Restoring the Hjerkinn military training area to natural state has set a standard for ecosystem restoration. Development of technical solutions for high alpine restoration, monitoring, adaptive interventions, and systematic involvement and training across professions have been developed and reported in scientific journals, media, and popular reports. The project demonstrates the full cycle of a large-scale restoration and illustrates the diversity of measures, solutions and cooperation needed during such an extensive project.

## Project Location

*If possible, please click the map to drop a pin on the map to indicate the project location.*

Hjerkinn, Hjerkinn, Norway, 62.22005, 9.54128, 3, ChIJdeIQ8PazFEYR857xPICwCCK, Hjerkinn, Hjerkinn, Innlandet, 2661, Norway, NO

## Geographic Region \*(select)

Europe

## Country or territory \*(select)

Norway

## Biome \*(select)

Tundra

## Ecosystem \*(select)

Montane Grasslands & Shrublands

## Project area \*(select)

More than 1,000 hectares

## What is the area of the site that is being restored?

5200 ha

## Project Lead \*

- Please indicate the entity that is primarily responsible for implementing the restoration activities.  
Norwegian Defence Estate Agency
- What type of organization is the lead entity? (select)  
Governmental body

## Key Partners \*

List the key organizations involved in the project.

Norwegian Defence Estate Agency  
 Norwegian Institute for Nature Research  
 The Norwegian Army Ministry of Defence  
 Norwegian Environmental Agency

## Project Stage \*(select)

Completed

## Project Duration \*

- Project Start Date  
When did planning and design begin? In YYYY-MM format, please.  
2003-01
- Project End Date  
When did implementation of restoration activities/treatments conclude, or when is it expected to conclude?  
In YYYY-MM format, please.  
2020-08

## Primary Causes of Degradation \*(select all that apply)

- Agriculture & Livestock
- Climate Change
- Contamination (biological, chemical, physical or radiological)
- Dams & Hydrology
- Deforestation
- Fire & Weather Events
- Fisheries & Aquaculture
- Fragmentation
- Invasive Species (native or non-native pests, pathogens or plants)
- Mining & Resource Extraction
- Urbanization, Transportation & Industry
- Other

## Degradation Description

Briefly describe both the cause(s) and degree of degradation, including its effect on ecosystem structure and function and its impact on local biodiversity. Include a discussion of any landscape-scale issues or socio-economic/political factors contributing to, or resulting from, the degradation.

The project area used to be a military training area during 100 years. Major parts of the technical infrastructure were developed during the 1960's to 1980's, including more than 90 km of roads, ~100 buildings and constructions, several large artillery training facilities, gravel pits and mounds. Major parts of roadless areas were also affected from being used for several types of military training and as target areas.

## Defining the Reference Ecosystem

Which of the following best describes how the reference ecosystem(s) was(were) determined?

- X The reference ecosystem is primarily based on contemporary reference sites or existing analogues of the pre-degradation ecosystem.
- o The reference ecosystem is primarily based on historical information about ecological attributes at the site prior to degradation.
- o The reference ecosystem is based on diverse sources of information (e.g. multiple extant reference sites, field indicators, historical records, predictive data).
- o I'm not sure.
- o Not applicable (e.g. dam removal or road removal projects)

### Reference Ecosystem Description

*Describe the key attributes of the reference ecosystem(s), and thus the benchmarks that will be used to evaluate restoration success. What will the restored system look like—in terms of structure, function and biodiversity. What rationale was used to select the reference ecosystem(s), and what adjustments were made to account for changing environmental conditions, whether actual or predicted?*

The Dovrefjell area is well-documented as a region of significant natural and cultural value. The military area used to be surrounded by many protected areas: National Parks, Nature Reserves and Landscape Protected Areas. Dovrefjell is a high-mountain ecosystem where the wild reindeer is a key species, and the area also hosts populations of wolverine, arctic foxes, golden eagles, gyrfalcons and other rare and threatened animal species, a high number of rare and red-listed plant species and a large diversity of vegetation types. Main vegetation types include lichen heaths and shrub heaths, mires as well as alpine meadows and snow beds. Dovrefjell holds the only European population of musk oxen, which was introduced from Greenland in the 1950' s and remains highly attractive for recreation and tourism.

### Project Goals \*

*What are the project's primary goals, both ecological and socio-economic?*

1. Considerable nature benefit,
2. Nature protection,
3. Civilian use,
4. Restore back to natural state.

### Monitoring

- Does the project have a monitoring plan?  
*Check the box if the answer is yes.*  
YES
- Monitoring Details (if applicable):  
The monitoring program include 1. Vegetation monitoring in permanent plots; 2. Systematic expert evaluation of 27 restored sites within the project area (indicators; vegetation recovery, landscape adaptation, water systems).
- When did monitoring begin, including baseline data collection?  
2004
- When did monitoring end or when is it expected to end?  
Not yet decided

### Stakeholders

*Who are the primary stakeholders in the project, and how have they been involved to date? Describe steps taken to engage them in the planning process, address their interests and concerns, and keep them informed of project activities. What education and outreach strategies have been used?*

Local and regional authorities (municipalities and Governor)

Tourist companies (e.g. hotels, guiding companies, tourist cabin managers)

Local land-owners and sheep farmers

## Description of Project Activities

*Describe in detail the restoration activities carried out at the site, in terms of the 6 ecosystem attribute categories discussed in SER's International Standards for the Practice of Ecological Restoration. What strategies and treatments were used to:*

### 1) eliminate existing threats to the ecosystem

The military activity was closed down between 2003 and 2008.

### 2) reinstate appropriate physical conditions (e.g. hydrology, substrate)

Removing existing military infrastructure and polluted soil.

### 3) achieve a desirable species composition

The following guidelines were used to guide the entire project and prepare for ecosystem recovery, including species composition, structural diversity, functionality, and exchange with surrounding landscape: 1. Acknowledge ecological processes, 2. avoid new disturbance during the implementation, 3. no use of introduced species, 4. time scale – consider both short and long term effects, 5. spatial scale (integrate small and large scale perspectives).

### 4) reinstate structural diversity (e.g. strata, faunal food webs, spatial habitat diversity)

The following guidelines were used to guide the entire project and prepare for ecosystem recovery, including species composition, structural diversity, functionality, and exchange with surrounding landscape: 1. Acknowledge ecological processes, 2. avoid new disturbance during the implementation, 3. no use of introduced species, 4. time scale – consider both short and long term effects, 5. spatial scale (integrate small and large scale perspectives).

### 5) recover ecosystem functionality (e.g. nutrient cycling, plant-animal interactions, normal stressors)

The following guidelines were used to guide the entire project and prepare for ecosystem recovery, including species composition, structural diversity, functionality, and exchange with surrounding landscape: 1. Acknowledge ecological processes, 2. avoid new disturbance during the implementation, 3. no use of introduced species, 4. time scale – consider both short and long term effects, 5. spatial scale (integrate small and large scale perspectives).

### 6) reestablish external exchanges with the surrounding landscape (e.g. migration, gene flow, hydrology)

The following guidelines were used to guide the entire project and prepare for ecosystem recovery, including species composition, structural diversity, functionality, and exchange with surrounding landscape: 1. Acknowledge ecological processes, 2. avoid new disturbance during the implementation, 3. no use of introduced species, 4. time scale – consider both short and long term effects, 5. spatial scale (integrate small and large scale perspectives).

What activities were undertaken to address any socio-economic aspects of the project?

Meetings with stakeholders, information letters to all local inhabitants, guided tours in the area, green training of project owner and contractors by trained ecologists.

## Ecological Outcomes Achieved

Describe the *extent* and *effectiveness* of recovery to date in terms of the same 6 ecosystem attribute categories as above. How successful has the project been in each of these areas based on the goals defined at the outset?

#### Eliminate existing threats to the ecosystem

##### No military activity after 2008

##### Reinstate appropriate physical conditions

In total 80.5 km of roads were removed, and the restored area amounted to 5.2 km<sup>2</sup>. More than 120 subterranean tubes were removed to restore natural hydrology systems. Additionally 80 buildings and 8 bridges were demolished and recycled. As roads and technical infrastructure were removed, the interference-free area, located greater than 1 km from heavy infrastructure, more than doubled, from 51 km<sup>2</sup> to 114 km<sup>2</sup>. More than 15,000 soldiers searched the entire area on foot, more than 19,000 UXOs were found and destroyed, and 550 tons of metal trash were removed.

##### Achieve a desirable species composition

The restoration measures have a documented effect on the recovery of native species and vegetation communities.

##### Reinstate structural diversity

The restored area of 5.2 km<sup>2</sup> consisted mainly of lichen heaths and shrub heath, with some wetlands and mires. The newly restored landscape is capable of storing an estimated 54,500 t carbon, with the additional sequestration of over 1,800 t carbon per year from net primary productivity.

##### Recover ecosystem functionality

Road removal also increased available habitat for wild reindeer.

##### Reestablish external exchanges with the surrounding landscape

In 2018, major parts (130 km<sup>2</sup>) of the former military area was protected as National Park and Landscape Protected Area.

##### Factors limiting recovery of the ecosystem

The natural recovery is very slow in northern high altitudes, and full recovery of native vegetation types is still going on. Some technical infrastructure was so devastating to local landscape features, soil and geomorphology, and will never be fully recovered.

### Socio-Economic & Community Outcomes Achieved

Describe the benefits generated for surrounding communities. How has the project contributed to improving human well-being in the following areas?

#### Economic vitality and local livelihoods

The restored area is a wilderness area with no permanent settlement. The restored area will support the income for local households within the tourist industry and local farmers, however quantification as household resilience or income has yet to be uncovered.

#### Regulation of climate, floods, disease, erosion, water quality, etc.

The newly restored landscape as a climax community, is capable of storing an estimated 54,500 t C, with the additional sequestration of over 1,800 t C yr<sup>-1</sup> from net primary productivity. The restoration has contributed to the restoration of sound and wellfunctioning alpine habitats.

Has the project had any negative consequences for surrounding communities or given rise to new socio-economic or political challenges?

Overall the project was wanted, and the safety in the area and the large wilderness values was highly appreciated. Removing the previous military roads, also used as access roads to the inner mountain areas, raised conflicts during the project. The Parliament decided to reformulate the

original goal of removing all infrastructure, and some of the roads in the mountains are kept with strongly regulated access.

### Key Lessons Learned

*Describe key lessons learned, including mid-course corrections or adaptive management actions to address unforeseen challenges.*

Methods and solutions have been tested, evaluated, researched and adapted, both scientifically and practically. Many of the restoration measures and experiences have been reported and published in MSc and PhD theses and scientific papers. Procedures from Hjerkin PRO, both “Green training” courses and restoration methods are transferable to many other types of restoration projects.

Another key lesson from the project was the cooperation/integration that linked the practical knowledge from activities on the ground, with scientific knowledge and research. The value of understanding between professions and communicate on a common platform is great for achieving the desired quality, reaching deadlines and a sensible financial implementation.

Having ambitious goals is vital, but defining measurable sub-goals is even more important to verify that the project has the desired effect upon completion.

Hjerkin PRO established five restoration principles that proved very important as guidelines in the on-going work.

Restoration represents prioritation of land use, and conflicts might rise about extent and forms of restoration. It is

important for a successful outcome that the conflicts are handled in a respectable and orderly manner.

A measure for good dialogue and progress was a very open communication with all interest groups, including the media, and by involving both stakeholders and authorities in important processes. This turned out to be a valuable

experience to be shared across countries, ecosystems and degradation stages.

### Long-Term Management

*What plans exist for post-implementation monitoring and long-term maintenance of the restored ecosystem? Who is responsible for each of these activities? What plans exist for the ongoing involvement of stakeholders? What other strategies are planned for future management of the site?*

Main parts of the area is protected as National Park with a board. The Norwegian Environmental Agency is the national management authority. Part of the area is grazed by domestic sheep farmers. Wild reindeer is hunted, based on strong regulations. Access to a tourist cabin /hotel is by a dedicated bus during summer season.

### Sources and Amounts of Funding

*What entities have provided funding and other support for the project? How much has been invested in the project to date? If know, what is the estimated cost per unit restored (e.g. cost per hectare, cost per river mile)?*

The project is funded by the Norwegian Ministry of Defence, and total cost is 58 mill Euro. Out of this approximately 14 million euro were used for the ecosystem restoration (5.2 km<sup>2</sup> restored) and 40 million euro for clearing of explosives. Consequently, the key number for ecosystem restoration costs was 2.7 euro per m<sup>2</sup>.

### Related Research

- Is the project part of any ongoing research or peer-reviewed study? (Y/N)  
YES

A large number of scientific papers have been published from this project. The total project have been reported by Hagen et al. 2022 <https://doi.org/10.1016/j.jnc.2021.126125>

- If not, are you interested in connecting with a researcher to collect data on the project? (Y/N)

#### Other Resources

Direct readers to more information about your project by providing a link to the project website or to relevant reports/publications.

Hagen et al. 2022 <https://doi.org/10.1016/j.jnc.2021.126125>

#### Primary Contact/Project Manager

If possible, provide an individual contact for the project (i.e. primary project manager or principal investigator) as well as an organizational contact.

Name **Dagmar Hagen**

Affiliation **Norwegian Institute for Nature Research**

City **Trondheim**

State/province

Email **Dagmar.Hagen@nina.no**

Phone

Country **Norway**

#### Project Photos

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Photo: Svein Solli/Norwegian Defence Agency



*Photo: Dagmar Hagen/Norwegian Institute for Nature Research*



*Photo: Dagmar Hagen/Norwegian Institute for Nature Research*

**Your Contact Info**

Name [Dagmar Hagen](#)  
Affiliation [Norwegian Institute for Nature Research](#)  
Email [Dagmar.Hagen@nina.no](mailto:Dagmar.Hagen@nina.no)  
City [Trondheim](#)  
Country (select) [Norway](#)