



Natural resources and bioeconomy studies 68/2025

Nordic Wild Berry and NTFP Conference 2025

7–8 October 2025, Rovaniemi, Finland

Manninen, Outi and Peltola, Rainer (Eds.)

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Welcome to Nordic Wild Berry and NTFP Conference

Welcome to the Nordic Wild Berry and NTFP Conference. The abstracts presented here span the full value chain: From molecular mechanisms and health outcomes to climate resilience, yield modelling, green processing, governance, and consumer perspectives. Together, they outline a modern Nordic bioeconomy built on berries and other non-timber forest products (NTFPs).

For centuries, NTFPs have been more than food in the Nordic region: they are deeply rooted in our forest–nature relations, shaping culture, livelihoods, and a sense of belonging. Foraging is both everyday practice and seasonal ritual, linking generations and landscapes. In many ways, the Nordic NTFP tradition is unique: One hand still reaches into the berry bush, while the other holds a GPS receiver guiding the picker. This image captures how tradition and modern time quite literally shake hands - heritage practices meeting cutting - edge science and innovation. Maintaining and modernizing these traditions requires cooperation across borders and disciplines, and continuous knowledge exchange between researchers, entrepreneurs, policy makers, and communities. This conference offers a platform for that exchange.

We are proud that this collection reflects the spirit of Nordic collaboration. By working together and learning from one another, we can sustain deep traditions while equipping them with modern science and technology. We thank all authors, reviewers, and partners for their contributions. Most of all, we hope this book is useful: To scholars, entrepreneurs, policy makers, and to citizens who simply love NTFPs.

The organizers warmly welcome you to Rovaniemi to share knowledge, build connections, and enjoy atmosphere of the northern autumn.

Rainer Peltola
Chair of the Organizing Committee

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Program

Time	Day 0 (6 October 2025, Monday)
18:00 – 20:00	Ice-breaking session in Pilke Science Center
Time	Day 1 (7 October 2025, Tuesday)
08:00 – 08:30	Registration & Morning coffee
08:30 – 08:45	Opening remarks
Session 1: Wild Berry Biocompounds for Health and Other High-Value Applications	
08:45 – 09:05	Anni Alatalo: Crowberry demonstrates health promoting effects on hepatic and systemic inflammation in obesity. An experimental study.
09:05 – 09:25	Iiro Piippo: Lingonberry supplementation induces anti-obesity and health-promoting effects on gut microbiome in mice on high-fat diet
09:25 – 09:45	Jenni Tienaho: High value-added products from lingonberry processing to yield bioactive waxes and extracts
09:45 – 10:05	Katja Karppinen: Softening bilberry fruit as source of hydrolytic enzymes for depolymerization of plant biomass
10:05 – 10:25	Susan Kunnas: Added-value fractions of cloudberry side streams by cascade processing
10:25 – 11:00	Keynote speech & reflections: Jasmiina Vilpponen, Chief Executive Officer & Co-founder, BärBar Inc
11:00 – 12:00	Lunch
Session 2: Phenology, Performance, and Distribution of Wild Berries under Changing Climates	
12:00 – 12:20	Ola Langvall: Swedish forest berry phenology for short-term forecasts and long-term scenarios of climate change effects
12:20 – 12:40	Inger Martinussen: Impact of Arctic Climate on Wild Berry Distribution, Growth, and Harvest Yields
12:40 – 13:00	Laura Jaakola: Climatic and geographical factors affecting the performance and quality of wild <i>Vaccinium</i> berries
13:00 – 13:35	Keynote speech & reflections: Associate Professor Per-Ola Hedwall, Swedish University of Agricultural Sciences
13:35 – 14:15	Coffee break & Poster Session
Session 3: Strategies for Enhancing Wild Berry Resources and Industry Networks	
14:15 – 14:35	Agita Tremaine: Commercial thinning increases bilberry and lingonberry cover
14:35 – 14:55	Jukka Tikkanen: Berries and other non-timber-forest-products in Forest Planning
14:55 – 15:15	Martin Jensen: Pathways for exploitation of superior European Blueberry plant material for future commercial berry production
15:15 – 15:35	Teija Kannianen: Companies of non-wood forest products sector as network actors
15:35 – 16:10	Keynote speech & reflections: Program Director Mikko Kurttila, Natural Resources Institute Finland
18:30 – 21:00	Conference Dinner

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Time	Day 2 (8 October 2025, Wednesday)
Session 4: Monitoring, Mapping and Managing Access to Wild Berries	
09:00 – 09:20	Kirsi Karila: Automatic cloudberry classification and mapping using deep learning
09:20 – 09:40	Leena Matikainen: Automatic processing flow for bilberry yield maps using airborne laser scanning and crowdsourced terrestrial images
09:40 – 10:00	Elaina Weber: Commercial foragers on common lands: Nature’s friends or foes?
10:00 – 10:20	Anne Matilainen: Large forest owners representatives' attitudes towards organic collection areas of non-wood forest products”
10:20 – 10:40	Marcus Klasson: Swedish consumers’ perspectives on wild bilberries: attitudes, consumption patterns, and foraging behaviour
10:40 – 11:15	Keynote speech & reflections: Senior Scientist Bjørn Egil Flø, Norwegian Institute for Bioeconomy Research
11:15 – 11:30	Concluding remarks
11:30 – 13:00	Lunch
13:00 – 17:00	An excursion to the natural sites in the surroundings of Rovaniemi led by students from Lapland University of Applied Sciences.

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Session 1: Wild Berry Biocompounds for Health and Other High-Value Applications

O2 Lingonberry supplementation induces anti-obesity and health-promoting effects on gut microbiome in mice on high-fat diet

Iiro Piippo, Antti Pemmari, Mari Hämäläinen, Eeva Moilanen

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Gut microbiota has a major role in the emergence of obesity and its co-morbidities. We have previously found that lingonberry supplementation prevents weight and visceral fat gain and the development of low-grade inflammation, hypercholesterolemia, hyperglycemia and fatty liver disease in high fat diet-induced experimental obesity. To further understand the effects and mechanisms of lingonberry supplementation, we evaluated its influence on gut microbiome.

Four groups of C57BL/6 mice (n=10 animals per group) were fed for six weeks either with low fat (LF) diet, high fat (HF) diet or high fat diet supplemented with lingonberry powder. The gut microbiome was studied using 16S sequencing with DADA2 and Tax4Fun analysis (Novogene GmbH, Munich, Germany).

Major differences in the microbiome between the diet groups were discovered. Lingonberry supplementation prevented many of the negative effects of the HF-diet. Lingonberry also induced additional beneficial changes and improved alpha diversity. At phylum level, HF-diet enhanced the relative abundance of *Firmicutes* and decreased that of *Bacteroidota*, and the effect was fully prevented by lingonberry supplementation. The finding is highly significant as increased *Firmicutes/Bacteroidota*-ratio is associated with the development of obesity, low-grade inflammation, insulin resistance and dyslipidemia. At genus level, lingonberry decreased the relative abundance of *Bacteroides*, *Desulfovibrio* and *Ruminococcus* which all have been associated with obesity-related inflammation and metabolic changes. In contrast, lingonberry enhanced bacteria of *Akkermansia*, *Alistipes* and *Prevotella* genera which are all known to support healthy glucose and lipid metabolism.

In the present study, lingonberry supplementation was discovered to induce several beneficial changes in gut microbiome in mice on high fat diet. The changes are likely to explain many of the previously observed anti-obesity and health-promoting effects of lingonberry, but additional studies are needed to further understand the mechanisms and bioactive compounds behind the effects, and to confirm their translation to humans.

O3 High value-added products from lingonberry processing to yield bioactive waxes and extracts

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Lingonberries (*Vaccinium vitis-idaea* L.) are the most common shrubs throughout Finland, producing one of the largest yields of wild berries annually. These small red berries are rich in functional fibers, minerals, and antioxidants, such as vitamin A, C, and E, as well as polyphenols making them one of the most important non-wood forest products in the Nordics. The nutritious berries are consumed as food in various ways, such as raw or cooked in lingonberry jam, compote, juice, or syrup. However, no significant application has been indicated for the berry press-cake residue created during processing.

In this study, the residual lingonberry press-cake was extracted with supercritical carbon dioxide to yield berry waxes and oils. Accelerated solvent extraction was used for hydrophilic and lipophilic extractives. In addition to extraction, the drying and fractionation conditions were optimized for desired properties such as vitamin content, bioactive properties, and yield. We found that the waxes and extractives from lingonberry press-cake show potent antibacterial and antioxidant activities. Lingonberry waxes retained the activity of the freshly frozen and dried berry skins in both pilot-scale and industrial-scale supercritical extraction against *Staphylococcus aureus* (gram-positive) and *Escherichia coli* (gram-negative) strains. Additionally, the ethanol-water extracts yielded high total phenolic content and consequently elevated antioxidant capacity.

We thus indicate that high value-added and bioactive products can be obtained from industrial berry processing side-streams using environmentally friendly refining and fractionation techniques. These products, namely bioactive waxes and extractives, offer green, local, and sustainably processed alternatives to replace fossil and animal-based raw materials. They show appealing potential for fields such as functional foods, cosmetics, coating, and biocolorants

O4 Softening bilberry fruit as source of hydrolytic enzymes for depolymerization of plant biomass

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Several attributes affect berry quality, including accumulation of pigments and other metabolites as well as texture and firmness. Ripening-related berry softening is mainly a consequence of the activity of cell wall degrading enzymes, including different types of hydrolases and lyases, which depolymerize and solubilize plant cell wall carbohydrates, namely cellulose, hemicelluloses and pectins. Nordic wild bilberries (*Vaccinium myrtillus* L.) undergo extensive and rapid softening leading to juicy interior and short shelf-life of berries. Our studies revealed that bilberry genome contains large number of genes encoding carbohydrate-active enzymes/proteins, namely cellulases, pectate lyases (PLs), polygalacturonases (PGs), xyloglucan endotransglucosylase/hydrolases (XTHs) and expansins. Expression of some of the genes were found to increase at berry ripening and they responded positively to the berry ripening inducer, abscisic acid (ABA), indicating important role for these enzymes in bilberry softening process. Our enzyme activity tests demonstrated degrading activities for cellulases against cellulose and hemicellulose, XTHs against hemicellulose as well as PLs and PGs against pectin. Especially cellulases showed high activity rate against cellulose and hemicelluloses, thermostability at high temperatures and ability to stay active at wide ranges of pHs, demonstrating that plants harbor cellulases with biochemical properties that are attractive for industrial bioprocessing applications. So far, the hydrolytic enzymes of plant origin have been poorly investigated for their potential in industrial use, in contrast to enzymes originating from fungi or bacteria. Thus, plants can provide a new source for variable enzyme activities against carbohydrates and plant biomass, to be utilized in sustainable industrial products, such as biofuels. Further, since wild bilberry belongs to the genus *Vaccinium*, which includes several economically important cultivated soft berry species, the knowledge gained from bilberry softening process can be beneficial for targeted breeding for improved soft fruit postharvest quality.

O5 Added-value fractions of cloudberry side streams by cascade processing

Risto Korpinen¹, Kalle Kaipainen¹, Jenni Tienaho¹, Päivi Haverinen², Pertti Moilanen², Ulla-Maija Poranen², Reeta Sipola³, Anu Tossavainen³, Tiia Muotkavaara⁴, [Susan Kunnas](#)⁵

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Cloudberry (*Rubus chamaemorus*), often referred to as the golden treasure of peatlands, is one of the most prized and harvested berries in Northern Finland due to its cultural, economic, and nutritional significance. This remarkable berry is a powerhouse of bioactive compounds, including phenolic acids, ellagitannins, flavonoids, vitamins E and C, carotenoids, dietary fibers, and essential minerals. Traditionally, cloudberries are enjoyed fresh or freshly frozen, but their versatility extends to the food and beverage industries, where they are transformed into jams, dairy and confectionery products, non-alcoholic and alcoholic beverages, and liqueurs. Moreover, cloudberry seeds and seed oil find applications in cosmetic products, although the range of products remains limited. Typically, cloudberries are processed by pureeing and sieving, leaving behind a nutrient-rich mash containing seeds and berry residues as by-products.

In this study, we explored two distinct cloudberry side-streams from the food industry. Initially, these side-streams underwent freeze-drying and heat drying at 37 °C temperature to assess the impact of drying methods. The oil fractions from the raw materials were extracted using supercritical carbon dioxide (scCO₂) on a pilot scale. Following this, the phenol-rich fractions of the scCO₂ residue were extracted using accelerated solvent extraction with water and aqueous ethanol. Beyond extraction, we optimized the fractionation conditions to enhance desirable properties such as vitamin content, bioactive attributes (e.g., antioxidative and antibacterial activities), and yield.

Our research aims to demonstrate innovative cascade processing of cloudberries utilizing environmentally friendly technologies to maximize the use of raw materials and expand product opportunities. We will also elucidate how processing conditions influence the chemical composition, vitamin content, and bioactivity properties of the extracts.

Session 2: Phenology, Performance, and Distribution of Wild Berries under Changing Climates

O6 Swedish forest berry phenology for short-term forecasts and long-term scenarios of climate change effects

Ola Langvall

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Detailed forest phenology data from the Swedish National Phenology Network has been used to produce public forecast models for the onset, maximum appearance and ending of flowering and ripening of the most common wild berries in Sweden; Cowberry (*Vaccinium vitis-idaea* L.) and Bilberry (*V. myrtillus* L.).

The forecasts are based on weekly assessments of flower and berry counting on berry shrubs at four Experimental Forests in Sweden, from 2006 and forward. Daily air temperature data from the same sites are used to produce critical accumulated temperatures for when target phenological phases appear. Current year's weather data until the date of the forecast, and long-term averages for future development, are used to produce forecasts predicting the timing of flowering and ripening of berries. The forecasts are specific for the current season and updated daily. As an example, the berry forecast model correctly predicted a 14 day earlier ripening of bilberries during 2024 than usual, as the spring and early summer was unusually warm. The berry forecasts are available to the public, enabling them to plan their berry picking by predicting the appearance of the first ripe berries, as well as when they are most abundant in the forest. Typically, the peak number of berries appear 2.5-3 weeks after the first berries appear, where after the numbers gets lower again. Berries are estimated to normally be available during 5-6 weeks.

The models have also been applied on scenario data, to reveal the long-term effect of climate change on the Swedish forest berries. Northern Sweden and local continental areas are expected to experience the least change, compared to southern Sweden and, especially, the maritime west coast area.

O7 Impact of Arctic Climate on Wild Berry Distribution, Growth, and Harvest Yields

Inger Martinussen¹, Laura Jaakola^{1,2} & Anne Linn Hykkerud¹

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Wild berries have played a vital role in the culture and cuisine of the Nordic region for centuries. Among the most important species are bilberries (*Vaccinium myrtillus*), lingonberries (*Vaccinium vitis-idaea*), and cloudberries (*Rubus chamaemorus*). The Arctic climate and unique light conditions significantly influence the distribution and yield of wild berries. However, climate change is altering the suitable habitats for many berry species across Arctic and sub-Arctic regions.

Studies on cloudberries, bilberries, and lingonberries from field plots and at controlled conditions have shown that flowering, number of flowers, and flowering time vary between eco-types. Yield is determined by the number of initiated flowers, the presence of pollinators, and weather conditions from flowering to mature berries. Additionally, these processes are affected by light quality and quantity in combination with the climatic factors and interactions with genotype. Since wild berries are perennial plants and initiate flower bud the year before fruiting, yields are affected both current and previous year biotic and abiotic conditions. This adds complexity to predicting productivity under changing climate scenarios. Results on factors affecting the flowering and yield in different wild berry species in the Nordic region will be presented, and discussed on how the predicted climatic changes can affect their distribution and yields.

O8 Climatic and geographical factors affecting the performance and quality of wild *Vaccinium* berries

Laura Jaakola^{1,2}, Katja Karppinen¹, Anne Linn Hykkerud², Inger Martinussen^{3,2}

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European wild berries grow under different climatic conditions in geographically widely distributed areas. Global warming is leading to rapid changes in climate causing new threats to plant species with increasing temperatures, extreme weather events and spreading of pest and pathogens in new areas. Therefore, it is important to study the response of different wild berry ecotypes on diverse climate conditions. Controlled and field studies on the most important Nordic wild berries, bilberry (*Vaccinium myrtillus*) and lingonberry (*V. vitis-idaea*) have shown that the ecotypes of different origin can exhibit different responses to climatic factors. Many of our studies have shown that the reddish and blueish anthocyanin pigments in wild *Vaccinium* berries are affected both by genetic and environmental factors having higher levels in more northern origins and growth conditions characterized by lower temperature and longer day length. Differences have also been detected in composition of other phenolic compounds, volatiles, acids, sugars and cuticular wax in *Vaccinium* berries of different origins as response to light and climate conditions. Moreover, recent results indicate that longer day length in growth season can increase the accumulation of stress related plant hormones in bilberry leaves, leading to improved resistance against herbivores and pathogens.

Session 3: Strategies for Enhancing Wild Berry Resources and Industry Networks

O9 Commercial thinning increases bilberry and lingonberry cover

Agita Treimane^{1,2}, Jānis Donis¹, Didzis Elferts¹, Zane Lībiete¹

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The new EU Forest Strategy for 2030 highlights the importance of sustainable forest development, with a special emphasis on preserving biodiversity, ensuring long-term availability of non-wood resources, and sustaining high timber yield. Commercial thinning is, and will likely remain in the near future, one of the most widely used forest management methods for extracting timber and decreasing tree competition in young and middle-aged stands. In Latvia, forests cover more than half of the land area, and young and middle-aged stands make up about 60% of all forests, therefore, it is necessary to determine the impact of different commercial thinning intensity on the long-term availability of bilberries and lingonberries.

To determine the occurrence of bilberry and lingonberry projective cover and trends before and after thinning, we set up 33 experimental sites in young and middle-aged Scots pine, Norway spruce and birch stands following the before-after-control-impact (BACI) experimental design. In each site, eight plots were established with control and various thinning intensities, replicated twice. In each sample plot, bilberries were assessed in 36 plots, 9 m² in total. Bilberry cover and berry yield were measured before thinning and five, six, and seven years afterwards.

In pine-dominated young and middle-aged stands of various forest types, the comparison of data obtained before thinning with the 2024 data show rather increase than decrease in the occurrence and projective cover of lingonberry after different intensity thinning. A similar trend was observed for bilberry – in most forest type groups, the projective cover values increased after thinning. It should be noted that in plots established in spruce or birch stands the projective cover of both *Vaccinium* species were initially low, therefore it is not possible to determine the exact effect of specific commercial thinning intensity on the values of bilberry and lingonberry cover in these sites.

O10 Berries and other non-timber-forest-products in Forest Planning

Jukka Tikkanen, Matti Maltamo, Jari Vauhkonen, Anu Laakkonen, Maria Riikonen, Marjut Turtiainen, Teija Kanninen, Veera Tahvanainen

University of Eastern Finland, Joensuu, Finland

The availability of non-timber-forest-products (NTFP) and the security of their availability are increasingly challenging the realisation of growth expectations in the natural products sector. One reason for this is the lack of information of forest owners about the potentials of NTFP in their forests. The know-how of forest professionals focuses on wood production aspects and they are unable to guide forest owners in production of NTFP, which is greatly affected by forest management measures. For example, thinnings that are timed correctly and are sufficiently strong can improve future blueberry yields. In turn, the yields of some natural products can be promoted by cultivation. For example, under-productive birch forests can be inoculated with the fungus and produce for example Shaga in 5–10 years. By taking into account different production possibilities, the total benefit from forests can be increased and significant additional income can be generated for the forest owner. One way to improve forest owners' awareness of the production possibilities is to include NTFP in targeted forest planning. So far, couple of experiments in this direction have been carried out but still there is lack of required models to evaluate and predict product potential.

In the presentation we will update the scientific bases regarding adoption of NTFPs in forest planning in the Nordic conditions. Two projects will serve main inputs for the presentation: Bohlin et al. (2021) et al. developed, the first in the world, to use remote sensing to estimate nationwide berry yields (Bohlin et al., 2021). Turtiainen et al. (2019) developed and tested a multi-objective and interactive forest planning process to prepare natural product-oriented forest plans that combine natural products and wood production. Basing on those experiences, the more general and theoretical challenges related to the forest mensuration and forest planning of NTFPs are examined and development proposals presented.

O11 Pathways for exploitation of superior European Blueberry plant material for future commercial berry production

Martin Jensen, Antonios Petridis

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Research has demonstrated large genotypic variation in both yield and quality of berries from European Blueberry but also large variation in the robustness and adaptation of plants in terms of growth habit, resistance to fungal diseases and mechanisms coping with climate changes for example escaping spring frost damage with later flowering. Superior plant material may be adaptively confined to individual regions, which suggests that genotypes optimally has to be selected in local regions. Genotype studies may provide input to what valuable characteristics related to berry production can be found in nature and give learnings on what to look for in mass selection from natural habitats. Examples of variation and recommendations for how to approach a first selection will be given. In recent years efficient and low cost vegetative propagation methods for European Blueberry has been established that allows upscaling of selected superior genotypes. Such vegetative production can either focus directly on clonal berry production in future orchards or be used to establish clonal seed orchards (CSO) that can produce superior seeds and seedlings. Sowing superior seeds may be used as a non-expensive method either to establish commercial berry orchards adapted to mechanical harvesting or be used in direct seeding into identified promising nature plots adapted for more efficient future wild berry picking based on genetically higher yield and quality, naturally favorable environmental conditions for berry yield and a site topography adapted to future more efficient semi-mechanized wild berry picking. The different pathways for exploitation of superior genotypes of European Blueberries will be discussed.

O12 Companies of non-wood forest products sector as network actors

Teija Kanniainen¹, Jouni Pykäläinen¹, Marjut Turtiainen², Veera Tahvanainen¹, Jukka Tikkanen¹

¹University of Eastern Finland, Joensuu, Finland. ²Arktiset Aromit ry, Suomussalmi, Finland

Systemic changes in society (e.g. urbanization, digitalization, platform economy and sustainability transitions) remarkably change the business environment of non-wood forest products (NWFPs) and may result in new kinds of business possibilities. These changes and possibilities must be well understood to enhance the development of sustainable business models and governance of NWFP sector. Hence, it was mapped out how NWFP companies create economic, ecological and social sustainability in their business networks. Northern Karelia and South-Eastern Finland are serving as case regions for the study as the utilization of NWFPs is effective in these areas, and the significance of forest-based sector is considerable. Actors-resources-activities (ARA) model was used as theoretical framework in the study. Semi-structured interviews were used to collect the data, and directed content analysis and inter-researcher triangulation was applied when analyzing the data. Activities, of which the most common are NWFP raw material dealing, refining and distribution, are characterized generally by the crossing of boundaries of industries and countries. The resources that are either used in companies or served out from the companies, i.e. inputs and outputs, are in partial balance. Many intangible resources, i.e. those where payments do not occur between actors, create a competitive advantage for actors as inimitable resources. Products of industrial process and research, development and education (R&D&E) got the most output hits in tangible resources in the business network. Some unique resource combinations, which are illustrated in the study, create quite strong resource ties. The significance of trust, long-term relationships and identity-related values, which affect the actor bonds, is identified in the data. The data shows that the balance of the NWFP network is constantly changing, but trust, commitment and shared values and local or domestic resources create foundation and promote networking.

Session 4: Monitoring, Mapping and Managing Access to Wild Berries

O13 Automatic cloudberry classification and mapping using deep learning

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Cloudberries (*Rubus chamaemorus*) are wild peatland berries growing in bogs, not always easy to access. In recent years, deep learning methods and drone technology have developed rapidly enabling new applications in environmental monitoring, forestry and agriculture. Our objective is to study the feasibility of drone data and deep learning for automatic cloudberry quality mapping. Following different berry stages from raw to overripe can be used to define the optimum picking time and the best locations to pick berries. This would lead to increased quantity and quality in cloudberry harvesting.

A diverse set of image data was collected using mobile phones, digital cameras, and drones in Northern Karelia and Kainuu regions in Finland during 2023 and 2024. The data comprised of variety of cloudberries in various stages and backgrounds. Latest object detection models were trained using annotated image data and tested on independent sets of drone imagery from natural forest sites. Models for berry detection and ripeness and quality estimation were evaluated using sets of manually classified berry images as the reference data, and different class divisions were studied. The preliminary results were promising especially for the berry detection and ripe berry classification, and berry maps were derived from the image data. The berry amounts per image predicted using the deep learning models were found highly correlated with the reference data.

The presentation will showcase the accuracy of the predictions and heatmaps obtained and discusses also potential use cases for the coming technology.

O14 Automatic processing flow for bilberry yield maps using airborne laser scanning and crowdsourced terrestrial images

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This study explores the development of an automated framework for bilberry (*Vaccinium myrtillus* L.) yield modelling in Finland, leveraging airborne laser scanning (ALS) data and crowdsourced imagery. The yields of bilberries, vital non-timber forest products in the Nordic region, are influenced by numerous environmental and stand characteristics, which can also be used in the yield modelling. In Finland, we have a country-level national laser scanning program providing point clouds with a density of more than 5 pts/m² allowing the detection of individual log-size trees with a detection rate of 90%. This research integrates automated berry counting, yield modelling, and ALS-derived feature extraction to create accurate yield maps.

The methodology encompasses the extraction of diverse feature categories, including topographic, area-based forest, individual tree based, neighborhood based, lake proximity based, and growing site related features. A 6 km x 6 km test site in Nuuksio, Southern Finland, was selected for extensive data collection, utilizing both drone and crowdsourced smartphone imagery.

A random forest classifier was employed to model the berry yield, categorizing it into three classes: few berries, some berries, and lots of berries. ALS- and map data-derived features from the different categories were utilized. Feature selection was performed using a greedy forward selection approach, optimizing for the quality of the "lots of berries" class. Model performance was evaluated through five-fold cross-validation and tested with an independent dataset of about 1,000 Nuuksio test plots collected with crowdsourcing.

This study uniquely integrates automatic berry counting from images and individual tree features from high-density national ALS and various map data-derived features for yield map processing.

The presentation introduces the complete processing flow for bilberry yield mapping, shows maps produced for the test site in 2024 and 2025, and discusses the usefulness of various features and the quality of the results.

O15 Commercial foragers on common lands: Nature's friends or foes?

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Within the gathering community in Norway, commercial gathering is framed as both an under-exploited opportunity to eat sustainably and a threat guaranteed to end in overexploitation. This paper explores diverse expressions of commerciality and the commons of wild edible plants and mushrooms in Norway.

Rather than focusing on market-based economies of scale, I use community economies theory to make legible the messier economies including bartering, payment in-kind, and alternative markets. This work is based on 2.5 years of multi-sited ethnography through the Norwegian Association of Mycology and Foraging, including 20 semi-structured interviews with commercial gatherers. These gatherers mostly run sole proprietorships or stay below a taxable threshold, but some gatherers with limited companies are also included. The gatherers sell a diverse configuration of wild products, but also knowledge, through courses, books, tours, and experiences. Many are also active caretakers of commoned lands and contribute to knowledge commons.

First, I analyze their economic practices based on the types of labor, enterprise, and transactions they engage in. For example, I note when gatherers go unpaid, when they are paid through a salary, and when they are paid otherwise: through reciprocal exchange, gifts, or remunerated volunteering. Likewise, enterprises are categorized as capitalist, alternative capitalist, or noncapitalist projects, and transactions as market, alternative markets, or nonmarket exchanges.

Second, I unpack how the commons are created, maintained, and deconstructed. I follow a plant or mushroom from commonly managed natural resource to private product, but also knowledge around gathering from unregulated or private to commons management. For this analysis, I assess the element in terms of its access, use, benefit, care, responsibility, and ownership. In doing so, I explore the relationship between the private, the unregulated, and the commoned, not just of wild products themselves, but also the surrounding knowledges. This paper, then, further unpacks the diversity of what it means to gather 'commercially' on 'common' lands, and if commercial gatherers can be reduced to nature's friends or foes.

O16 Large forest owners representatives' attitudes towards organic collection areas of non-wood forest products

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Organic production is a controlled quality system that can be used to prove the origin and purity of a raw material or natural product. In the case of non-wood forest products (NWFP), it has been found to have significant added value, especially in foreign markets. Non-wood forest products are considered organic when they are collected from certified collection areas. This means that the collection area (typically forest or peatland) is approved as organic, i.e. checked by an authority and linked to control system of organic production, similar to agricultural products.

Even though, organic certification can have significant importance to the processing companies operating in the NWFP sector, especially when it comes to raw materials collected through Everyman's rights, it often has little economic importance to the forest owners. However, the establishment of an organic collection area can also be considered from other than economic perspectives. The question is whether organic collection area could be one way for the companies or communities to demonstrate their corporate social responsibility by supporting other business activities in the region and the utilisation of domestic wild products. Thus, the idea of this study is to examine organic collection above all from the perspective of corporate social responsibility and to assess whether the organic collection area could be significant for the stakeholders of large landowners and thus create a positive image.

For this study, 10 representatives of companies or communities owning significant forest areas were interviewed during 2023. The results provide insights of corporate forest owners' opinions on organic NWFP collection and also attitudes towards the sector in general.

017 Swedish consumers' perspectives on wild bilberries: attitudes, consumption patterns, and foraging behaviour

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This study examines Swedish consumers' perspectives on wild bilberries (*Vaccinium myrtillus*), focusing on attitudes, associations, consumption patterns, and foraging behavior. Data were collected via an online survey (N=2010) that was nationally representative in terms of age, region, and gender. The results indicate that a majority of respondents (56.5%) foraged for bilberries in 2023, with an estimated average of eight liters per person. Women and residents of Northern Sweden were somewhat more likely to forage, and respondents who viewed foraging as important were almost 50% likelier to engage in it.

Purchasing decisions were driven primarily by sensory attributes (taste and texture) and Swedish origin, whereas social aspects—such as working conditions for foreign berry pickers—ranked lower in importance. Consumers showed nuanced associations with bilberry products along three interconnected dimensions: familiar/unfamiliar (linked with enjoyment), natural/artificial (linked with perceived processing and sweetness/sourness), and utilitarian/exclusive (linked with “everyday” versus “festive” contexts). Contrary to earlier assumptions of waning interest in berry foraging, these findings suggest that foraging may remain an integral part of Swedish food culture—especially in Northern regions—while also supporting a notable non-commercial harvest.

By highlighting consumers' high valuation of Swedish-sourced bilberries, the study points to potential synergies between cultural identity, business development, and sustainable resource use. Strategies aimed at expanding domestic berry refining, creating innovative bilberry-based products, and strengthening local stakeholder collaboration could help address labor challenges while promoting regional economies and preserving cultural heritage. The results also provide important insight for efforts to promote a more sustainable wild berry industry that acknowledges the voice of the consumer and contribute to ongoing discussions about how the berry value chain can support sustainable transitions in Nordic contexts.

Poster abstracts

P1 Valorising side streams of forest bioeconomy: extraction and utilization of spruce bark

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In forest bioeconomy, a significant amount of side streams is generated but not sufficiently utilized. Nowadays, many side streams end up directly in energy production for combustion. However, valuable compounds can be separated from these streams before combustion. One valuable compound-containing side stream is spruce bark. It can be extracted using supercritical fluid extraction (SFE) with carbon dioxide. SFE, using carbon dioxide as a solvent, is a selective and environmentally friendly method that leaves no solvent residues in the final product, making it suitable for producing food supplies and cosmetics, for example.

In this study, spruce bark extracts are analysed using gas chromatography with a mass selective detector to identify their compounds. The antimicrobial activity of the extracts is tested using the agar dilution method with *Staphylococcus aureus*. The data from these analyses can help assess potential applications for spruce bark extracts.

An essential part of the valorisation process includes analysing the acquisition and price structure of side streams. The goal is to build value based on the structure and functional ingredients of forestry side streams like needles, bark, and branches. Market studies of current and anticipated demand will guide the focus of value chain activities.

The forest bioeconomy structures are well-established and can incorporate necessary steps for material procurement with minimal additions to existing pipelines. For example, needle and branch side streams can be procured simultaneously, utilizing existing pipelines from logging sites to wood terminals and potential users like energy companies and the pulp industry. Bark material can be obtained at sawmills and pulp factories, where processing facilities can be built to valorise side streams before they are used for energy production. This will diversify factory output and open new sales avenues as a part of green transition.

P2 Challenges and opportunities in cloudberry value chain

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In Finland, the majority of cloudberries (*Rubus chamaemorus*) are harvested in the Lapland region. In 2023, this amounted to 73,5 thousand kilos commercially, representing 91% of the crop with a value of 0.64M€. The yield of cloudberries is highly sensitive to annual fluctuations caused by varying growing season conditions. Additionally, also the difficult accessibility of remote peatlands contributes to higher raw material costs compared to many other wild berries, thereby affecting product development. Currently, cloudberries are utilized in culinary and beverage sectors, where they are crafted into jams, dairy treats, confectioneries, cosmetic products, as well as non-alcoholic and alcoholic drinks, including liqueurs. However, product variation remains limited. The northern berry production sector faces several challenges that limit its growth and business development. The majority of the companies, 72%, are micro enterprises that often lack advanced methods and technology necessary for value-added production and sustainable cascade utilization of natural raw materials.

To address these challenges, we demonstrate pretreatment, extraction, and separation methods for sustainable cascade processing, ensuring multiple utilizations of the entire plant raw material. This enhances the efficient use of the expensive raw material and improves production profitability. The development of regional value chains from raw material collection to market is essential, as it promotes the retention of added value within the region rather than its outflow. We will manufacture high-value products and prototypes (food, nutritional supplements, feed, cosmetics, and coatings) by guiding entrepreneurs through practical workshops, videos, and materials.

This project aims to equip local companies with practices, technology, guidance, and innovative solutions to expand their product portfolios, increase revenue, and enhance their understanding of the value and production network of natural raw materials. By promoting small businesses, enhancing technological expertise, and utilizing local development environments, we aim to drive growth and sustainability in the northern berry production sector.

P3 Low-grade inflammation in obesity: Beneficial effects of lingonberry supplementation

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Obesity is an increasing health problem worldwide. It is associated with co-morbidities such as diabetes, fatty liver disease and cardiovascular diseases, which are preceded by a state called metabolic syndrome. Diets rich in fruits and vegetables have been reported to have health-promoting properties. Polyphenol-rich berries, including lingonberry (*Vaccinium vitis-idaea* L.), have also been of interest to possibly prevent obesity-induced metabolic disturbances.

The aim of the present study was to explore the effects of lingonberry supplementation on inflammatory and metabolic changes associated with obesity by utilizing high-fat (HF) diet-induced experimental model of obesity in mice. Possible effective constituents in lingonberry were investigated *in vitro*.

Lingonberry powder supplementation significantly prevented the HF diet-induced adverse changes in blood cholesterol and glucose levels and had a moderate effect on weight and visceral fat gain. The levels of circulating serum amyloid A, alanine aminotransferase, and leptin were significantly lower in the lingonberry-supplemented HF diet-fed mice than in the control HF diet group. Lingonberry supplementation also affected the expression of several genes in the liver, analysed by NGS-based genome wide expression analysis. The expression of many genes related to lipid or glucose metabolism and inflammation was changed by the HF diet, and lingonberry supplementation partly prevented these changes. Lingonberry skin extract partly prevented weight and epididymal fat gain as well as glucose intolerance and rise in fasting glucose level in HF-diet fed mice.

The effects of twelve selected lingonberry phenolic compounds were investigated on murine and human macrophages. Resveratrol, kaempferol, and proanthocyanidins were found to shift macrophage polarization towards the anti-inflammatory and healing-promoting M2 phenotype. Resveratrol and kaempferol also inhibited the pro-inflammatory M1-type activation.

The results extend previous data on the beneficial metabolic effects of lingonberry. Further research is needed to explore the mechanisms behind these effects and to develop further health-promoting lingonberry applications.

P4 Blue or black bilberry fruits: effect of wax composition on their soluble phenolic and sugar concentrations

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Bilberry (*Vaccinium myrtillus* L.) is a deciduous shrub with wide distribution in cool temperate regions and mountain areas of Europe and Asia. In addition to the common wild type (WT) of blue bilberry, it is common to find a glossy type (GT) black bilberry ("mustamustikka", "pikimustikka" in Finnish). Berries from both types of plants are harvested. Research showed that GT are mutants affected in wax composition and morphology, but not content (Trivedi et al., 2021 doi:10.1016/j.foodchem.2021.129517). In this study, we addressed the question of the polyphenolic and sugar composition in both types of berries.

Mature blue and black bilberries were collected in 7 sites in August 2022 in Rovaniemi, Ruukki and Kuusamo areas. Berries were analyzed for their soluble phenolic composition and soluble sugars using liquid chromatography coupled to MS or ELSD detectors.

Soluble phenolics of bilberry fruits are typically composed of more than 80% anthocyanins and so the composition can be divided as anthocyanins (ACN), and non-anthocyanins (non-ACN) compounds.

The total amount of soluble phenolics was higher in WT than in GT berries: this was explained by higher concentrations of ACNs and flavonols. On the contrary, GT berries contained higher concentrations of non-ACN compounds, including chlorogenic acid, epicatechin and proanthocyanidins. Iridoids, a group of monoterpenoids present in bilberry fruits but rarely reported, were also more abundant in GT than in WT berries. The soluble sugar (glucose, fructose) concentration was not statistically different between the two types of berries.

Our analyses showed that the secondary metabolite composition of bilberry fruits varies between WT and GT. Although the sugar content was similar, the consequences on the taste of the berries should be tested, especially regarding the higher content of iridoids, known for their bitter taste.

P5 Optimal growing conditions for the cultivation of native Finnish cranberry (*Vaccinium oxycoccos* L.)

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The native Finnish cranberry (*Vaccinium oxycoccos*, European cranberry) is traditionally harvested from forest bogs and also imported to Finland, as the domestic supply does not meet the demand. Production of cranberry in controlled environment would increase its domestic supply. This study aimed to investigate cranberry production in a high plastic tunnel and different soilless substrates. We assessed growth of *V. oxycoccos* plants in forest plant peat and *Sphagnum* moss under both high tunnel and open-field conditions.

Plant material was collected from multiple-use forests in Lohja and Salo, Finland, in August 2023, and propagated in a high plastic tunnel using forest peat. One hundred plants were randomly assigned into a factorial experiment. The treatments included (1) cultivation environment: table-top cultivation in high plastic tunnel or outdoors conditions, (2) growth substrate: forest plant peat or *Sphagnum* moss. In October 2024, vegetative growth was measured in five single-plant replicates, while the remaining plants overwintered outdoors.

Results show that cranberry plants grown inside the tunnel had more vigorous vegetative growth than those in open-field conditions, while the substrates had no significant effect. Tunnel-grown plants had more uprights, and these were taller than in the outdoor conditions, resulting in higher total upright dry weight (DW) in the high tunnel. Runner growth was less affected by the growing environment. However, higher DW for runner stems was recorded in the tunnel grown plants. In contrast, the number of runners, average runner length, total runner DW, and DW of runner leaves were not significantly affected by either the growing environment or substrates. Eventually, the higher production of uprights in tunnel-grown plants may lead to increased yield in the following growing season. To investigate the effects of these cultivation methods on generative growth, the study will continue through the 2025 growing season focusing on yield and berry quality assessment.

P6 The Potential of Nordic Wild Berries to Inhibit *Desulfovibrio* spp. and Mitigate Parkinson's Disease Progression

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Desulfovibrio (DSV) bacteria have been implicated in the pathogenesis of Parkinson's disease (PD) due to their ability to produce hydrogen sulfide and promote alpha-synuclein aggregation in the gut. This study investigates the inhibitory effects of Nordic wild berries on DSV growth as a natural compound without side-effect, with the aim of developing a dietary approach to modulate the gut microbiome and slow PD progression.

A range of wild and local berry extracts, including blueberry, raspberry, black raspberry, cranberry, cloudberry, redcurrant, and strawberry, were tested for their antibacterial properties against DSV strains isolated from patient fecal samples. The Minimum Inhibitory Concentration (MIC) assay revealed that redcurrant, raspberry, and black raspberry exhibited the strongest inhibitory effects, with dose-dependent reductions in bacterial growth. The bioactive compounds in these berries, particularly polyphenols such as anthocyanins, flavonols, and ellagitannins, are likely responsible for this antimicrobial activity.

Furthermore, simulated gastrointestinal digestion experiments confirmed that the inhibitory potential of selected berry extracts remains effective after exposure to gastric and intestinal conditions, supporting their feasibility as dietary interventions. The study also will explore synergies between berries and probiotic strains (e.g., *Lactobacillus plantarum* and *Bacillus coagulans*), demonstrating enhanced inhibition of DSV growth when combined.

These findings highlight the potential of Nordic wild berries as functional food components for gut microbiome modulation and neuroprotective strategies in PD. Future research should explore clinical applications and mechanisms of action to establish dietary guidelines for PD patients.

Keywords: Nordic wild berries, *Desulfovibrio*, Parkinson's disease, gut microbiome, probiotics

P7 Genotypic variability in fruit quality attributes among bilberry clones

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Bilberries are considered as having excellent organoleptic characteristics and as rich sources of bioactive compounds which are beneficial to human health. But to which extent do those quality characteristics vary within a bilberry clonal population? To address this question, we collected 55 clones from different regions across Denmark, grew them in the same field in a completely randomized block design, harvested their berries at full maturity, and analyzed several quality parameters (total and individual sugars content, total phenol and anthocyanin content, volatile content, and antioxidant activity) and their inter-correlation. As expected, the values of each parameter varied considerably among the clones. As to the classification of the clones, the general trend was that when a certain clone displayed a high value for one parameter, then for all the other parameters it displayed moderate or low values; nonetheless, there were some clones that displayed high values for more than one parameters (e.g., high phenol and high sugar content). The high variability among the clone population, which has been observed for each of the examined parameters, suggests that breeding for the development of premium-quality, commercial varieties is a feasible task.

P8 Fruit quality of bilberry (*Vaccinium myrtillus* L.) in boreal forests

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Bilberry (*Vaccinium myrtillus* L.) fruits are valued for their taste and chemical composition. Although genetically regulated, the synthesis of chemical compounds in bilberry fruits is strongly influenced by the growing conditions. We analyzed total phenolics, anthocyanins (ACNs), flavonols, iridoids and sugars in different stand types in the boreal forest. Four stand types were included: pine-dominated peatland and sub-xeric stands, and pine- or spruce-dominated mesic stands (totally 28 sites). We investigated the role of light (leaf area index, LAI), air temperature, soil properties, dominant tree species and their age, understorey composition and forest stand type on berry quality.

The mean (\pm SD) values of total phenolics, ACN, iridoids and sugars in bilberry fruits were 88.7 ± 14.2 , 78.9 ± 13.4 , 0.52 ± 0.11 , 339.1 ± 44.6 mg g⁻¹ d.w., respectively. Based on linear mixed models, forest stand was the strongest predictor of high phenolics and ACNs, while soil organic layer best explained sugar concentrations. Daily minimum temperatures correlated with higher sugar levels. High ACNs were associated with the high understorey graminoid abundance. The bilberry fruits with the highest ACN concentrations were found in peatland forests dominated by pine. Furthermore, in spruce-dominated forests, a higher light availability increased ACN levels, suggesting that the harvesting of high-quality bilberry fruits should be directed to light spruce forests treated by thinning. This information could also be applied in forest management guidelines. Overall, our results reflect the functioning of the boreal forest as a multilayered ecosystem and highlight the complexity of concurrent factors that shape the boreal forest floor environment.

P9 Communicating Sustainability Dimensions for Nordic Berries Through Geographical Indication System

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Berry picking and berry products have been integral to Nordic food culture, diet, and nourishment for centuries. As such, berries play a crucial role in shaping both the reputation of the Nordic berry sector and Nordic food culture as a whole. Their good reputation and quality can be communicated precisely, systematically, and distinctively from other similar products. One effective system for this purpose is the European quality scheme for geographical indications (GI), which emphasizes the geographical origin, authenticity, and reputation of products as regulated by EU law. GI products serve as drivers of sustainable food systems within their geographical areas. They are typically rooted in local plant varieties, animal breeds, and traditional know-how, all of which contribute to regional biodiversity. Furthermore, the GI system enhances economic resilience, enabling communities adapt to or avoid external shocks.

To effectively communicate the berry picking industry as a sustainable sector, the berry industry requires a trustworthy and controlled framework to promote such practices. The reform of the regulation governing European GIs ((EU) 2014/1143) provides a legal basis for producer groups to agree on sustainable practices to be followed in the production of products designated by a geographical indication. These practices should aim to address and contribute to one or more sustainability objectives, such as social, environmental, economic sustainability or animal welfare. Sustainability practices can be included in product descriptions, thereby granting these dimensions a legitimate status that is monitored within the EU and recognized in third countries through bilateral agreements.

The ongoing GI application process for "Nordiska blåbär/ Pohjoismainen mustikka" can benefit from the new regulation and the opportunity to incorporate sustainability dimensions into the product description and documentation specifications. This application process could also pave the way for other commercial berry products in Nordic countries, such as lingonberries.

P10 Potential of lingonberry waxes as replacement for shortenings in cookies

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Lingonberries (*Vaccinium vitis-idaea* L.) are the most productive wild berries in Northern Finland. These berries are highly nutritious, rich in vitamins and polyphenols, and are commonly consumed as juices, jams, and purees. In the food industry, approximately 100,000 to 200,000 kg of lingonberry press-cakes are generated annually as a by-product of juice production. While some of these press cakes are used in granolas, there are no significant techno-economically feasible applications for this high-potential raw material.

Lingonberry press cakes contain peels with 3–4% biowax, which can be extracted using supercritical carbon dioxide. This biowax can be utilized in the food industry to replace unsustainable waxes and unhealthy trans fat in products like cookies. The intake of saturated and trans fats has been studied as a potential cause of cardiovascular disease. For health preservation, fat intake should not exceed 30% of total energy intake.

This study explores the possibility of replacing shortenings, such as margarine, in cookie formulations with oleogels. Oleogels are a special network of molecules that bind liquid oil with plant wax to form gel-like structures, allowing for a reduction in the saturated fatty acid content of cookies. We produced oleogels from rapeseed oil and lingonberry wax and used them to replace margarine in various ratios.

The results demonstrated that the saturated fat content in the cookies was successfully reduced, depending on the ratio of oleogel used. Additionally, the color, texture, and dimensions of the cookies were analyzed. While there were differences in the L, a*, b* color values, the dimensions of the cookies remained unaffected.

These findings highlight the great potential of producing healthier cookies using oleogels made with lingonberry wax, reducing saturated fatty acid content while maintaining functional properties.

P11 Non-wood product monitoring within the framework of National Forest Inventory in Latvia

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Forest ecosystems provide a wide range of ecosystem services, including products such as wild berries, nectar-producing plants and medicinal plants. To provide data on the long-term resilience and availability of various non-wood forest products (NWFPs), it is important to carry out systematic assessments and, by understanding the ecology of each species, to predict changes related to, for example, climate change or specific forest management practices. Repeated assessments can help to determine changes in ecosystems and their spatial and temporal variability.

This contribution summarizes the results of non-wood product monitoring conducted in Latvia on a subset of National Forest Inventory plots. The goal was to evaluate different species – lingonberries, bilberries, bog bilberries, cranberries, cloudberries, wild raspberries, wild strawberries, black crowberries, heather, and lichens – across various forest types. Data was collected from 2019 to 2023 on almost 8,000 permanent sample plots. The dataset represents one five-year census cycle. In each forest stand, one 3×3 m plot were established, and the projective cover of each species was recorded.

In the hemiboreal forests of Latvia, consisting of a mixture of coniferous and broadleaved stands, the most frequently observed and widespread species were bilberry (25%) and lingonberry (21%), common in forests dominated by coniferous trees. The third most frequently occurring species was wild raspberry, typically occurring in more fertile forest types or areas affected by forest management activities. Other assessed species were found rarely: cloudberries were recorded in less than 1% of monitored forest plots, cranberries in 3%, and bog bilberries in 4%. The projective cover of two *Vaccinium* genus species, bilberries and lingonberries, mostly growing in oligotrophic (nutrient-poor) forests, was relatively high, approximately 30% and 20%, respectively.

P12 FEROX Finns' opinions on possible future berry picking technologies

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An online questionnaire survey on wild berry picking in Finland was conducted between February and April 2025. The survey was announced through several information channels in the natural products sector, and respondents were also encouraged to share it further.

A total of 2921 Finns participated in the survey, 93 % of whom had picked wild berries in 2024. Almost all pickers stated that they use to collect berries on picking sites familiar from previous years. In addition, 12 % of the pickers used some kind of mobile application - terrain map app, berry map app or something else - to find berries. Only 5 % utilized traditional printed maps.

One tenth of the respondents had used at least one of the berry map applications that are currently available in Finland. About 40 % of them considered that more accurate berry map apps are needed. However, the willingness to pay for a more accurate app was quite low: an average of 9 euros per year.

Only 8 % of the respondents would be interested in using a drone to find good harvest locations for cloudberry (*Rubus chamaemorus*) collection. The proportion was higher among commercial pickers (17 %) compared to pickers who had other motives for berry collection (7 %). The willingness to pay for such a drone was an average of 146 euros.

One fifth of the respondents considered that in 10 years they could use a drone to make their berry or mushroom picking more efficient. The proportion was again somewhat higher among commercial pickers (27 %) than among other pickers (19 %).

P13 Preliminary results on commercial wild berry picking by Finns

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In 2025, a survey on wild berry picking in Finland gathered responses from 2921 people, 93% of whom had picked berries in 2024. The survey was distributed through several channels in the natural products sector. The majority of respondents (44%) were aged 45-64, and most of them were women (85%). Commercial picking was practiced by 11%, most of them were men (77%).

The total harvest of the berries was 194 990 kg, 90.5 % consisting of bilberries (*Vaccinium myrtillus*), lingonberries (*V. vitis-idaea*), and cloudberries (*Rubus chamaemorus*). Of the total harvest, 31.5% was collected for sale, the majority (63%) being lingonberries. Bilberries and cloudberries accounted for 27% and 7% of the berries collected for sale, respectively. Raspberries (*R. idaeus*) and cranberries (*V. oxycoccos*, *V. microcarpum*) made up less than 3% of the sold berries

Many berry sellers used more than one sales channel. Most (83%) sold berries to friends and relatives, while purchase points/berry companies (30%) and social media (29%) were equally common. Restaurants and tourism companies (8%), institutional kitchens (6%) and market vendors (6%) were the least used channels.

Most respondents (93%) picked berries exclusively for their personal use and therefore not for sale. Lack of time and low prices hindered commercial picking for 24% and 17% of respondents, respectively. 11% of respondents stated that commercial picking is too laborious, and 10% did not know where to sell berries. 7% considered the berry picking areas too remote and therefore did not collect berries for sale.

The main factors identified by respondents that could encourage them to engage in commercial picking were better prices for berries (31%), more free time (23%), more available purchase points or cars (16%), as well as good berry yields and easy access to picking sites (15%). Extra income was a motivation only for 4% of respondents.

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