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## **WORD OF WELCOME FROM THE ORGANISERS**

MATTIAS LINDHOLM

### Dear participants,

It is a great pleasure and a true milestone for us to welcome you to the 18th European Heathlands Workshop – and for the first time, to Sweden.

We are delighted to host this gathering of passionate researchers, practitioners, and land managers from across the countries that share a commitment to Atlantic heathlands. This year's theme – Small-Scale Strategies for Big Impact in Heathland Management – invites us to reflect on the power of scale, the richness of biodiversity, and the value of unconventional approaches in shaping vibrant and resilient heathland landscapes. You'll find that what may seem modest in scale can in fact yield extraordinary ecological outcomes.

Our programme is designed to showcase the diversity of Swedish heathlands, from the sandy plains of southern Sweden to the wind-exposed coastal cliffs of the Bohuslän archipelago. Each site has its own character and challenges, and we look forward to sharing examples and ongoing experiments in heathland restoration and management.

Beyond field visits and presentations, this is a unique opportunity to exchange experiences, spark new collaborations, and enjoy each other's company in some of Sweden's most stunning coastal landscapes. We hope you will find inspiration not only in the heathlands we visit, but also in the perspectives and stories shared by colleagues from near and far.

We wish you an engaging, enjoyable, and memorable week on Sweden's west coast.

On behalf of the organising committee, *Mattias Lindholm* 



## **WELCOME FROM THE CHAIR OF THE NETWORK**

GEERT DE BLUST

Looking back on the 17 European Heathland Workshops (EHW) that have been organized since the early 1980s most of which I've had the pleasure to attend — I can't help but conclude that these workshops, or symposia if you prefer, are truly one of a kind. Without any formal organization, and entirely on a voluntary basis, it is remarkable how such meetings are repeatedly organized and actively attended. This shows how deeply people value them — both professionally and personally. They are familiar gatherings we genuinely look forward to. The many questions I regularly received about the location, date, and preparation of the next workshop are clear evidence of that. Over the years, colleagues became friends; cross-border collaborations in research projects emerged; management experiences were shared and exchanged. The heathlands we visited during the workshops even became vacation destinations for some, with return visits to local managers and researchers.

The reason why all this unfolds so naturally and informally, I believe, has a lot to do with the way we approach research and management — not only in a cool, distant, strictly academic manner, but with genuine engagement. And we don't shy away from showing that involvement. We learn from research and management outcomes, but we also advocate for conservation, for its societal value and embeddedness. And yes, there's nothing wrong with simply enjoying heathland landscapes.

That strong sense of connection is also rooted in the subject itself: the heathland landscape. An ancient European cultural landscape, shaped, maintained, used, and altered over centuries by people. To understand this landscape and all its ecosystems, we must view it through multiple lenses — ecology, geography, geosciences, climatology, and equally, cultural studies, history and archaeology, social sciences, and economics. Only by integrating these perspectives can we truly grasp both the historical and current state of heathlands, as well as their future potential. Heathland is not just a collection of ecosystems and ecological processes; it is a socio-ecological system, where ecological and societal processes are deeply intertwined and mutually influential. But even without all these big words, practitioners and policymakers among us have long been aware of this.

At the EHW, we've embraced this integrated view for a long time. We welcome contributions not only from ecologists and land managers — the usual suspects — but also from historians, archaeologists, soil scientists, agronomists, cultural historians, nature guides, and educators. During field trips, we encourage exchanges with farmers, landowners, policy advisors, recreational users, and dog owners. Our aim is to bring together knowledge from different disciplines and, most importantly, to help researchers, managers, and public agency staff get to know each other. So, a good mix, though admittedly, some years are more successful than others.

We also strive to remain responsive to current developments and the challenges faced by managers and researchers. While these challenges don't change every two or three years, the points of debate, expectations, and societal context certainly do shift.

Take, for instance, the impact of excessive nitrogen deposition on the ecological functioning of heathlands. It calls for drastic reduction measures. Yet, in recent years we have seen growing and intense resistance to an effective nitrogen policy. And this resistance has not been limited to nitrogen: it has extended to another cornerstone of biodiversity policy, the Nature Restoration Law. Recall how the political stance on that regulation flipped within a few months, and how a watered-down version was only just adopted.

The data, the facts, the scientific understanding of nitrogen's effects on ecosystems beyond critical loads are available. The possibilities, and importantly, the limits, of what can be achieved through proper management and restoration are well known to practitioners. Further research and trials can refine this, but to gain wider societal acceptance and political support, we must renew our attention to the spatial integration of heathlands. Which land use models hold the most promise? To what extent can the development and long-term survival of viable heathland ecosystems be combined with sustainable and just agriculture? Are we looking more toward land sparing or land sharing?

For centuries, heathlands and local agricultural economies

were interdependent. Can heath be functionally integrated into a multifunctional landscape again, and under what conditions? We've touched on these questions in past workshops, but often only theoretically or anecdotally. There have been scattered attempts to integrate heathland and local farming, but in recent years, increasing polarization has significantly hindered local collaboration — the so-called coalition of the willing. What is needed now is a strong wave of experimentation: integrated case studies and local examples that can translate theory into practical, scalable reality; turning desktop models into real landscapes and operational farms. This will require collaborative research with agricultural sciences, land-use planning, and environmental management to give the land sharing model real substance.

Or perhaps the future lies more in land sparing: large heathland areas functioning autonomously, clearly separated from high-productivity agricultural land. This strategy, often linked to rewilding, is also being promoted. But how do the characteristic heath species develop under such conditions? Which ones thrive, and which ones decline? Will everything ultimately turn into woodland? How much land, region by region, is needed to make heathland rewilding viable? And which landscape ecological processes must or will steer that development? There is much uncertainty and widespread societal distrust about this, fuelled by media polemics, also in our own regions.

Objectives related to climate mitigation and adaptation are increasingly shaping the debate about the meaning and role of heathland in society. We know that old heathland systems can store significant amounts of carbon, and that wet heathlands, especially the associated peat areas, serve as essential climate buffers through water retention. But what happens when the challenge is to optimize all this in the context of climate policy, while at the same time aiming to deforest in order to expand, rewet, and make heathland more climate-resilient?

Removing trees and deforestation have become highly sensitive issues. More intensive and frequent management of heathland, to prevent large amounts of flammable biomass (fuel) from accumulating, so that it becomes less vulnerable to the increasing threat of wildfires. It may be well intended, but such measures can also severely disrupt ecological processes and harm species.

Climate change, ongoing land-use intensification, fragmentation and isolation, environmental pressures that don't stop at the edges of heathland areas, and the evergrowing and changing roles assigned to heathland, all of these along with a rapidly shifting society and land use, are making heathland conservation and management increasingly complex. The old, trusted approaches are no longer sufficient. At the end, it can all seem contradictory and confusing, not only for heathland visitors, but also for policymakers, politicians, and even the managers themselves.

Heathland managers and researchers are well aware of this. They are conducting experiments and analyses to find appropriate responses and gain new insights. This workshop will again reflect that ongoing effort. But if we want to secure a future for heathland, good management and careful research alone won't be enough. Now more than ever, it's vital to invest in informing and communicating with the outside world, in collaboration and connection.

That is a task for everyone who cares about heathland. These are not easy times, but I am convinced that during this 18th EHW, we will find new ideas, inspiration, ambition, and confidence which we can all spread in our own ways.

Enjoy the workshop, Geert De Blust

## **ORGANISATION**

### Västkuststiftelsen

Västkuststiftelsen ("The West Coast Foundation") is a non-profit foundation that manages around 300 nature reserves across the west coast of Sweden – covering more than 50,000 hectares – on behalf of the County Administrative Boards of Västra Götaland and Halland. Heathlands are found in many of these reserves, and are maintained through prescribed burning, grazing, and selective clearing. Over the years, the foundation has worked actively to restore and sustain these habitats, often in collaboration with local stakeholders and landowners.

In addition to habitat management, the foundation coordinates large-scale coastal clean-up efforts, maintains regional hiking and cycling trails, and offers free guided walks to promote public engagement with nature.

Read more about Västkuststiftelsen at: www.vastkuststiftelsen.se www.westswedentrails.se



### **Kosterhavet National Park**

Kosterhavet National Park and the surrounding nature reserves are managed by a unit within the County Administrative Board of Västra Götaland. Our office is situated locally on the Koster Islands, adjacent to the visitor center, naturum.

Heathlands are present on many of the islands and are largely maintained through controlled burning and grazing. Over the past two decades, significant efforts have been made to restore these heathlands. Nonetheless, there remain areas in need of further restoration.

Read more about Kosterhavet National Park at: www.kosterhavet.se



## **County Administrative Board** of Halland

The County Administrative Boards are the most versatile of Sweden's authorities. It is the legal regional authority responsible for regional physical planning, environmental monitoring and environmental protection. They are responsible for the regional implementation of decisions made by the government and the parliament. The main objective is a sustainable development of the region. One of the responsibilities is the management of Nature reserves and Natura 2000 areas in the region as well as actions for threatened species.

The County Administrative Board of Halland (CABN) manages around 32 000 hectares of nature reserves in the county of Halland (15 000 hectares land surface and 17 000 hectares water surface). CABN also manages a lot of places within the Natura 2000 areas. The county as total has almost 70 000 hectares within Natura 2000 areas. Some of the nature reserves consists of heathlands where the main management is controlled burning, fencing, clearing of overgrowth and grazing by cattle from local farmers. In some areas with endangered species the management also includes creating small-scale mosaics that offer a great variety of important microenvironments for the species. To achieve this, burning of small spots and soil disturbance to regain mosaic structures is used, together with adapted grazing regimes.

Read more about The County Administrative Board of Halland at: www.lansstyrelsen.se/halland



## **ACCOMMODATIONS**



### Scandic Hallandia

Scandic Hallandia is centrally located in Halmstad, close to shops, museums, and local attractions. The hotel offers conference facilities for up to 100 people and a relaxation area with sauna and jacuzzi. Halmstad's beaches and coastal nature are within easy reach.

ADDRESS: Rådhusgatan 4 Halmstad

EMAIL: hallandia@scandichotels.com

PHONE NUMBER: +46 35 295 86 00



### **TanumStrand Spa & Resort**

TanumStrand Spa & Resort is located by the sea between Grebbestad and Fjällbacka in Bohuslän. It is one of the region's largest hotel and conference venues, with rooms, cottages, and a guest harbor. The facility can host up to 1,000 guests for accommodation and meetings year-round.

ADDRESS: TanumStrand hotel 457 95 Grebbestad

EMAIL: reception@tanumstrand.se

PHONE NUMBER: +46 525 190 00

## **IMPORTANT INFORMATION**

Emergency telephone number: 112 Taxi service: Please ask in hotel reception

**Organisation committee:** 

Mattias Lindholm +46 730-44 87 15

## **PROGRAMME SUMMARY**

### SUNDAY 17<sup>TH</sup> AUGUST

Arrival

16.00 - 21.00: Check-in at Scandic Hallandia in Halmstad

19.30: Dinner

**MONDAY 18<sup>TH</sup> AUGUST** 

Presentations | Excursion

07.00 - 08.30: Breakfast

09.00 - 09.30: Opening by Chair and word of welcome

by the organising committee

09.30 - 10.30: Session 1 chaired by Christian Damgaard

10.30 - 11.00: Coffee break

11.00 - 12.00: Cont. session 1

12.00 - 13.00: Lunch

13.00 - 13.45: Travel to Mästocka

13.45 - 17.00: Field excursion at Mästocka (includes

coffee break)

17.00 - 17.45: Return journey to Scandic Hallandia

19.00: Dinner

TUESDAY 19TH AUGUST

**Presentations** 

07.00 - 08.30: Breakfast

09.00 - 10.20: Session 2 charied by Jill Kowal

10.20 - 10.50: Coffee break

10.50 - 12.10: Session 3 chaired by Liv-Guri Velle

12.10 - 13.10: Lunch

13.10 - 14.30: Session 4 chaired by Joost Vogels

14.30 - 15.15: Coffee break

15.15 - 15.45: Introduction to excursions

15.45 - 17.00: Poster session

19.00: Dinner

WEDNESDAY 20TH AUGUST

**Excursions | Transfer to Tanum Strand** 

07.00 - 08.00: Breakfast

08.30 - 09.15: Board bus and travel to Långasand

and Vesslunda

09.15 - 11.20: Field excursion at Långasand

and Vesslunda

11.20 - 12.00: Board bus and travel to Björkäng vägkrog

12.00 - 13.00: Lunch at Björkäng vägkrog

13.00 - 13.35: Travel to Fjärås Bräcka

13.35 - 15.30: Field excusion at Fjärås Bräcka (includes

coffee break)

15.30 - 18.00: Travel to Tanum Strand (short comfort

break at Spekeröd, 16.45 - 17.00)

18.10 - 18.30: Check-in at Tanum Strand

19.30: Dinner

THURSDAY 21TH AUGUST

Excursion

07.00 - 08.30: Breakfast

09.00 - 09.45: Travel to Ramsvikslandet

09.45 - 13.30: Field excursion at Ramsvikslandet

(includes field lunch)

13.30 - 14.00: Travel to Nordens Ark

14.00 - 14.30: Coffee break and introduction to

Nordens Ark

14.30 - 17.15: Field excursion at Nordens Ark

17.15 - 18.00: Return journey to Tanum Strand

19.30: Conference dinner at Tanum Strand

FRIDAY 22<sup>TH</sup> AUGUST

Excursion | Farewell | Plus programme

07.00 - 08.30: Breakfast

09.00 - 09.30: Travel to Tjurpannan Nature Reserve

09.30 - 13.15: Field excursion at Tjurpannan Nature

Reserve (includes field lunch)

Departure:

13.15 - 15.45: Travel to Gothenburg Central Station for participants not continuing with the Plus Programme

Plus Programme:

13.15 - 15.20: Travel to Kosterhavet National Park

15.20 - 16.00: Check-in at Ekenäs Havshotell

16.00 - 17.00: Visit to Kosterhavet National Park

Visitor Centre

19.00: Dinner

SATURDAY 23<sup>TH</sup> AUGUST

Excursion | Plus programme excursion | Departure

07.00 - 08.30: Breakfast

09.00 - 15.00: Field excursion at Kosterhavet National

Park (includes field lunch)

15.00 - 16.00: Travel to Strömstad railway station

## **PARTICIPANTS**

### FAMILY NAME, FIRST NAME | AFFILIATION | COUNTRY

**Alness, Lena** | County Administrative Board of Halland | Sweden

**Andersson, Emelie** | County Administrative Board of Halland | Sweden

Antonsson, Henrik | Västkuststiftelsen | Sweden
Arrigoni, Elena | Royal Botanic Gardens Kew | UK
Bisset, Rebekah | Forestry England | UK
Prott Corl | County Administrative Board of Helland

**Bratt, Carl** | County Administrative Board of Halland | Sweden

Calvo, Leonor | University of León | Spain
Claesson, Christina | Västkuststiftelsen | Sweden
Clement, Bernard | Retired from University of Rennes |
France

**Clement, Mireille** | Retired from Educational Service of France | France

Damgaard, Christian | Aarhus University | Denmark De Blust, Geert | University of Antwerp | Belgium de Winter, Jef | Agentschap voor Natuur en Bos | Belgium

**Dictus, Chris** | Natuurpunt | Belgium **Dobbedal, Eirik** | Jomfruland nasjonalpark og Stråholmen landskapsvernområde | Denmark

Finsberg, Camilla | County Administrative Board of Västra Götaland | Sweden

Gorissen, Ingemar | Germany

Hansson, Jeanette | Municipality of Varberg | Sweden Hederstedt, Ellinor | Västkuststiftelsen | Sweden Hellman, Mikael | County Administrative Board of Halland | Sweden

**Johannesson, Anders** | County Administrative Board of Halland | Sweden

**Kaland, Peter Emil** | University of Bergen | Norway **Karlsson, Amanda** | County Administrative Board of Halland | Sweden

**Karnfält, Lisa** | Kosterhavet (County Administrative Board of Västra Götaland) | Sweden

Kowal, Jill | Royal Botanic Gardens Kew | UK Kron, Linus | Västkuststiftelsen | Sweden

**Kusse, Veronique** | Agentschap voor Natuur en Bos (ANB) | Belgium

Kvamme, Mons | Lyngheisenteret | Norway Larsson, Krister | University Natur Bimlångsdalen | Sweden

Larsson, Catharina | Västkuststiftelsen | Sweden Lennerås, Anders | Västkuststiftelsen | Sweden Lindholm, Mattias | Västkuststiftelsen | Sweden Lindqwister, Kim | Västkuststiftelsen | Sweden Lundqvist, Carina | County Administrative Board of Halland | Sweden

**Machielsen, Karel** | Agentschap voor Natuur en Bos | Belgium

Marco, Elena | University of León | Spain Martinsson, Henrik | County Administrative Board of

Halland | Sweden

Miscevic, Diana | Västkuststiftelsen | Sweden

Morris, Dave | Forestry England | Belgium Mölholm, Martin | Västkuststiftelsen | Sweden

Niklasson, Mats | Nordens ark /SLU | Sweden

**Norbaek, Frederikke** | Naturstyrelsen Trekantsområdet | Denmark

Olsen, Monika | Ytre Hvaler nasojnalpark | Norway

Persson, Kill | MiNa Natur | Sweden

**Poll, Rene** | Natural burials Netherlands | The Netherlands

**Post, Peter** | County Administrative Board of Västra Götaland | Sweden

**Rosquist, Gabrielle** | County Administrative Board of Skåne | Sweden

Siepel, Henk | Radboud university | Belgium Sitters, Judith | B-WARE Research Centre | The Netherlands

**Smiths, Jap** | Jap Smits Ecological advice | The Netherlands

**Stenström, Anna** | County Administrative Board of Västra Götaland | Sweden

**Tomingas, Marie** | County Administrative Board of Västra Götaland | Sweden

Torsøe, Lars Christian | Agder Villsau DA | Norway Torsøe, Leif Christian | Agder Villsau DA | Norway Van Assche, Luc | Agentschap voor Natuur en Bos | Belgium

Veland, Siri | Norce | Norway

Velle, Liv-Guri | NIBIO | Norway

**Vogel, Joost** | Bargerveen Foundation / Radboud university | Belgium

**Weiters, Maaike** – B-WARE Research Centre | The Netherlands

Wiklander, Anna | Västkuststiftelsen | Sweden Wingård, Patrik | Västkuststiftelsen | Sweden

## **SCIENTIFIC PROGRAMME**

### **SESSION 1**

MONDAY 18<sup>TH</sup>

INTRODUCTION TO SCANDINAVIAN HEATHLANDS AND THEIR MANAGEMENT

09.30 - 09.50 - Session 1.1

Krister Larsson

"Heathlands – Mosaic Management Promotes Unique Biodiversity. Experiences from Halland, Sweden"

09.50 - 10.20 - Session 1.2

Kill Persson

"Small-Scale Prescribed Burning – A Beacon for Flora and Fauna!"

10.20 - 10.30 - Session 1.3

Lena Alness

"Action Plan for Endangered Species and Habitats"

11.00 - 11.20 - Session 1.4

Anna Stenström

"Grazing, raking, sowing – trying to save a species"

11.20 - 11.40 - Session 1.5

Liv Guri Velle

"Coastal heathlands in Norway – an update on mapping, management and monitoring"

11.40 - 12.00 - Session 1.6

Carina Lundqvist, Krister Larsson

"Mästocka nature reserve - introduction to field excursion"

### **SESSION 2**

TUESDAY 19<sup>™</sup>

MANAGEMENT AND CULTURAL PRACTICES

09.00 - 09.20 - Session 2.1

Christian Damgaard

"Adaptive management of heathland ecosystems"

09.20 - 09.40 - Session 2.2

René Poll

"Natural burial as a stimulus for biodiversity: practical experiences from Schoorsveld natural burial site"

09.40 - 10.00 - Session 2.3

René Poll, Jap Smits

"Heathland management on natural burial grounds"

10.00 - 10.20 - Session 2.4

Siri Veland, Scott Bremer, Abel Crawford, Mari Korsbrekke, Alexandra Meyer, Camilla Risvoll, Stine Rybråten

"Culture-based solutions to heathland wildfires and other climate-related hazards"

### **SESSION 3**

### TUESDAY 19<sup>™</sup>

### SOIL AMENDMENTS, ACIDIFICATION & NUTRIENT MANAGEMENT

### 10.50 - 11.10 - Session 3.1

Henk Siepel, Joost Vogels, Maaike Weijters

"The working of silicate rock powder (SRP) on soil microarthropods and decomposition in heathlands"

#### 11.10 - 11.30 - Session 3.2

Joost Vogels, Henk Siepel, Kevin Geurts, Juliette van der Schoor, Maaike Weijters, Evi Verbaarschot, Roos Loeb, Mirjam Scherpenisse, Peter Verbeek, Sophia Findeisen, Willem-Jan Emsens, Erik Verbruggen, Erik Cammeraat, Boris Jansen

"Nine years of rock dust application research in heathlands: the role of soil cation exchange capacity on effect size"

### 11.30 - 11.50 - Session 3.3

Judith Sitters, Maaike Weijters

"Application of silicate rock powder mitigates effects of soil acidification in old oak forest"

### 11.50 - 12.10 - Session 3.4

Elena Arrigoni, Ruairi Hafferty-Hay, Pino-Raquel Bodas, Liv G. Velle, Kerry Bradshaw, Zeren Yang, Amanda Cooper, Tim Wilkinson, Jeffrey G. Duckett, Silvia Pressel, Rachael Howlett, Justin Moat, Susan Zappala, Martin I. Bidartondo, Laura M. Suz, Jill Kowal

"Effects and Recovery from N Pollution on Heathlands: Mycorrhizal Fungi as Indicators"

### 13.10 - 13.30 - Session 3.5

Maaike Weijters, Roos Loeb

"Abiotic Constraints and Restoration Potential of Nardus Grasslands on the Veluwe: Insights from Dutch and Danish Sites"

### **SESSION 4**

TUESDAY 19<sup>™</sup>

### TRADITIONAL LAND USE & GRASSLAND CONSERVATION

### 13.30 - 13.50 - Session 4.1

Jef De Winter

"Challenges in managing grazing on the Kalmthoutse Heide"

### 13.50 - 14.10 - Session 4.2

E. Marcos, I. Prieto, G. Ansola, A. Reguero, J.M. Fernández-Guisuraga, L. Calvo

"Management model for the development of multifunctionality and the bioeconomy in high ecological value areas, through ecological extensive livestock farming and transhumance"

#### 14.10 - 14.30 - Session 4.4

Leonor Calvo, Víctor Fernández García, José Manuel Fernandez-Guisuraga, Reyes Tárrega, Luz Valbuena, Elena Marcos

"Transhumance as a key element in the conservation of biodiversity in the Cantabrian Mountains"

### **POSTER SESSION**

### 15.45 - 17.00

Elena Arrigoni, Ruairi Hafferty-Hay, Raquel Pino-Bodas, Liv G. Velle, Kerry Bradshaw, Zeren Yang, Amanda Cooper, Tim Wilkinson, Jeffrey G. Duckett, Silvia Pressel, Rachael Howlett, Justin Moat, Susan Zappala, Martin I. Bidartondo, Laura M. Suz, Jill Kowal

"The Air Pollution Recovery Indicators Programme: Focus on Heathlands"

## **SESSION 1**

## INTRODUCTION TO SCANDINAVIAN HEATHLANDS AND THEIR MANAGEMENT

SESSION 1.1 - MONDAY 18<sup>TH</sup> | 09.30 - 09.50

Heathlands – Mosaic Management Promotes Unique Biodiversity. Experiences from Halland, Sweden

### **Krister Larsson**

ALLMA Natur och Kultur



### **ABSTRACT**

**Background**: The heathlands of Halland and Västra Götaland are critical for Sweden's threatened species and biodiversity. These regions still contain relatively large areas of heathland. As part of the development of a new management plan for heathlands, the County Administrative Board of Halland initiated a comprehensive biological monitoring of the heathlands between 2016 and 2018 to better understand their ecological values and conservation needs.

**History**: Heathland was once widespread in Halland, with an estimated 150,000 hectares in the late 1800s. Today, only about 2,000–3,000 hectares remain, a mere 2% of the original area. Heathland was primarily a man-made landscape, created by grazing in areas with a mild winter climate conducive to its spread.

**Terminology**: The term "heathland" specifically refers to areas where burning is a part of the management, which is crucial for biodiversity. Other heath-like areas are referred to as heathland-like, and areas deemed suitable for restoration are called restoration sites.

Objectives: The primary goal was to improve

the understanding of the biological values of heathlands in Halland and to identify key species and habitats in need of targeted conservation actions. The aim was to gather data on red-listed and other conservation-worthy species, assess the best management models for maintaining biodiversity, and pinpoint areas requiring restoration or specific management interventions.

**Methods**: Fieldwork was conducted primarily in the northern parts of Halland to create a more consistent dataset. Sites with limited prior knowledge but high potential for rare species were prioritized. The research focused on various insect groups, including butterflies, bees, and ground-dwelling beetles, using a range of techniques like direct searching, traps, and light lures.

**Results**: A total of 226 red-listed species from 12 groups were recorded across 44 study sites. Notably, butterflies were the most diverse group, followed by vascular plants and fungi. The findings highlight the exceptional value of heathlands for invertebrates, with several significant fungal discoveries.

Conservation Targets: The biodiversity of heathlands is highly diverse, with considerable variation across different heath types and succession stages. There is no single "ideal" heathland model, as various stages and structures support different species. A mosaic management approach is essential for sustaining the full range of species found in these habitats.

Management: Burning remains a key management tool for maintaining the mosaic structure of heathlands. However, there is a shift toward smaller-scale burns in Halland. Grazing pressure must also be carefully controlled to support nectarand pollen-dependent insects. Management techniques without grazing have also been developed in certain areas.

**Future Directions**: To maintain and enhance the ecological values of heathlands, the quality of existing areas needs to be improved, and new restoration efforts should focus on strategically important locations. Key actions include advancing small-scale burning, reducing excessive grazing, and introducing mechanical disturbance in areas lacking bare sand and gravel.

SESSION 1.2 - MONDAY 18<sup>TH</sup> | 09.50 - 10.20

## Small-Scale Prescribed Burning – A Beacon for Flora and Fauna!

#### Kill Persson

MiNa Natur



### **ABSTRACT**

Burning to improve grazing on pastures is a skill that generations of farmers have used. By burning patches of grass and herbs early in the spring, the land can be maintained in good condition. This practice allows areas with herbs to bloom during the summer or creates patches where thick last year's grass lies like a blanket, which can then return to herb-rich grasslands.

Some pastures—or parts of them—with many blooming herbs might be temporarily left ungrazed to preserve them for pollinators, such as insects visiting for pollen and nectar, and then burned the following spring. When used correctly and with consideration, small-scale conservation burning can increase the diversity of our grasslands.

### **PLAYING WITH FIRE - WHY?**

Burning away thick layers of old grass reduces nutrient accumulation in the soil. This keeps the pasture poor in nutrients as nitrogen escapes into the air, and the ash raises the soil's pH. Many herbs benefit from this, which in turn attracts pollinating insects. The fire's scattered patches create space for new seedlings to sprout, while bees and other pollinators find nesting sites.

Historically, fire has been used by farmers for clearing land and strengthening grass and herb growth on meadows and pastures - today, it may be most beneficial for biodiversity. Just think of the traditional heath burning in southwestern Sweden - a practice that has never completely disappeared, and flowers still bloom on the heathlands.

### HEADWIND, WATER, AND THE CRITICAL CORNER - HOW?

Burning with a slight headwind gives you better control over the fire, as the fire front moves slowly, and the burn goes deep enough to burn away the litter. The direction of the wind at the time will determine where and how to light the fire. Ensure there are good firebreak lines around the outer edge of the area. Roads and ditches are ideal, and sometimes a simple path with some bare earth that you water along can limit the direction of the fire. Always make sure there is access to water and fill up several watering cans to place along the firebreaks. A steel rake, or flame suppressor (a special tool resembling a leaf rake with flat, fanlike metal blades) should be available for those monitoring the burn. These tools can help "sweep" out small hotspots if the fire tries to escape the firebreaks. Once the most critical part has been burned, you can light arcs upwind, allowing smaller areas to burn downwind towards the already burned section.

SESSION 1.3 - MONDAY 18<sup>TH</sup> | 10.20 - 10.30

## Action Plan for Endangered **Species and Habitats**

### Lena Alness

County Administrative Board of Halland



### **ABSTRACT**

The action plans are developed as a targeted effort for species and habitat types that require specific measures not addressed by general considerations (such as those in agriculture or forestry), legal requirements, or traditional conservation and management of natural areas.

The Swedish Environmental Protection Agency (Naturvårdsverket, NV) and the Swedish Agency for Marine and Water Management (Havs- och vattenmyndighten, HaV) are responsible for

administrating and approving the programs. The Swedish Species Information Centre (ArtDatabanken) provides expert support. Then, the County Administrative Boards (Länsstyrelserna) are responsible for developing and implementing the programs in collaboration with other activities and stakeholders. The programs are advisory and can be used as a basis for the work of authorities and organizations, while also being directed at an interested public.

It is a broad undertaking – there are just over 130 terrestrial (land-based) action plans and more than 20 plans for aquatic species and habitat types (both in freshwater and marine environments).

The action plans are evaluated regularly, usually every five years. This is long-term work, and sustained efforts are often required to see an effect on threatened species and habitats. At the same time, the action plan work provides an opportunity to develop new forms of collaboration and innovate conservation measures, including testing methods that may not be feasible within traditional nature conservation frameworks.

### ACTION PLAN FOR SOUTHWEST SWEDISH HEATHLANDS

Why an action plan for heathlands in southwest of Sweden? Sweden has a major responsibility for preserving heathlands. Heathlands are the home of a large number of red-listed species. Heathland species are threatened not only by the rapid disappearence of their habitats, but also by inappropriate management of the remaining areas. Remaining populations are small and isolated, concentrated to a small number of heathlands in favourable conservation status. Populations of heathlands species outside these areas are as a rule rapidly decreasing and their future is unsecure.

Heathlands are to be seen as a complex ecosystem including several habitats, among which the Natura 2000 habitats Dry heaths (4030) and Northern Atlantic wet heaths with Erica tetralix (4010) are dominating.

The Action plan gives a broad introduction to heathland ecology, with fire and extensive grazing as major management regimes. In addition, other small-scale disturbance processes essential for the maintenance of heathland biodiversity are presented.

Suggested actions include restoration of overgrown and forestated heathlands, with an objective that 10 000 hectares will have favorable status until 2040. In addition, measures are needed to increase the quality and conservation status of remaining heathlands.

All actions need to be carefully monitored and evaluated in order to approach an evidence based

management. Further knowledge is essential not only as to different management methods, but also regarding historical distribution of heathlands as well as the ecology and habitat demands of heathland species. Further inventories together with landscape analyses are needed for planning and prioritization of management actions. Information to landowners and the public is essential, as well as training of managers.

A holistic approach to heathland management is necessary in order to approach and maintain favourable conservation status of heathlands as well as heathland species.

SESSION 1.4 - MONDAY 18<sup>TH</sup> | 11.00 - 11.20

## Grazing, raking, sowing – trying to save a species

### Anna Stenström

The County Administrative Board of Västra Götaland, Sweden

#### **ABSTRACT**

Gentianella campestris ssp baltica (GCB) is a threatened species classified as endangered on the Swedish redlist. It's main habitat are the heathlands on the westcoast. It is an annual, while the other Swedish subspecies are biennial. It grows in unfertilized grazed areas and meadows on the coast, such as heathlands but also in more grassrich pastures. The species is a poor competitor and the seed can not reach the soil when the moss gets thick.

The county of Västra Götaland has about 80% of the populations of GCB in Sweden. During the last 50 years the number of populations has declined with 50%. To try to reverse the negative trend a national action plan was decided. The County Administration in Västra Götaland has together with Västkuststiftelsen, land owners and NGOs worked with special management and sees dispersal.

Grazing with either cows, horses and/or sheep works well for the species, if done at the right time and right intensity. Moss-raking is beneficial, and the plant is often growing in the exact spot we have been raking. Seed dispersal is difficult but can work when done directly after collecting the seeds.

SESSION 1.5 - MONDAY 18<sup>TH</sup> | 11.20 - 11.40

# Coastal heathlands in Norway – an update on mapping, management and monitoring

### Liv Guri Velle

NIBIO, Sykkylven, Norway

#### **ABSTRACT**

The 2025 update of the Norwegian Red List shows that coastal heathlands remain threatened. Key ongoing threats include abandonment of traditional land use and development of the areas. Recently compiled statistics from habitat mapping provide insights into the ecological condition of the heathlands. The data reveal that more than half of the remaining coastal heathland areas lack active management, putting them at risk of encroachment in the coming years. Moreover, data show that the proportion of areas in the late successional phase is surprisingly low, just over ten percent, despite widespread degradation due to encroachment. This suggests that degraded coastal heathlands are difficult to identify and are likely being misclassified as other habitat types, such as forest. To help field surveyors avoid misidentification, a map illustrating the potential distribution of coastal heathlands in Norway has been developed, along with clear inclusion and exclusion principles. The map extends the previously known northern range of heathlands and reaches south eastward toward heathland areas in Sweden. Norway currently lacks representative monitoring of coastal heathland, as existing programs miss rare habitats. It is therefore a welcome step that the Norwegian Environment Agency now proposes the development of a dedicated monitoring program.

MONDAY 18<sup>TH</sup> | 11.40 - 12.00

## Mästocka nature reserve - introduction to field excursion

Carina Lundqvist, Krister Larsson



Burning in Mästocka Nature Reserve. Photo: Carina Lundqvist.



## **SESSION 2**

## MANAGEMENT AND CULTURAL PRACTICES

SESSION 2.1 - TUESDAY 19<sup>TH</sup> | 09.00 - 09.20

## Adaptive management of heathland ecosystems

### **Christian Damgaard**

Aarhus University, Aarhus, Denmark

### **ABSTRACT**

To set-up adaptive management plans for heathland ecosystems, it is important to make quantitative predictions of the effects of different management scenarios for a local area. Using nationwide ecological monitoring data and the hypothesized causal relationships in a structural equation model, it is possible to generate short-term ecological predictions of vegetation cover as a function of the local levels of environmental drivers (nitrogen deposition, soil pH, soil C/N, soil texture, precipitation and grazing). Some of these environmental drivers may be manipulated in an adaptive management plan, and local ecological predictions may provide input for setting-up local adaptive management plans. It is critical to quantify the different sources of uncertainty of the predictions. In a case study of three wet heathlands, different management scenarios on the vegetation cover of key species were predicted and communicated to local managers, who used this information in developing adaptive management plans for the areas.

SESSION 2.2 - TUESDAY 19<sup>TH</sup> | 09.20 - 09.40

# Natural burial as a stimulus for biodiversity: practical experiences from Schoorsveld natural burial site

### René Poll

Natural burials Netherlands, Hertogenbosch, Netherlands

### **ABSTRACT**

Natuurbegraven Nederland is committed to restoring and enhancing natural ecosystems while providing a final resting place within nature. At six locations across the Netherlands, active nature management aimed at biodiversity restoration and landscape quality is combined with natural burial practices. Schoorsveld natural burial site, located near the city of Eindhoven in the south of the Netherlands, was established in 2016.

The original soil structure and historical landscape transformation were taken into account during the design. Historically, the area consisted of heathlands and fens. In the 19th and 20th centuries, the fens were filled up and production forests were established, comprising of Scots

pine, Norway spruce, and Douglas fir. During the site's establishment in 2016, parts of the production forest were cleared to facilitate the regeneration of the original heathland vegetation. Additionally, a former fen that had previously been filled up and planted with production forest was restored. By reopening the fen and spreading the excavated soil mixture of loam and sand over open fields, a unique soil structure rich in minerals was created in the upper layer. This provided a valuable foundation for the development of diverse flora and fauna. Various management practices were implemented, including targeted forest conversion to structurally diverse, mixed deciduous and coniferous forests, and the development of dry heathland and nutrientpoor grasslands. Examples include the application of compost, bokashi, and the spreading of heather cuttings.

This approach resulted in rich habitat diversity, creating attractive conditions for rare species such as the moor frog and the common lizard. Monitoring and research indicate that careful management and proper landscape design contribute significantly to increased biodiversity. Schoorsveld thus forms an essential ecological connection for flora and fauna between surrounding natural areas.

In this presentation, we share our experiences with specific management strategies, results from ecological monitoring, and the challenges encountered. We aim to illustrate how natural burial sites can effectively contribute to nature restoration and the enhancement of biodiversity on nutrient-poor sandy soils.



SESSION 2.3 - TUESDAY 19<sup>TH</sup> | 09.40 - 10.00

### Heathland management on natural burial grounds

### René Poll<sup>1</sup>, Jap Smits<sup>2</sup>

- <sup>1</sup> Natural burials Netherlands, Hertogenbosch, The Netherlands
- <sup>2</sup> Jap Smits Ecological advice, Eindhoven, The Netherlands

#### **ABSTRACT**

In 2022, the Insect Working Group (IWG) of the Royal Dutch Society for Natural History (KNNV) conducted an inventory of invertebrates at the natural burial site het 'Schoorsveld' in Heeze Noord-Brabant the Netherlands. During this inventory, it turned out that the Schoorsveld was home to a number of rare insect species. They were mainly species bound to poor sandy soils with a diverse regional flora.

Many Dutch heathland vegetations suffer loss of minerals and micronutrients due to acidification due to acid rainfall. The above-ground fauna species composition of typical heathland-bound plant species has also been severely decimated. In nature burial grounds, mineral sandy soil becomes available during landscaping and burial activities. The vegetation that develops creates a species richness with a healthy mineral balance, which in turn has a positive influence on herbivores and pollen and nectar consumers. Targeted maintenance and vegetation management can greatly contribute to diversity and biodiversity of the nature burial site and its surroundings.

The presentation will focus on the design, management and maintenance of the cemetery and its location in relation to surrounding natural areas. Natural burial places can therefore function as a good refuge and steppingstone for the distribution of regional flora and (entomo) fauna.

With thanks to the members of the Insect Working Group of the Royal Society for Natural History of Eindhoven, Natuurmonumenten and Natuurbegraven Nederland for surveying the Schoorsveld natural burial site.

SESSION 2.4 - TUESDAY 19<sup>TH</sup> | 10.00 - 10.20

### **Culture-based solutions to** heathland wildfires and other climate-related hazards

Siri Veland, Scott Bremer, Abel Crawford, Mari Korsbrekke, Alexandra Meyer, Camilla Risvoll, Stine Rybråten

#### **ABSTRACT**

This presentation suggests that the cultural goals of heathland stewardship, including its material and intellectual heritage, and its underlying values, traditions, and beliefs, also provides solutions to climate change adaptation. Building on the concept of nature-based solutions (NbS), we argue that the complementary idea of culture-based solutions (CbS) seeks to recognize the intrinsic societal and cultural context of good land stewardship. By centering stewardship and care for the land (skjøtsel in Norwegian), we show that CbS, if built on a regenerative understanding of human agency in Earth systems, can provide a framework that showcases the efforts of communities to take care of heathlands. This approach can help to highlight to governments and funding bodies the need for resources and for better policy and governance to support safe and timely up-scaling of existing stewardship efforts. NbS approaches have been criticised for focusing on engineering and top-down solutions where community actors are framed as co-benefits rather than co-creators. Through CbS, the optic is inverted, asking what cultural

goals might have co-benefits for hazard risk reduction and nature conservation, and for other co-benefits such as social cohesion, inclusion, and heritage. The presentation builds on existing work on CbS by Unesco and a proposal to the Research Council of Norway by the authors that includes a case study from Lygra in

Nordhordaland.



## **SESSION 3**

## SOIL AMENDMENTS, ACIDIFICATION AND NUTRIENT MANAGEMENT

SESSION 3.1 - TUESDAY 19<sup>TH</sup> | 10.50 - 11.10

The working of silicate rock powder (SRP) on soil microarthropods and decomposition in heathlands

### Henk Siepel<sup>1</sup>, Joost Vogels<sup>1, 2</sup>, Maaike Weijters<sup>3</sup>

- <sup>1</sup> Radboud University, dept of Ecology, The Netherlands
- <sup>2</sup> Bargerveen Foundation, The Netherlands
- <sup>3</sup> B-Ware Research Centre. The Netherlands

### **ABSTRACT**

Heathlands in the Netherlands are subject to longlasting and heavy N deposition. The consequences of this N deposition is an increasing acidification of the top soil and a shift in N/P stoichiometry, whereas heavy metals such as aluminium are set free and trace elements are leaching to deeper soil layers. To combat these effects silicate rock powders (SRP) are now used as a method of soil restoration. The goal is to increase pH again from 3.5 to at least 4.5 and lift the hampering on the decomposition process. Important animals is this decomposition process are soil microarthropods, such as mites and springtails. It is expected that especially the herbivorous species among these microarthropods are stimulated when the N/P ratio is decreased again. For fungivores, we expect an increase at higher pH, so when the buffer capacity of the soil is increased again. Furthermore, we expect this process to continue for years when stimulated with the gift of one firm dose of SRP. Effects on the decomposition process could be demonstrated on the short to medium term (3 years), but seem to weaken again on the longer run. Whether this is a consequence of ongoing N deposition or a too low dose remains unsolved at the moment.

SESSION 3.2 - TUESDAY 19<sup>TH</sup> | 11.10 - 11.30

Nine years of rock dust application research in heathlands: the role of soil cation exchange capacity on effect size

Joost Vogels<sup>1,2</sup>, Henk Siepel<sup>2</sup>, Kevin Geurts<sup>1</sup>, Juliette van der Schoor<sup>1</sup>, Maaike Weijters<sup>3</sup>, Evi Verbaarschot<sup>3</sup>, Roos Loeb<sup>3</sup>, Mirjam Scherpenisse<sup>4</sup>, Peter Verbeek<sup>4</sup>, Sophia Findeisen<sup>5</sup>, Willem-Jan Emsens<sup>5</sup>, Erik Verbruggen<sup>5</sup>, Erik Cammeraat<sup>6</sup>, Boris Jansen<sup>6</sup>

<sup>1</sup>Bargerveen Foundation, Nijmegen, The Netherlands (j.vogels@science.ru.nl) <sup>2</sup>Radboud University, Nijmegen, The Netherlands <sup>3</sup>B-Ware Reseach Centre, Nijmegen, The Netherlands <sup>4</sup>Natuurbalans-Limes Divergens, Nijmegen, The Netherlands <sup>5</sup>University of Antwerp, Belgium <sup>6</sup>University of Amsterdam (UvA) – IBED, Amsterdam, The Netherlands

### **ABSTRACT**

Western European heathland ecosystem are subject to decades of increased inputs of sulphur dioxide, nitrous oxides and ammonia due to human activities. As a result of the acidifying effects of these increased inputs, naturally acidic and poorly buffered soils deteriorated strongly, resulting in a loss of characteristic plant and animal diversity. Management efforts to restore the natural soil buffer capacity have been implemented in the past by applying lime (Ca and Mg carbonates) to the soil. By having a high dissolution rate and, liming of heathland soils is accompanied by practical limitations due to the risk of overdosing. Another drawback is that other (micro)nutrients are not restored by liming. In order to fill this management gap, silicate rock powder (SRP, a.k.a. rock dust) application has been researched extensively during the last decade. SRP's are composed of minerals that potentially supply more nutrient to the soil system, but typically weather much more slowly, thus reducing the risks imposed by liming. Too slow dissolution rates may however also result in failure to sufficiently restore the elemental balance of the soil system. Another drawback is that effect studies need longer time windows in order to assess the efficacy of these measures.

Here, we present a result overview of nine years of interdisciplinary SRP research conducted in two large heathland reserves in The Netherlands. We will focus on an important soil component - the soil cation exchange capacity - as important modulator of the effect size of SRP application on soil and plant chemistry and subsequently: soil biota, vegetation and invertebrate responses.

SESSION 3.3 - TUESDAY 19<sup>TH</sup> | 11.30 - 11.50

# Application of silicate rock powder mitigates effects of soil acidification in old oak forest

### **Judith Sitters, Maaike Weijters**

### **ABSTRACT**

Atmospheric nitrogen (N) deposition has led to extensive acidification of forest soils in Europe, particularly in nutrient-poor sandy systems. This process reduces soil pH and base saturation levels, mobilizes toxic aluminium (AI), and causes foliar nutrient imbalances that impair tree vitality. While liming is a common mitigation strategy, it carries ecological risks and does not replenish the full spectrum of weatherable minerals. In this study, we evaluated whether silicate rock powder (SRP) additions can mitigate acidification effects in temperate deciduous forests. We applied two SRP types (Eifelgold and Soilfeed) to experimental plots in ten old oak (Quercus robur) forests in the Veluwe, Netherlands, and monitored changes in soil and leaf chemistry over four years. Both SRPs significantly increased topsoil pH, base saturation levels, and concentrations of exchangeable Ca and K; Eifelgold also raised exchangeable Mg levels. Foliar concentrations of Ca, K, and Mg increased under both treatments, with P increasing slightly only under Eifelgold-addition. However, the SRP-additions did not fully alleviate foliar nutrient deficiencies. SRP-addition did not reduce exchangeable soil Al-concentrations, but decreased the exchangeable AI/Ca-ratio below the critical toxicity threshold through the increase in Ca supply. Our results show that SRPs can partially restore soil chemical status and tree nutrient balance in acidified oak forests. SRP addition therefore offers a promising low-risk alternative to liming for longterm ecosystem recovery on nutrient-poor sandy soils.

SESSION 3.4 - TUESDAY 19<sup>™</sup> | 11.50 - 12.10 **Effects and Recovery from N Pollution on Heathlands: Mycorrhizal Fungi as Indicators** 

Elena Arrigoni<sup>1</sup>, Ruairi Hafferty-Hay<sup>1</sup>, Pino-Raquel Bodas<sup>1,2</sup>, Liv G. Velle<sup>3</sup>, Kerry Bradshaw<sup>1</sup>, Zeren Yang<sup>1</sup>, Amanda Cooper<sup>1</sup>, Tim Wilkinson<sup>1</sup>, Jeffrey G. Duckett<sup>4</sup>, Silvia Pressel<sup>4</sup>, Rachael Howlett<sup>5</sup>, Justin Moat<sup>1</sup>, Susan Zappala<sup>5</sup>, Martin I. Bidartondo<sup>1,6</sup>, Laura M. Suz<sup>1</sup>, Jill Kowal<sup>1</sup>

<sup>1</sup>Royal Botanic Gardens, Kew, London (United Kingdom)

<sup>2</sup>Universidad Complutense de Madrid (Spain)

<sup>3</sup>Norwegian Institute of Bioeconomy Research (Norway)

<sup>4</sup>Natural History Museum, London (United Kingdom)

<sup>5</sup>Joint Nature Conservation Committee, Peterborough (United Kingdom)

<sup>6</sup>Imperial College London (United Kingdom) (e.arrigoni@kew.org; j.kowal@kew.org)

#### **ABSTRACT**

Heathlands are among the most iconic habitats in Northern Europe, with 20% of the world's total area in the UK. Their wide, open landscape is dominated by low-growing Ericaceae shrubs and associated ericoid mycorrhizal (ErM) fungi on nutrient poor, acidic, dry or waterlogged, organic soils. ErM fungi enable N and phosphorus uptake by their plant hosts in exchange for carbon, playing a crucial role in nutrient cycling and contributing to carbon stocks. These fungi also form intimate associations with the rhizoids of several leafy liverworts, including the widespread heathland liverwort Cephaloziella divaricata.

In the 20th Century, nitrogen (N) pollution alongside urbanisation and tree encroachment, have severely impacted heathlands, contributing to their sharp decline. The effects of N pollution on heathland vegetation are well documented, with useful indicators including lichens and bryophytes. However, little is known about how the soil microbiome, including mycorrhizal-forming fungi, is impacted by N pollution. Also lacking is understanding of how heathland might recover; with N pollution now declining across parts of Europe, there is demand from managers and policymakers for novel indicators of heathland recovery. Our research investigates responses of ErM fungi to, and recovery from N pollution, and evaluates their suitability as recovery indicators.

In 2021, we reinstated a dormant experiment in a dry heathland at Thursley National Nature Reserve (Surrey, UK) where N additions ceased in 2010. Results showed lingering effects of N additions on heather vegetation, moss ground cover, lichen communities, soil chemistry and soil fungal communities, while a negative trend was observed in root ErM colonisation in N-treated plots. In 2023, we established thirty new plots, 15 fertilised with 30 kg/ha of ammonium nitrate (NH4NO3), and 15 as controls. To account for plant age, 20 plots were located within mature C. vulgaris stands, and 10 on pioneer vegetation (wildfires occurred in 2006 and 2020, respectively). Combining eDNA techniques and microscopy, we are monitoring ErM root and rhizoid colonisation in C. vulgaris and C. divaricata respectfully, diversity of fungal communities in roots and soil, and soil fungal biomass. A lichen survey was conducted to assess differences in postfire recovery. Vegetation structure and biomass changes are monitored with LiDAR, RGB and multispectral drone imaging to develop a complementary carbon calculation method.

We also sampled six coastal heathlands in Norway, along a south-north N deposition gradient (1-6 kg N/ha/yr), and a comparable wet heathland at Thursley (13 kg N/ha/yr) to investigate potential mycorrhizal indicators of healthy heathlands below the N critical load.

Preliminary results show ErM fungi are more diverse than expected, with ongoing analyses linking root colonisation to N deposition and climate data to understand heathland recovery and identify potential nitrophilic and nitrophobic ErM fungi as recovery indicators.



Arnica montana and Boloria selene. Photo: Kill Persson.



Gentianella campestris. Photo: Kill Persson.

## **SESSION 4**

## TRADITIONAL LAND USE AND GRASSLAND CONSERVATION

SESSION 4.1 - TUESDAY 19<sup>TH</sup> | 13.10 - 13.30

## Challenges in managing grazing on the Kalmthoutse Heide

### Jef De Winter

Agentschap voor Natuur en Bos, Dendermonde, Belgium

(jef.dewinter@vlaanderen.be)

### **ABSTRACT**

The Kalmthoutse Heide is one of the larger heathland areas in Belgium and faces several challenges. It is located near residential neighborhoods and cities, which leads to a lot of recreational pressure. The area also receives too much nitrogen from nearby farming, traffic, and the Port of Antwerp. On top of that, the heathland is drying out because of drainage of both surface and deeper groundwater.

To help manage these problems, we use grazing with sheep and cattle. Two shepherd-led sheep flocks and about fifty cows help maintain the heath. Horses are no longer used, but we are considering bringing them back in the future. However, using animals for grazing is not always easy. We often need to adjust our plans because of new animal welfare laws, the return of wolves, livestock diseases, changing weather conditions, and so on.

I will explain how we deal with these issues in practice, and why flexible and adaptive grazing strategies are needed to protect heathland areas like the Kalmthoutse Heide.

SESSION 4.2 - TUESDAY 19<sup>TH</sup> | 13.30 - 13.50

### Abiotic Constraints and Restoration Potential of Nardus Grasslands on the Veluwe: Insights from Dutch and Danish Sites

### Maaike Weijters, Roos Loeb

B-WARE Research Centre Nijmegen

### **ABSTRACT**

Nardus grasslands (habitat type H6230) are among the most threatened ecosystems in the Netherlands and Europe. Despite restoration efforts, biodiversity continues to decline, largely due to soil acidification and eutrophication. To assess the current condition of these grasslands, the Province of Gelderland commissioned a soil survey across 598 potential Nardus grassland sites on the Veluwe.

Soil samples were collected based on a GIS-selection of locations with potential Nardus-type vegetation or locations where typical species were seen in the recent past. Samples were analyzed for buffering and nutrient availability. Results were compared to reference values derived from well-developed Nardus grasslands in the Netherlands.

To better understand the ecological potential of Nardus grasslands, a comparative study was conducted in Denmark (Poulsens Minde, Lystbæk, Randbøl Hede, Jordløse Bakker, and Rødme Svinehaver), where historical nitrogen deposition has been lower and soil acidification less severe.

In this presentation we will show you the results of the dutch survey, and place the results in context with the Danish sites.

SESSION 4.3 - TUESDAY 19<sup>TH</sup> | 13.50 - 14.10

Management model for the development of multifunctionality and the bioeconomy in high ecological value areas, through ecological extensive livestock farming and transhumance

### E. Marcos, I. Prieto, G. Ansola, A. Reguero, J.M. Fernández-Guisuraga, L. Calvo

Department of Biodiversity and Environmental Management. Faculty of Biology and Environmental Sciences. University of León (elena.marcos@unileon.es)

#### **ABSTRACT**

BiONNOMIA is an ambitious project focused on the protection of nature and biodiversity, as well as the preservation of natural heritage, natural resources, and green infrastructure. At its core lies extensive livestock farming—particularly transhumance and local seasonal livestock movements (trasterminancia)—as a key tool for the conservation of habitats and species typical of Mediterranean and mountainous landscapes.

Through transhumance, the areas of origin benefit from a reduction in grazing pressure, allowing for the natural regeneration of resources during the summer resting period. Meanwhile, in the mountain pastures of the Cantabrian Range, where sheep graze during the harshest months for water and forage availability in the Andalusian and Extremaduran dehesas and steppes, there is a noticeable enhancement of biodiversity, both in terms of flora and fauna. Furthermore, these mountain pastures help prevent shrub encroachment, contributing to the maintenance of a sustainable ecological balance that supports climate change mitigation, particularly through the increased sequestration of greenhouse gases, notably CO<sub>2</sub>.

Moreover, transhumance is an ancestral practice, and ensuring its continuity contributes to the preservation of both natural and cultural heritage. By acting on both the sending and receiving territories of transhumant livestock, the project ensures the maintenance and improvement of associated infrastructures, such as shepherd shelters and facilities for field workers, incorporating renewable energy technologies.

In conclusion, transhumance—the focus of this project—can be regarded as a fundamental tool within the broader concept of sustainability, both in terms of the responsible use of endogenous resources and the value-added products that may derive from this practice.

SESSION 4.4 - TUESDAY 19<sup>TH</sup> | 14.10 - 14.30

Transhumance as a key element in the conservation of biodiversity in the Cantabrian Mountains

Leonor Calvo, Víctor Fernández García, José Manuel Fernandez-Guisuraga, Reyes Tárrega, Luz Valbuena, Elena Marcos

Dept. of Biodiversity and Environmental Management, University of León (Spain) (leonor.calvo@unileon.es)

### **ABSTRACT**

In the Iberian Peninsula, heathlands dominated by *Calluna vulgaris* are restricted to the Cantabrian Mountains (North-Western Spain), where they represent the southern-most distribution limit of this ecosystem type in Europe. These Cantabrian heathlands are considered as a biodiversity hotspot, hosting a wide variety of species, many of them being endemic. For centuries, Cantabrian Mountains have received transhumant sheep flocks. However, transhumance has declined drastically

in recent decades, potentially causing significant changes in the landscape. The aim of this study is to analyze the relationship between sheep grazing and grassland dynamics in the Cantabrian Mountains between 1990 and 2020. To achieve this, 126 study sites (puertos de merinas) were classified according to the duration of sheep use (none, low, moderate, and high) during the 1990-2020 period. In addition, a time series of 30 Landsat images (one per year) was used, to which a spectral unmixing technique (MESMA) was applied in order to estimate the proportion of grassland in each Landsat pixel (fractional image), and to identify pixels where grassland was the dominant cover (hard classification). The results showed those areas (puertos) with high levels of sheep use had greater grassland cover and more core grassland areas, with increases in both variables during the last decade. These areas also exhibited shorter distances between grassland patches.



Hesperia comma. Photo: Mikael Hellman.

## **POSTER SESSION**

## THE AIR POLLUTION RECOVERY INDICATORS PROGRAMME: FOCUS ON HEATHLANDS

Elena Arrigoni<sup>1</sup>, Ruairi Hafferty-Hay<sup>1</sup>, Raquel Pino-Bodas<sup>1,2</sup>, Liv G. Velle<sup>3</sup>, Kerry Bradshaw<sup>1</sup>, Zeren Yang<sup>1</sup>, Amanda Cooper<sup>1</sup>, Tim Wilkinson<sup>1</sup>, Jeffrey G. Duckett<sup>4</sup>, Silvia Pressel<sup>4</sup>, Rachael Howlett<sup>5</sup>, Justin Moat<sup>1</sup>, Susan Zappala<sup>5</sup>, Martin I. Bidartondo<sup>1,6</sup>, Laura M. Suz<sup>1</sup>, Jill Kowal<sup>1</sup>

- <sup>1</sup>Royal Botanic Gardens, Kew, London (United Kingdom)
- <sup>2</sup>Universidad Complutense de Madrid (Spain)
- <sup>3</sup>Norwegian Institute of Bioeconomy Research (Norway)
- <sup>4</sup>Natural History Museum, London (United Kingdom)
- <sup>5</sup>Joint Nature Conservation Committee, Peterborough (United Kingdom)
- <sup>6</sup>Imperial College London (United Kingdom)

### **ABSTRACT**

The Joint Nature Conservation Committee (UK) launched the Air Pollution Recovery Indicators Programme (APRI) in 2023. Royal Botanic Gardens Kew's APRI experimental work focuses on heathland recovery where nitrogen (N) pollution has significantly impacted ecosystem services, including carbon sequestration and biodiversity. Despite the important ecosystem services they provide, little is known about how heathlands might recover from N pollution, especially below ground. We are investigating the potential of ericoid mycorrhizal (ErM) fungi, in both soil and roots, as novel indicators of recovery from N pollution in southern England, and comparing these results to soil and heather roots sourced in less polluted Norway heathlands. ErM fungi form symbiotic associations with heather roots and liverwort rhizoids, mining organic N and phosphorus from nutrient-poor heathland soils; in exchange, the plants supply carbon to the fungi. As such there is an expectation that ErM fungi will respond rapidly to changes in N pollution.

Our field experiments are also assessing changes in lichen community composition and evaluating the practicality of using LiDAR, RGB and multispectral drone technology to measure and link biomass changes above ground to N fertilization. We have the following research questions regarding above and below ground heathland condition:

- How are ErM and soil fungal communities impacted by, and how do they recover from, N pollution?
- 2. How do changes in above ground vegetation (plants, lichens) link with ErM and soil fungal communities?
- 3. What are the ErM and non-mycorrhizal fungal communities across a N pollution gradient, in southern England and coastal Norway?



Platanthera bifolia. Photo: Kill Persson.

MONDAY 18TH AUGUST

EXCURSION 1 - MONDAY 18<sup>TH</sup>

### Mästocka Heathland

### Your guides:

Carina Lundqvist, County Administrative Board of Halland

Krister Larsson, ALLMA Natur och Kultur Kill Persson, MiNa Natur

### SITE DESCRIPTION AND NATURAL VALUES

The Mästocka Heathland Nature Reserve (156 ha) has had an almost uninterrupted history of traditional land use, including grazing and burning, up until the present day. Burning was resumed for conservation reasons in 1955 after a few decades without the fire. Forty-four red-listed species are known to inhabit the heath, including eleven threatened butterflies and the ginstsandbi (Andrena russula) red-backed mining bee that feeds on hårginst (Genista Pilosa) hairy greenweed.

Mästocka Heath is one of the few heathlands in the country that has maintained an almost continuous history of grazing and burning into modern times. For a few decades in the early 1900s, heathland burning ceased, but a wildfire swept through the area in 1934. From 1954, there are reports that the heath was still grazed by cattle, but the heather was very coarse, with only a few hairy greenweed plants remaining. For conservation reasons, burning was resumed in 1955, and hairy greenweed quickly returned in large numbers. Since then, the heath has been continuously burned and grazed by livestock.

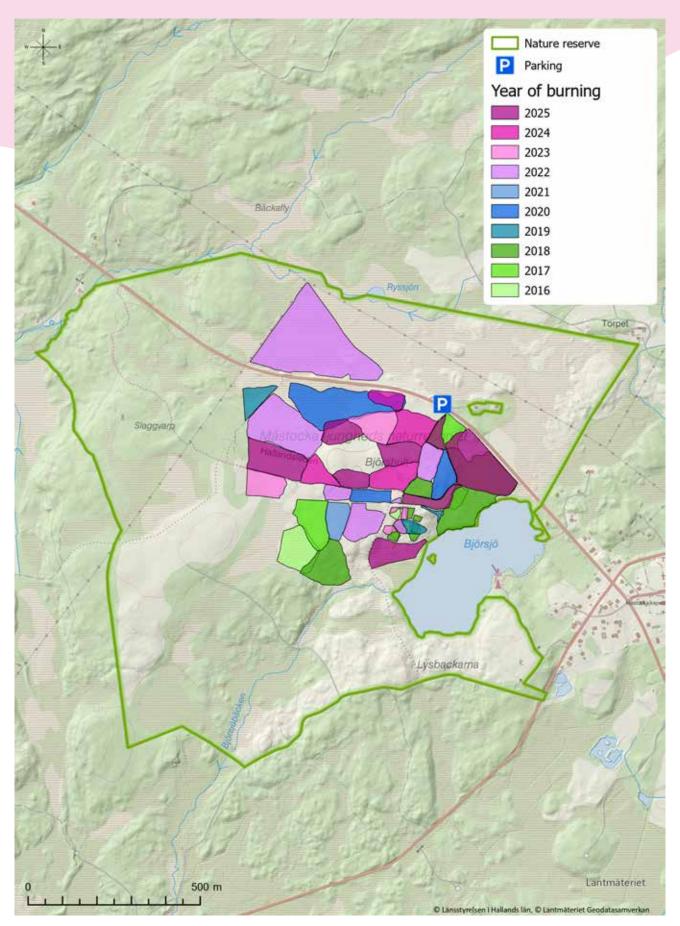
In 1970, Mästocka Heath was first noted as a site for lepidoptera species (butterflies) living on Genista plants. The larvae of the butterflies live on Genistaspecies and closely related plants, in Sweden hairy greenweed is the main food resource. Over the following decades, all species of lepidoptera have been observed in the area, often in large numbers. In the 1990s, reports emerged indicating a drastic decline in lepidoptera on the heath, with the likely cause being a significant increase in grazing pressure combined with more extensive burning. In recent years, management practices have been adjusted to better suit the lepidoptera, and the heathland has been expanded southward. As a result, the butterfly populations are recovering, and all eleven species have been observed in recent years.

A wide range of other red-listed species also inhabit the heath, which is among the top sites nationally for the occurrence of threatened species in heathland habitats. In addition to lepidoptera, species such as mosippa (Pulsatilla vernalis) pasque flower, cypresslummer (Cypresslummer Lycopodium) clubmoss, ginstsandbi (Andrena russula) red-backed mining bee, huvudbägarlav (Cladonia peziziformis) main cup lichen, and large populations of slåttergubbe (Arnica montana) mountain arnica are found here. Mästocka Heath has recently been expanded by clearing older coniferous forests, which are now being grazed again. Spot disturbances with excavators have been carried out in several areas. In these patches, thriving populations of hairy greenweed have flowered, and a few species of lepidoptera, such as the gulstreckad backmätare (Scotopteryx mucronate) lead bell and större ginststävmal (Prolita solutella), have been observed. No burning has yet been conducted in the southern part.

### MANAGEMENT MEASURES

Past management: After the area was designated as a nature reserve in 1976, management became increasingly intensive, with heavier grazing pressure and larger-scale burning. When reports indicated a decline in the genista-dependent butterflies, grazing pressure was regulated, paddock divisions were introduced, and smaller-scale burning was implemented, which the butterflies responded positively to. Grazing pressure on the heath decreased starting in 2009, and livestock are now introduced at the earliest in July every year. To facilitate burning, fire ponds have been created in the old heath. The burning pattern for the last ten years is shown in the map.

Additionally, the heathland has been expanded by restoring forested areas. The Swedish Environmental Protection Agency purchased 2001 areas south and west of the old heath to restore new hairy greenweed heaths. The former red spruce forest in the area south of the old heath was felled twenty years ago and is now in progress of restoration. It is now being grazed, and in some locations, mineral soil has been scraped with excavators to benefit hairy greenweed and lepidoptera (butterflies). The red spruce forest in the area west of the old heath the forest is going to be cleared in the autumn of 2025 and further restoration actions will be taken to transform the area to heathland.



WEDNESDAY 20TH AUGUST

EXCURSION 2 - WEDNESDAY 20TH

### Långasand

### Your guides:

Krister Larsson, ALLMA Natur och Kultur Kill Persson, MiNa Natur

### SITE DESCRIPTION AND NATURAL VALUES

In Långasand (30 hectares), there is a large area of sand heaths within the green area between the residential area and the sandy beach. Nature conservation agreements cover parts of the land. Since 2008, a project has been ongoing in collaboration with local residents to restore and manage sand heaths of high ecological value. Since the start of the project, 34 red-listed species have been found in the area, including batavsandbi (Andrena batava), martorn (Eryngium maritimum) sea holly, vridfingersvamp (Clavaria amoenoides) and ängsväddantennmal (Nemophora cupriacella).

Invasive vresros (*Rosa rugosa*) Japanese rose has been removed, and major clearings have taken place. Old, coarse heather has been rejuvenated through controlled burning. The land is managed without grazing animals using continuous burning, mowing (on older, sandy fields), and mechanical soil disturbance.

In Långasand, a larger area of sand heathland exists between the residential area and the beach, where major restoration efforts have been undertaken in recent years. Closest to the beach in the west are sand dunes, which transition inland into flat sand heaths. In the far east, meadow areas are also included—often in a mosaic with heather-covered sand heath—which were cultivated as farmland until the 1950s. Previously, the land was heavily overgrown with coarse heather, deciduous trees, pine, and juniper, as well as extensive thickets of Japanese rose to the west. This has been completely transformed through restoration.

In newly created patches of exposed sand, several red-listed solitary wasps and bees have made their home, such as the hedsidenbi (*Colletes fodiens*) and the sandsmalbi (*Lasioglossum sabulosum*). The silversandbi (*Andrena argentata*), formerly red-listed, is entirely dependent on heather, whose pollen feeds its larvae. It flies in late summer when the heather blooms beautifully on the heath. Repeated burning has benefited rich populations of key nectar and pollen plants like käringtand (*Lotus corniculatus*) bird's foot trefoil, flockfibbla

(Hieracium umbellatum) hawkweed, blåmunkar (Jasione montana) blue bonnets, which attract species like silversmygare (Hesperia comma) silverspotted skipper, praktbyxbi (Dasypoda hirtipes) pantaloon bee, småfibblebi (Panurgus calcaratus), and havstapetserarbi (Megachile dorsalis) among many other insects. As the land is not grazed, the supply of nectar and pollen remains abundant for most of the summer.

In damp dune hollows, red-listed species such as strandlummer (*Lycopodiella inundata*) clubmoss and dvärglin (*Linum catharticum*) fairy flax grow. In the sand dunes, the rare dynstinksvamp (*Phallus hadriani*) dune stinkhorn fungus can be found. The area is a popular destination for swimming and outdoor activities, and many plants and insects benefit from the sandy paths created by visitors. In 2022, the managed area was expanded both to the northeast and the south. Three new areas were restored, primarily through the removal of pine trees and Japanese rose. The area in the northeast was patch-burned during the spring.

#### **MANAGEMENT MEASURES**

The restoration work in Långasand began in 2008 with the removal of all Japanese rose in the northern half of the dune area, along with large amounts of composted seaweed previously dumped in the dunes during beach clean-ups. The Japanese rose in the southern dunes was removed in 2010. Since then, new sprouting rose plants have been removed annually. Initially, deciduous trees, pine, and juniper that had established abundantly behind the dunes were also uprooted, and firebreaks were mowed with a flail mower.

Large areas of coarse heather were present on the heaths. The heather has been rejuvenated in stages by annual burnings, during which accumulations of dead grass also have been burnt away. In the eastern parts, sand heaths and dry meadows have been leveled to allow mowing with modern machines. Mowing takes place in late summer after flowering, and the hay is removed. Ongoing maintenance includes the continuous creation of new areas of exposed sand scattered throughout the site, as well as wet dune depressions. These measures have been funded by the action plans for endangered species (ÅGP), the Rural Development Program's "Utvald miljö" initiative, and funds for managing areas with nature conservation agreements.



WEDNESDAY 20TH AUGUST

EXCURSION 2 - WEDNESDAY 20TH

### **Vesslunda Nature Reserve**

### Your guides:

Krister Larsson, ALLMA Natur och Kultur Kill Persson, MiNa Natur

### SITE DESCRIPTION AND NATURAL VALUES

At Vesslunda, there is a stretch of open sand heaths, wet heaths, and smaller rocky heaths on hilltops throughout the western part of the reserve. In the middle of the area, a couple of older dune ridges with open sand heaths extend eastward through the surrounding pine forests. In spring, the songs of the common rosefinch, skylark and meadow pipit can be heard over the heaths. The central part contains larger wet heaths where bird's-foot trefoil (Lotus corniculatus) blooms abundantly. Red-listed plant species such as clubmoss (Lycopodiella inundata), huvudtåg (Juncus capitatus) dwarf rush, and fairy flax (Linum catharticum) can also be found here.

On the dry sand heaths near the sea, insect life is rich, with species such as the hedpärlemorfjäril (Fabriciana niobe) niobe fritillary, silversandbi (Andrena argentata), and havstapetserarbi (Megachile leachella). Along the trail that runs eastward along the open dune ridge through the pine forest, there are large nesting colonies of the vårsidenbi (Colletes cunicularius) spring mining bee. Its brood parasite, bibagge (Apalus bimaculatus) early blister beetle, and the rare flygsandvägstekel (Arachnospila wesmaeli) are also found here. The area is a popular place for walks and swimming.

### MANAGEMENT MEASURES

The heaths at Vesslunda were previously heavily overgrown before a major restoration project was carried out in the entire area in 2015. The efforts were funded through the Rural Development Program's "Utvald miljö" initiative and ÅGP funds. Deciduous trees and pines were uprooted, Japanese rose was removed from dunes and sand heaths near the sea, and firebreaks were dug toward the pine forest to the east. Parts of the heath were also burned in spring 2016. Since then, additional clearing and conservation burning have taken place. Grazing has not yet been introduced in the area.



View in Vesslunda Nature Reserve. Photo: Carina Lundqvist.



WEDNESDAY 20TH AUGUST

EXCURSION 3 - WEDNESDAY 20TH

### Fjärås Bräcka Nature Reserve

### Your guides:

Mikael Hellman and Carina Lundqvist, County Administrative Board of Halland

### SITE DESCRIPTION AND NATURAL VALUES

Fjärås Bräcka is a prominent terminal moraine formation. A prehistoric road runs along the ridge, and there are numerous ancient remains from the Bronze and Iron Ages. At that time, the area was covered with extensive heathland. About 100 years ago, the heathlands were replanted, primarily with pine, but also with spruce on Svalhögen. However, small remnants of the heath landscape remained on the preserved ancient sites, such as the unique Li burial field with standing stones at the foot of the ridge, which was kept open through clearing and mowing at intervals of several years. During the storm of 1969, the spruce forest on Svalhögen (in the southern part of the heath area) was blown down, marking the beginning of the restoration of larger open heathlands at Fjärås Bräcka. In the early 2000s, the older pine forests near the parking lot and the cholera cemetery were also felled, and today's magnificent heathland landscape emerged. Several conservation burnings have been carried out since.

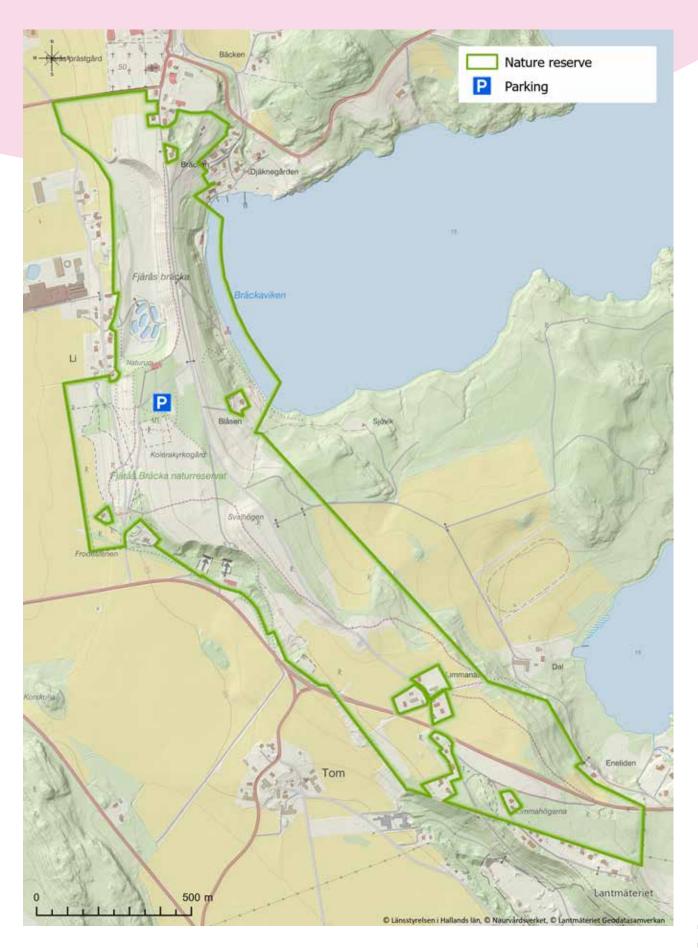
At Fjärås Bräcka, there are several gravel pits, including the large SJ gravel pit in the north, which is now part of the reserve. Many of the heathland species have been able to survive in the area, particularly in the gravel pits and on the open heathlands near the Li burial field. Today, the natural values of the entire heath area are very high. Exclusive species, such as getingrovfluga (Asilus crabroniformis) hornet rubberfly, röd sammetsstekel (Mutilla europaea) large velvet ant, and rovstekeln Crossocerus exiguus, which has few known sites in the county, can be found here. The dung beetle fauna is also rich, including the red-listed snyltdyngbaggen (Aphodius porcus) dung beetle. The guldsandbi (Andrena marginata) small scabious mining bee is abundant in several places in the area, and Fjärås Bräcka likely hosts one of the country's largest populations of this red-listed bee. Adjacent to the heathlands are the large gravel pit in the north and flower-rich meadow areas that contribute to the area's rich plant and animal life.

### MANAGEMENT MEASURES

The restoration of the former heathlands at Fjärås Bräcka began in 1969 when the planted spruce forest on Svalhögen was felled by a storm. In 1976, sheep grazing began here, and later, the animal species varied, with horses and cattle also grazing in the area. In 2004, large-scale clearings of the older planted pine forests that stretched between Svalhögen and the current Naturum (visitor center) began. These areas were also enclosed for grazing, and today's heathland landscape on the ridge took shape. Today, sheep and horses graze in the reserve. Since then, several nature conservation burns have been carried out, both on Svalhögen and the more recently restored heathlands. In 2018, the Iron Age burial field at Li was burned for the first time. Li burial field had previously been managed with heather mowing and clearing at intervals of several years. From 2025 grazing will be reintroduced at Li burial field.



View in Fjärås Bräcka Nature Reserve. Photo: Mikael Hellman.



THURSDAY 21ST AUGUST

EXCURSION 4 - THURSDAY 21ST

### **Ramsvikslandet Nature Reserve**

### Your guides:

Martin Mölholm and Mattias Lindholm, Västkuststiftelsen

### SITE DESCRIPTION

Ramsvikslandet, located on Sweden's west coast in the municipality of Sotenäs, is a striking coastal reserve known for its windswept granite outcrops, intricate cultural landscapes, and ecologically rich heathlands. Formerly a peninsula but now connected to the mainland via a swing bridge across the Sotekanal, Ramsvikslandet offers a dramatic meeting of land, sea, and cultural history.

During our excursion, we will explore various stages of heathland succession—from overgrown stands with birch, juniper, and bramble, to areas undergoing active restoration and well-established, low-growing heaths rich in Calluna vulgaris. Management techniques include rotational shrub clearance, prescribed burning at 6–10 year intervals, and targeted grazing, which together help preserve this historically open landscape. These interventions are not only restoring the landscape's visual character but also ensuring the long-term survival of numerous threatened species tied to open, sun-exposed habitats.

The heathlands of Ramsvikslandet are especially diverse due to patches of calcareous shell gravel found in the otherwise acidic granite terrain. These calcareous microhabitats are ecological hotspots that support rare and sensitive plant species. One such species is the endangered Baltic field gentian (*Gentianella campestris ssp. baltica*), which thrives in nutrient-poor but calcium-rich soils that are maintained through traditional grazing. Other botanical highlights include species like marsh helleborine (*Epipactis helleborine*), chaffweed (*Anagallis minima*) and yellow horned poppy (*Glaucium flavum*) along the coastal fringe.

Ramsvikslandet is equally notable for its fauna, particularly its invertebrates. The rare digger wasp Scolia hirta was rediscovered here in 2001—its first mainland observation in Sweden for over 150 years—underscoring the exceptional quality of the reserve's insect habitats. Carefully managed areas where open land meets groups of trees and shrubs create valuable environments for wildlife. These sunny, sheltered spots are rich in flowers,

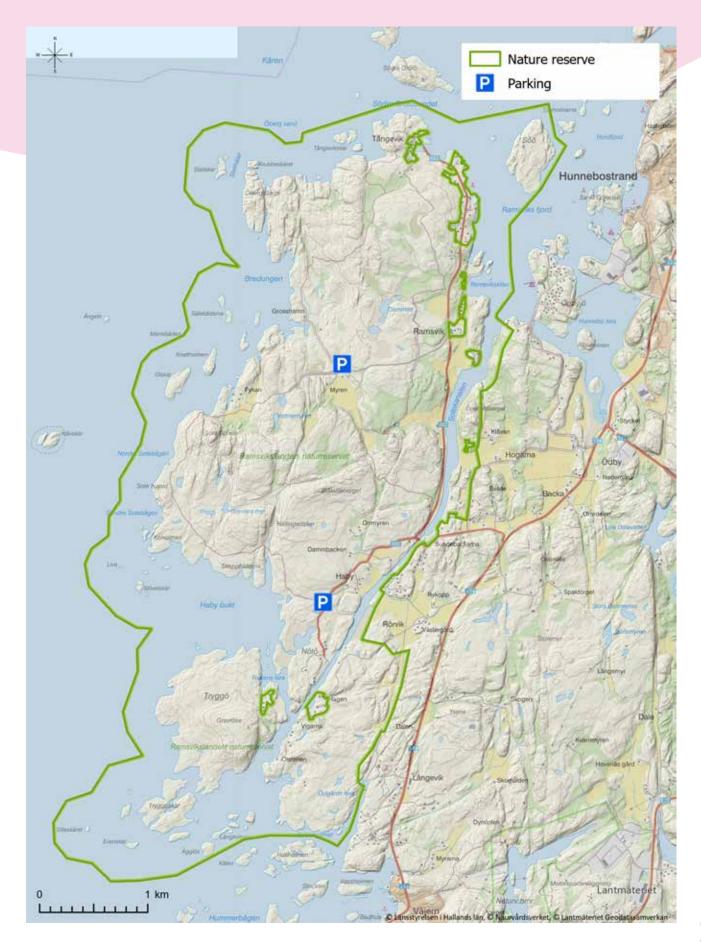
offering nectar for pollinating insects like bees and butterflies. They also provide important shelter and feeding opportunities for birds and other animals that depend on a mix of open and semi-wooded habitats.

Culturally, Ramsvikslandet bears deep historical significance. The landscape is shaped by centuries of traditional land use, visible today in the form of stone fences, ancient field systems, and abandoned crofts. On nearby Tryggö island stands a large Bronze Age burial cairn known as King Tryggve's Grave, and several stone age sites and fishing huts speak to the area's long human occupation.

The combination of geological features, rare habitats, cultural landmarks, and active conservation work makes Ramsvikslandet a unique field site for studying heathland restoration. It vividly illustrates how targeted ecological management, grounded in historical land use, can promote biodiversity, preserve cultural values, and recreate landscapes that are both biologically rich and historically resonant.



View in Ramsvikslandet Nature Reserve. Photo: Västkuststiftelsen.



### THURSDAY 21ST AUGUST

EXCURSION 5 - THURSDAY 21<sup>ST</sup>

## Nordens Ark – Conservation in Practice

### Your guide:

Mats Niklasson, Nordens ark

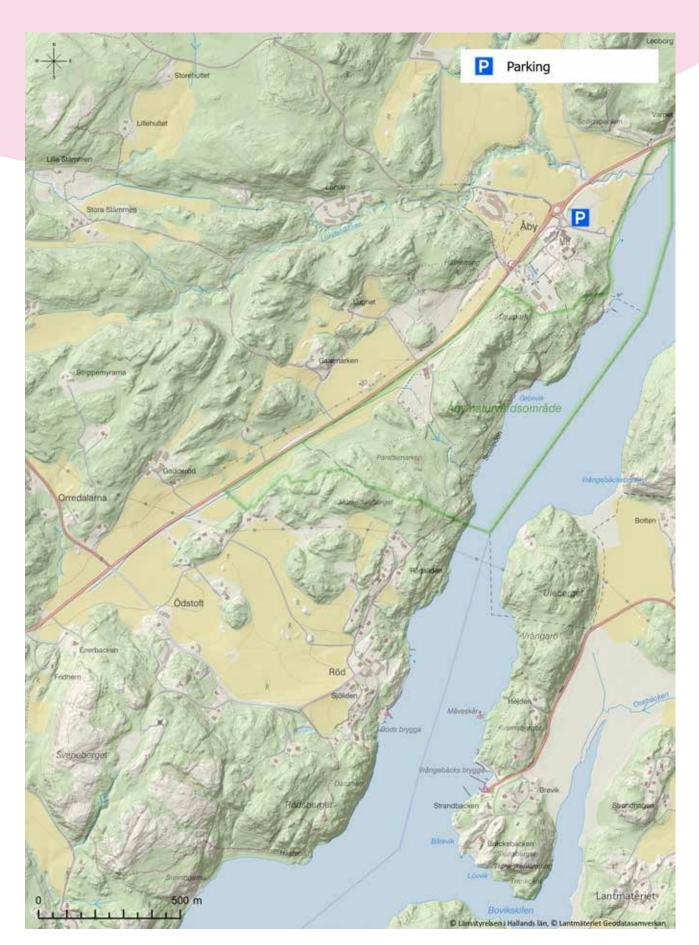
### SITE DESCRIPTION

Nordens Ark is a unique destination where visitors can witness firsthand how science and conservation come together to protect biodiversity. Located at Åby Säteri on the west coast of Sweden, this non-profit foundation has, since 1989, been committed to saving endangered species through breeding, research, habitat restoration, and public education. While many associate Nordens Ark with its zoological park, much of the conservation work takes place in the surrounding landscapes and through field projects both in Sweden and internationally. Nordens Ark's Ekopark is not only a site of active conservation and research—it is also a living classroom. Students and visitors alike are invited to explore the landscape, learn about sustainable land use, and see how centuries-old farming practices can still play a crucial role in modern nature conservation.

Our excursion will focus on the ongoing restoration of the Ekopark—a 300-hectare mosaic of pastures, meadows, and forested areas surrounding the park. Here, traditional land use methods are being reintroduced to benefit native plants and animals. Former spruce plantations are being replaced with open grazing landscapes managed with old Swedish livestock breeds. Meadows are restored through mowing and sowing of native wildflowers, creating rich environments for butterflies, insects, and birds.

In this setting, researchers have carried out longterm field experiments to understand how fire and grazing shape plant communities. The results show that grazing helps open-ground plants to establish, while fire encourages flowering and reduces competition from woody species. Together, these forces prevent the land from becoming overgrown and help preserve species-rich grasslands. The project also highlights how fire and grazing influence each other. Studies using camera traps show that cattle are drawn to recently burned patches, where they feed more intensively. This changes how fuel builds up over time and affects how future fires behave—illustrating the complex interactions between natural processes and management.

This excursion offers a rare opportunity to explore the links between research, practice, and education in one of Sweden's most innovative conservation landscapes.



FRIDAY 22ND AUGUST

EXCURSION 6 - FRIDAY 22ND

### Tjurpannan Nature Reserve

### Your guides:

Patrik Wingård and Mattias Lindholm, Västkuststiftelsen

### SITE DESCRIPTION

Tjurpannan Nature Reserve, located on the exposed coast northwest of Grebbestad in Tanums municipality, is a striking landscape of windswept granite cliffs, coastal heaths, and open seascapes. With no protective outer archipelago, this area is one of the most weather-exposed parts of Sweden's west coast, offering spectacular views and a dramatic meeting of land and sea.

The reserve spans over 495 hectares, including 212 hectares of sea, and holds a rich mosaic of habitats—ranging from dry heathlands and wet heaths to marshes, small lakes, and ancient coastal meadows. Our excursion will primarily focus on the restoration of heathlands, that is now rare and threatened due to the decline in traditional land use practices. Historically maintained by grazing, burning, and occasional cutting, heathlands have gradually turned into bushland and forest following land abandonment. At Tjurpannan, large-scale efforts have been made to reverse this process through grazing reintroduction, shrub clearance, and prescribed burning.

During the field visit, we will observe heathland areas in different stages of restoration—from overgrown zones dominated by juniper and birch to newly cleared patches and well-managed heaths rich in heather and grass species. Both dry and moist heathland types are represented, with the latter supporting specialised flora such as cross-leaved heath (*Erica tetralix*), common lousewort (*Pedicularis sylvatica*), slender eyebright (*Euphrasia micrantha*) and common moonwort (*Botrychium lunaria*).

Tjurpannan har much more to offer than its heathlands alone. The reserve encompasses a variety of other ecologically valuable habitats, including coastal meadows, gravel beaches, and rocky shorelines that support a rich and specialised flora. Among the rare and protected plant species found here are the endangered oyster plant (*Mertensia maritima*) and yellow horned poppy (*Glaucium flavum*). The reserve also provides important breeding and foraging

grounds for several bird species, which benefits from the structural diversity offered by the mosaic of shrubs and open ground. These habitats, though different from the heathlands, are equally crucial for maintaining the biodiversity of the area and are integral to the conservation goals of the reserve.

The site holds significant cultural value as well. Bronze Age burial cairns, ancient stone walls, and even a labyrinth are found within the reserve, providing insight into the historical use of the landscape and its importance through time.

This excursion offers a unique opportunity to explore the ecological, historical, and management aspects of a coastal heathland reserve. Participants will gain insights into ongoing conservation strategies and the ecological responses of heathland habitats to active restoration measures.



View in Tjurpannan Nature Reserve. Photo: Västkuststiftelsen.



SATURDAY 23RD AUGUST

EXCURSION 7 - SATURDAY 23<sup>RD</sup>

### Kosteröarna

### Your guide:

Lisa Karnfält, Nature conservation manager at Kosterhavet National Park, County Administrative Board of Västra Götaland

### SITE DESCRIPTION

Koster Islands Nature Reserve (1,254 hectares) includes most of North and South Koster. The islands are located on the west coast near the Norwegian border and are surrounded by Kosterhavet National Park (38,900 hectares).

Koster has been inhabited at least since the 15th century. The residents lived off fishing and smallscale farming. The islands were largely treeless, with heathlands covering rocky and sandy terrain. Large areas of North Koster served as grazing land for livestock, while the village's enclosed fields were located in the southern part. Over time, as livestock numbers declined, the grazing areas were left unused between 1950 and 1980. In the early 1900s, Pinus sylvestris (Scots pine) and Pinus nigra (Black pine) were planted. Highland Cattle were introduced as part of the initial restoration efforts. The major restoration work carried out in the 2000s brought back areas of heathland, clearing overgrown juniper and pine. Controlled burning of heather has also been conducted with mixed results— in some areas, the heather returned, while in others, it did not. Today, grazing animals of traditional Swedish breeds of cattle, sheep, and goats, continue to help maintain the landscape combined with small scale burning.

The Koster Islands have a mild, almost continental climate, which benefits more warmth-demanding species. Much of the rainfall is blocked by the Norwegian coast, meaning the islands receive less precipitation compared to the coast further south. The bedrock is dominated by gneiss. Areas that were once seabeds are rich in lime from mussel and snail shells, supporting lime-loving flora such as *Orchis mascula* (early-purple orchid). On the sandy heaths there are red-listed species such as *Phleum arenarium* (Sand Cat's-tail), Andrena argentata and its parasitic bee *Nomada baccata*,

stalkballs (*Tulostoma*), and the antlion Myrmeleon bore. The heath mainly consists of *Calluna vulgaris* (common heather), *Empetrum nigrum* (crowberry), and *Erica tetralix* (cross-leaved heath) in some wetter areas.

In the northern part of North Koster lies a large cobble field, one of the most impressive in Sweden. The sorted stones in the ridge were formed after the last Ice Age, around 8,000 years ago. Closer to the water is a coastal meadow popular with migrating birds, and it is one of the best birdwatching locations on the Koster Islands.



View at Valnäs hed, Nordkoster. Photo: Lisa Karnfält.

