



Fotograf: Victor Wrange.

Subject Areas at the Faculty of Landscape Architecture, Horticulture and Crop Production Sciences

Förord

Fakulteten har under åren 2022–2025 genomfört ett omfattande arbete med översyn av fakultetens ämnesområden. Detta för att balansera behov av ämnesmässig bredd i forskning och forskarutbildning och för att säkerställa utbildningarnas kompetensförsörjning och kunskapsbehov, samt sektorsuppdraget i form av expertkunskap. Samtidigt ska forskningen ges goda villkor för hög kvalitet och konkurrensförmåga om kompetens och externa medel

The faculty has, during the years 2022–2025, carried out extensive work reviewing the faculty's subject areas. This has been done to balance the need for disciplinary breadth in research and postgraduate education and to ensure the programmes' competence supply and knowledge requirements, as well as the sector-related mission in the form of expert knowledge. At the same time, research must be given good conditions to maintain high quality and competitiveness in terms of expertise and external funding.

Content

Department of Biosystems and Technology

Head of department: Lise Lykke Steffensen

Subject areas and subject area responsible:

Biosystems Engineering in Horticulture and Agriculture – Thomas Prade

Animal-centered Environments – Rebeka Zsoldos

Horticultural and Agroecological Systems – Georg Carlsson

Department of Landscape Architecture, Planning and Management

Head of department: Ingrid Sarlöv Herlin

Subject areas and subject area responsible:

Landscape Governance and Management – Thomas Randrup

Design of Landscapes – Caroline Dahl

Landscape Planning – Anders Larsson

Vegetation Design and Function – Åsa Ode Sang

Department of People and Society

Head of department: Mats Gyllin

Subject areas and subject area responsible:

Business Management – Kes McCormick

Environmental Psychology – Caroline Hägerhäll, Anna Bengtsson

Department of Urban and Rural Development

Head of department: Stina Powell

Subject areas and subject area responsible:

Landscape Architecture – Design – Helena Nordh

Landscape Architecture – Urban Ecology – Marcus Hedblom

Landscape, Planning and Society – Mattias Qviström

Department of Plant Breeding

Head of department: Dennis Eriksson

Subject areas and subject area responsible:

Genomics and Phenomics of Plant Diversity – Cecilia Hammenhag

Applied Genetics and Crop Genetic Improvement – Kimmo Rumpunen

Plant Biotechnology and Functional Genomics – Per Hofvander

Plants and the Environment – Larisa Gustavsson

Plant Product Quality Improvement – Ramune Kuktaite

Department of Plant Protection Biology

Head of department: Kristina Karlsson Green

Subject areas and subject area responsible:

Chemical Ecology – Rickard Ignell

Integrated Plant Protection – Johan Stenberg

Resistance Biology – Erik Andreasson



Fotograf: Jenny Sverrås Giltner

Department of Biosystems and Technology

Institutionen för biosystem och teknologi (BT)

Head of department: Lise Lykke Steffensen

At the Department of Biosystems and Technology, we explore interactions between soil, plants, animals, the environment, climate, and humans in systems for sustainable food production and renewable raw materials. Our teaching and research focus on the sustainable and efficient use of limited resources for production in greenhouses, on agricultural land, and in farm buildings.

Subject areas

Horticultural and Agroecological Systems

Hortikulturella och agroekologiska system

Subject area responsible: Georg Carlsson

The subject area Horticultural and Agroecological Systems combines Horticultural Science and Agroecology in system-oriented studies of the resilience and sustainability of plant production for a wide range of uses, focusing on biological and ecological aspects. It considers system performance based on the interactivities among abiotic and biotic inputs, pressures and outcomes. Outcome dimensions are (in hierarchical order) environmental impacts, food and nutrition security including food safety, ecosystem services, yield and quality.

The subject area's activities are embedded in the OneHealth concept, specifically addressing plant stress physiology and ecological interactions with a cross-kingdom approach (from virus and microorganisms to plants and animals). Outcomes are assessed through systems analyses and multivariate statistics.

Horticultural value networks and arable cropping systems share common settings and the basis for transformation when contextualizing the research questions and outcomes. Focus areas for sustainability enhancements of horticultural value networks include cropping systems, process management in the cultivation of food and ornamentals, pre- and post-harvest management to generate high-quality and safe products. Arable cropping systems are characterized by crops grown on large areas for production of carbohydrates, fats, fibres and proteins, but also minor crops of high value in monetary or functional terms (e.g. enhancing ecosystem services).

The sustainability of arable cropping systems is influenced by choice and diversity of crops, their management, and the resulting environmental, ecological and societal impacts. Agroecology in broad sense entails studies of the ecology of entire food systems, but in the frame of the subject area the focus is on sustainability and practical feasibility of diversified production systems. Agroecological principles of e.g. recycling, input reduction, soil health, biodiversity and synergy are applied in research in the subject area both in horticultural and agricultural plant production.

Central topics that unite Horticulture and Agroecology are biological processes and interactions, value network/value chain perspectives, resilience, sustainability, food and nutrition security. Horticulture and Agroecology provide assessment dimensions that can synergistically be applied to several established and innovative/emerging type of production systems. Both are key with respect to national crisis preparedness and contingency.

The subject area covers studies of a wide range of crops in horticultural and agricultural cropping systems, including non-plant production such as edible mushrooms, in indoor and open-field systems and under both organic and conventional/integrated management at various scales and processing levels. It considers both rural, peri-urban and urban production sites, including annual (e.g. grain legumes, vegetables) and perennial

crops (e.g. leys, fruit trees and perennialcereals) and different end-uses of the harvested products, e.g.: food, feed, ornamentals, green manure, bioenergy feedstocks. In addition to empirical investigations performed in field experiments, greenhouses and laboratories, the subject area engages in participatory research with various stakeholders, and interdisciplinary collaborations to design and assess transition pathways. Transdisciplinary and multicriteria approaches are key for identifying and suggesting actions that enhance economic, environmental and social sustainability.

The research includes studies of circularity in systems for efficient, safe and sustainable use of renewable resources, e.g. growing media, nutrients, energy. Food safety and food security are important topics, including issues around responsible use of resources and impacts of consumer behaviours (e.g. sustainable diets concepts) for sufficient and safe production of food.

The subject area performs teaching linked to its research areas and has several responsibilities at course and programme levels within the Agricultural and rural management, Horticultural engineer – cultivation, Agroecology, Food and Landscape, and Horticultural science programmes.

The subject area is also responsible for the management of field experiments at the field research station Lönnstorp.

Biosystems Engineering in Horticulture and Agriculture

Biosystemteknik inom trädgård och jordbruk

Subject area responsible: Thomas Prade

The Biosystems Engineering in Horticulture and Agriculture subject area is dedicated to advancing sustainable and competitive agricultural and horticultural production, through research, innovation, education, and collaboration. The scope of the subject is on technical aspects of how plants, animals, the environment, and humans interact within outdoor and indoor production systems, particularly in the face of climate change and environmental pressures.

Our research spans a broad spectrum of technology applications, aiming to improve both the sustainability and efficiency of food, feed and other biomass production. We work on optimizing cropping systems and agricultural machinery systems, enhancing the energy performance of agricultural buildings, and assessing renewable building materials. A major focus lies in using agricultural and horticultural crop residues as a key resource for the emerging bioeconomy. We're also tackling challenges such as reducing emissions from livestock housing, improving nutrient recycling from residual streams, finding sustainable alternatives to peat as a growing medium and minimizing GHG via introduction cover crops in agricultural and horticultural crop rotations.

Underlying these efforts is a commitment to key sustainability principles. We promote circular use of plant nutrients, carbon, and water, and strive to reduce emissions by utilizing renewable materials and refining operational practices. Our research supports the development of resilient systems through smart crop rotations that integrate food and non-food production.

To guide improvements across entire production systems, we apply systems analysis methods such as energy balances, life cycle assessments, soil organic carbon modelling, systems dynamics, and nutrient and techno-economic assessments. We also use GIS-based data tools to assess and optimize production on a spatial scale.

Digital technologies play a growing role in our work. By integrating sensors, cameras, artificial intelligence, machine learning and data analytics, we are developing smarter, more responsive agricultural and horticultural systems. Infrastructure development is another important area of our expertise, covering stables, storage facilities, greenhouses, and other buildings essential to food and biomass production and storage.

Our current research topics reflect emerging needs and opportunities in the sector. We are developing systems for producing low indirect land use change (ILUC) biomass, exploring agrivoltaic integration in farming landscapes, and examining urban horticulture innovations like rooftop greenhouses. Additionally, we are advancing the concept of plant protein biorefineries, particularly in combination with biogas production, to maximize resource efficiency and plant nutrient recycling.

Through this multifaceted approach, Biosystems Engineering in Horticulture and Agriculture contributes to a climate-smart, resource-efficient, and circular bioeconomy that supports sustainable food, feed and biomass production now and into the future.

Animal-centered Environments

Djurcentrerade miljöer

Subject area responsible: Rebeka Zsoldos

The proposed subject area Animal-centered Environments represents a robust and interdisciplinary research domain dedicated to advancing the welfare, health, and sustainability of animals in human-managed environments. It focuses on integrating animals' sensory, cognitive, and physical needs into the design and management of agricultural systems, research environments, and other animal-use settings (including but not exclusive to companion and working animals).

At the heart of the subject area is the principle that decision-making - whether in scientific inquiry, technology development, or agricultural practice - must prioritize animal welfare. This includes ensuring relevance to their lived experience, impartial consideration of their needs, welfare-focused outcomes, and a commitment to minimizing harm or distress. Additionally, this also contributes to the animal work environment and ergonomics, opening up cross-domain development.

This subject area builds on the recognition that animals are active participants in their environments, not passive components of production systems. By centering research and innovation around the species-specific needs and biological motivations of animals, the field promotes the development of adaptive, high welfare environments that improve both animal welfare, sustainability and system performance.

Animal-centered Environments fosters novel advancements by combining:

- Cutting-edge technologies such as precision livestock farming (PLF), sensor-based welfare monitoring, and AI-driven environmental management;
- Innovative methodologies that integrate animal behavior, environmental design, and user-centered approaches tailored to animals as sentient beings;
- Ethical frameworks that position animals' interests at the core of both research and practical implementation.

By extending these principles across all domains of animal research and application, the subject area offers a structured ethical framework based on relevance, impartiality, welfare, and consent. This framework supports responsible and transparent research practices, enhancing both the credibility and societal acceptance of animal-related research and innovation.

Ultimately, Animal-centered Environments aims to drive a paradigm shift toward systems that are not only productive and sustainable but also ethically sound and welfare-driven. This positioning makes the subject area a transformative force in addressing key societal challenges in animal welfare, food production, environmental sustainability, and responsible technology development, fully aligned with SLU's mission and the LTV Faculty's strategic priorities.



Fotograf: Jenny Sverinäs Gillner

Department of Landscape Architecture, Planning and Management

Institutionen för landskapsarkitektur, planering och förvaltning

Head of department: Ingrid Sarlöv Herlin

Department of Landscape Architecture, Planning and Management is Sweden's leading academic institution for education and research in the field of landscape architecture and a part of SLU Landscape.

Subject areas

Design of Landscapes

Landskapsdesign

Subject area responsible: Caroline Dahl

The subject area Design of Landscapes conducts research, education (at all cycles) and outreach activities that positions design as an indispensable conceptual and technical activity for addressing landscape change and the understanding of processes that influence such change.

Three main strands of knowledge production define the subject area:

- Design of places (aesthetics & construction)
- Design processes (methods, tools and fabrication)
- Design thinking (epistemology and ontology)

Sustained trajectories for the subject area focus on long-standing contributions to research and education related to the design of places, parks, districts, towns, streetscape etc. as well as research and education on artistic methods and design processes. These practices support both individual capacity building and collaborative practices.

The subject area plays a key role in numerous courses across SLU's landscape related programmes, both at the Alnarp and Ultuna Campus. The teaching relates to topics including design and construction processes, materials and materiality, regenerative design and blue-green infrastructure, universal design and landscape analysis. Other areas of teaching address design history and theory, artistic methods and design research methodology, design built through large-scale modeling, visual communication and applied aesthetics.

A core pedagogical approach for the subject area is the intertwined learning activities of theoretical and applied knowledge. Important vehicles for supporting learning are the studio environment, reflection in action, and the materialization of ideas and phenomena.

Research within the subject area is multidisciplinary, with a strong emphasis on design research and artistic methods. Ongoing, and longstanding, research engagements include areas such as sensorial and experiential dimensions of landscapes, landscape-oriented living labs, spatiotemporal transformation and landscape change, mobility and public space.

Research projects are often carried out in collaboration with other universities, both in Sweden and internationally. Transdisciplinary projects in collaboration with practice is common. For education, collaboration with practice and local municipalities are critical in training the next generation's landscape architects, designers and engineers.

Expanded trajectories for the subject area includes visual communication and hybrid fabrication using advanced digital and analogue techniques to shape, communicate and

represent design proposals and processes. Of importance is methodologies and protocols for reuse and upcycle of mineral and biotic materials, contributing to circular design strategies.

Future trajectories involve critical reflections on ethics and the rewriting of landscape architectural history, theory and practice. This includes a stronger focus on environmental justice and resource management, and a deeper understanding of local and regional contexts. Another related trajectory for the subject area to explore is how design can evolve in response to new understandings of the agency between humans and other species (non-humans, more-than-humans, transspecies, etc.). These concerns reshape not only what and how we design, but for whom. Appreciating landscape architecture projects that embrace co-creation and co-production involves recognizing their collaborative nature and the involvement of diverse stakeholders and communities in the design process.

Landscape Governance and Management

Landskapets governance och förvaltning

Subject area responsible: Thomas Randrup

The Landscape Governance and Management Theme Group (LGM) conducts research, education (at all levels) and outreach activities pertaining to governance and management of landscapes.

Management covers strategic, inclusive and long-term approaches for continuous re-planning, re-design, re-construction and maintenance of open space, including organizational perspectives such as leadership and strategic development of landscapes.

Governance covers both the many ways public and private actors cooperate to govern public spaces with a special emphasis on inclusion and awareness of power relations, and (ii) how (public) organizations are structured and organized in their work – related to management of urban open spaces.

LGM has a strong inter-, and multidisciplinary research basis, with numerous larger projects financed by the EU, Nordic Council of Ministers, and Swedish funding agencies such as Formas and Vinnova. We also attract funding from academies, national boards, SLU and LTV, and use smaller grants strategically e.g., for short term-employments, and outreach activities such as the annual event Utemiljödagen. We often attract significant funding via cooperation with other Theme Groups, Departments or Universities as well as collaborators outside academia, nationally and internationally.

The LGM subject area contributes to a large number of courses on all landscape related programs across the LTV faculty. This includes a bi-annual PhD course on Landscape Governance and Management.

The teaching has expanded much during later years on bachelor level, while the contributions on master level can be increased further.

Educational activities emphasize landscape management from strategic, organizational and operational perspectives, and covers governance of relevance for all

the department's subject areas. Emphasis is on research-based teaching at all educational cycles, and across all teaching activities where research projects, cases, and learnings are used to exemplify, relationalize and conceptualize landscape governance and management. LGM also contributes to the development of educational literature such as compendiums and textbooks.

Much of the focus of LGM is related to landscape management practice and practitioners' needs. This plays a central role both in education and research, which we often develop and conduct in close collaboration with practitioners and local governments in Sweden and abroad.

Our research approaches and methodologies are related to the social sciences but not strictly limited to these. We prioritize using real-world situations in both research and education by the use of physical testbeds, living laboratories, and policy laboratories. Using such living labs as an outset, we perform real life studies in order to further understand and potentially develop landscapes and the related social-ecological interaction at several levels. Thus, we usually frame our studies in relation to a specific geographical scale, being it local (school grounds or local parks), neighborhood, city, national or global. Our methodological approaches include for example document analysis, stakeholder analysis, organizational and governance analysis and interviews, often in a comparative mode.

Within the LGM subject area all individuals should feel part of the group, being able to find synergies inwards and (re)present us outwards. In line with SLU policies, an important purpose of being part of the LGM subject area is thus to support each other and stimulate joint resilience in our activities. The basis for doing that is to develop and promote a common language, terminology, and understanding for the theme and its approaches in education and research. This is supported by common activities such as authoring the Routledge book on Urban Open Space Governance and Management, the educational compendium *Forested Landscapes: Analysis & Governance*, *Utemiljödagen*, the Governance Talks, and the International Symposium on Managing Public Space.

We use our Mission and Vision actively and are discussing and updating both when needed. Group discussions are aimed at creating a safe space for critical thinking, to secure the Theme Group constitutes a strong social network for all members. Thus, we prioritize personal academic interests and experience in the theme, not only to represent it but also to contribute to the further development of the subject area and the group.

Landscape Planning

Landskapsplanering

Subject area responsible: Anders Larsson

The subject area of Landscape Planning deals with research, education, cooperation and environmental monitoring and assessment (EMA) for and on cross-sectorial planning

of landscapes for society's demands and landscape-related contemporary challenges, embracing all types of landscapes (rural, urban, peri-urban; land, water and coastal areas) and at all levels of concern for planning.

The process of landscape planning embraces procedural, substantive, and professional knowledge, drawing on competences from the natural sciences, technology, arts, social sciences and the humanities.

Contemporary subfields within Landscape Planning are often complementary, reflecting the interdisciplinary nature of the discipline. These include:

Landscape Planning Practices and Theory. This subfield encompasses knowledge of planning theory and practice, including legal planning systems, planning tools, processes, and policies. It addresses conflicts and trade-offs related to land use, multi-functionality, and planning ideas. Recent research increasingly engages with the digital transformation of planning.

Landscape Analysis. This area examines landscape dynamics by integrating biogeophysical components with the human dimension, including activities, values, experiences, and local knowledge, and how humans interact with their environment. It combines environmental data with human perceptions, including cultural, aesthetic, and spiritual dimensions.

Methods include risk and decision-making analysis, distributed modelling, Geographic Information Systems (GIS), geo-statistics, digital visualisation, landscape assessment and characterisation, and evaluation of when scientific and local knowledge can be integrated to produce context-sensitive insights that inform decision-making, communication and policy.

Cultural Heritage and History. This subfield explores the historical dimensions of landscapes, including garden, park, and wider landscape history. It engages with both tangible and intangible heritage, concepts of time depth, and democratic approaches to heritage planning.

Social Aspects of Landscape Planning. This area investigates issues such as landscape justice, democratisation processes, housing and mobility, and the everyday environments of children and young people.

It explores notions of sense of place, landscape identity, and other socio-cultural values, emphasising participatory and inclusive planning approaches.

Ecological Aspects of Landscape Planning. This subfield addresses biodiversity, landscape ecology, and green infrastructure, alongside the restoration of ecosystems.

It also considers the ecological and environmental implications of climate change and environmental hazards, promoting resilient and sustainable landscape solutions.

Food as a Lens in Landscape Planning. This emerging subfield highlights the role of food systems in shaping sustainable landscapes and examines food-related dynamics within landscape planning, the interrelationships between food, people and place, as well as issues of food security, food sovereignty, and urban agriculture.

The subject area contributes substantially to teaching across more than seven academic programmes. It plays a key role in the educational programmes for Landscape Architecture, Landscape Architecture Master's, Landscape Engineering, Food and Landscape, and Sustainable Urban Development. In addition, it contributes to the programmes Forest and Landscape, Agroecology, and Outdoor Environments for Health and Well-being.

Course offerings range from holistic, integrative studio courses to more specialised modules focusing on planning, cultural heritage, digital landscape analysis, and the intersection of food and landscape.

The subject area has a long-standing tradition of collaboration with professional practice, including partnerships with municipalities, regional authorities, government agencies, and non-governmental organisations at various levels. It is also embedded in strong national and international academic networks.

External collaboration forms a cornerstone of both research and education within the subject area. Many projects are grounded in real-world challenges of a spatial and contextual nature, addressing physical and administrative scales from regional to local levels.

Vegetation Design and Function

Vegetationsbyggnad

Subject area responsible: Åsa Ode Sang

The urban vegetation group conduct socially relevant research and teaching in the areas of planning, design, construction and management of vegetation in primarily, but not exclusively in an urban context.

In our research, we work to develop new concepts for the design, construction and management of attractive and functional urban greenery that contributes to sustainable urban development by mitigating climate change and delivering desired functions and ecosystem services, such as biodiversity, recreation, temperature regulation and stormwater management.

We focus on the functionality and dynamics of vegetation in a long-term perspective, where management is an active tool for shaping and designing vegetation over time, and investigate the ability to deliver various ecosystem services in the long term. The group has a wide international network, with projects currently carried out in collaboration with researchers in countries such as Japan, Ethiopia, USA, Australia, Germany, Norway and Denmark.

Within the framework of urban greenery, we have ongoing projects on urban trees, green roofs, green walls, street-scapes, roadside environments, perennial plantings, urban forests and private gardens. This research is often carried out in inter- and transdisciplinary collaborations with larger projects funded by Formas, VR, Vinnova, Trafikverket, and Interreg.

The group carry out much of their research in close collaboration with stakeholders, with many such projects funded by Movium partnership. The group collaborate with other theme groups across the faculty as well as broader within SLU through multiple projects.

In our research, we conduct a variety of measurements of vegetation properties to increase our understanding of how we can achieve viable ecosystems that deliver the ecosystem services needed. We combine methods from landscape architecture, plant physiology, plant and soil ecology, and ecosystem ecology, with measurements made in both lab and field settings, with focus on vegetated systems and people's interactions with vegetation. Lab-based measurements include plant traits and plant physiology aspects, for example specific leaf area and colour, leaf water potential at turgor loss, tissue nitrogen and carbon content; as well as soil and water quality analyses including soil organic matter, carbon and nitrogen content, soil water holding capacity, and dissolved nutrient concentrations.

The groups research on perception and preference of vegetation is carried out through different form of surveys, interviews, focus groups and workshops with a diverse set of stakeholders. We conduct different forms of physiological measurements of reaction to vegetation in collaboration with SLU Sensola.

Our experimental-based research is conducted in a number of different contexts and scales, including greenhouses, test beds on the Alnarp campus and in-situ in the city or in the countryside, often together with various societal actors such as municipalities, regional organisations and governmental bodies.

We are interested in seeing how we can use vegetation in the form of nature-based solutions to help create better living environments in a future climate, as well as meet other societal challenges. Through the research we are carrying out we provide knowledge that contributes to the teaching that the group carries out within the landscape architecture, landscape engineer and garden engineer programmes.



Department of People and Society

Institutionen för människa och samhälle

Head of department: Mats Gyllin

We conduct research and education in environmental psychology, business management, and advisory services. The department focuses on the human environment as a space for work, economic activity, health, and well-being. Our core principle is that health and well-being are key drivers of positive societal development, including business and management.

Subject areas

Business Management

Företagsledning

Subject area responsible: Kes McCormick

The subject area has as an overall objective to develop knowledge and increase awareness of economically, socially and ecologically sustainable operations and systems. The group engages with entrepreneurship, leadership, management and governance across agriculture, forestry and horticulture as well as urban and rural landscapes.

The focus for the subject area's research, teaching and collaboration is based on business administration with a profile towards business management and connected to broader social sciences.

Priority sub-topics are production, environmental and circular economy, strategy, entrepreneurship, innovation, marketing, management, leadership and organization, work environment and knowledge transfer, in agriculture, horticulture and landscape, at community, company and individual level, in rural areas and in the city, as well as on a national and global level.

The subject area uses both qualitative and quantitative research methods to solve complex problems and issues, influencing and contributing to a positive and sustainable economic, social, and ecological development for the companies and employees of the green industries.

The objective of the subject area is to act as an engine of change in the sector through cooperation with other actors. The area's research is characterized by interdisciplinarity, systems thinking, holistic applied research and implementation in collaboration with industry stakeholders, and other institutions within and outside SLU.

Within education the subject area is involved in education programmes at both bachelor's and master's levels: Agroecology, Agriculture, Horticultural science, Landscape engineer, Agricultural and rural management, Sustainable food systems and Horticultural management.

Teaching within the subject area is mainly given in the subject of business administration with a profile towards business management. Examples of prioritised sub-subjects in teaching are production, environmental and circular economy, financial management, business strategy and models, entrepreneurship, innovation, marketing, management, work environment, leadership and organisation, social sustainability, project management and facilitation, as well as methods and thesis courses in agriculture, horticulture, and landscape management.

The goal is to develop high-quality interdisciplinary education for both national and international students with a focus on economic and social sustainability within the green industries, in the countryside as well as in the urban environment (ecological sustainability is a given condition). The area is characterised by a close interaction and collaboration with society, business, and other universities. Courses are linked to the

green industries and are characterised by a systems perspective with a close connection to the latest research.

Important infrastructure for the subject area is the national and international networks and platforms that are prerequisites for the subject area's collaborations and cooperation within both research and education. The networks span everything from individual companies, industry, and interest organisations, to authorities, universities, and scientific associations. Linked to the subject area is also the collaboration platform Swedish Centre for Agricultural Business Management and a communicator, which are of great importance in making the subject area's activities and future development visible and useful.

Environmental Psychology

Miljöpsykologi

Subject area responsible: Caroline Hägerhäll och Anna Bengtsson

The group is multi- and interdisciplinary, focusing on research in social and behavioural sciences with intellectual ties to landscape architecture. The scope and interest in environmental psychology have grown substantially over the years and currently staff from our group are involved as teachers in many different education programmes at LTV/SLU. Recent years has also seen development of the international master's programme Outdoor environments for Health and Wellbeing (OHW) as well as establishing Environmental psychology as its own education subject ("huvudområde") at SLU.

Environmental psychology is a multidisciplinary subject that studies the relationship between human beings and our surroundings. Our research focuses on how place and landscape surrounding people contribute to socially sustainable everyday environments. Particular attention is paid to outdoor environments promoting people's health, well-being and development. In line with this, basic research concerning the mechanisms contributing to specific outcomes (e.g. physical activity, play and learning, recreation, restoration, health interventions and creativity) is at the centre of our work.

Moreover, methods for evidence-based research and practice, as well as conceptual development of nature-based health interventions are developed. At present, the group conducts research focusing on the following aspects:

- Landscape preferences and landscape perception.
- Planning for health promotion in various types of outdoor environments, from natural to planned, e.g. forests, parks, schoolyards and health care facilities.
- People and environment interaction from the perspective of specific user groups, e.g. children, youth and vulnerable groups.
- Salutogenic experiences and activities of interaction with nature and biodiversity, e.g. gardening, exercise, outdoor office work, and connectedness to nature.

Our problem-based approach and close collaboration with essential actors and policymakers generate unique opportunities to work with and integrate different aspects of sustainability in relation to urban as well as rural environments, in line with the UN goals. We see a potential in an emerging discourse that highlights synergies between the needs of people and other species, exemplified by concepts like nature-based solutions and one health.

The group is characterized by most staff being involved in both research and teaching, which results in teaching with a high degree of research connectedness. We welcome students from a wide range of disciplines and countries to our courses. We are often engaged as supervisors and examiners for independent projects in a wide range of programs at SLU.

In addition, the group has contributed to SLU's mission of continuous environmental analysis through several projects within the newly developed Environmental Monitoring and Assessment Programme for Built Environments.



Foto från AdobeStock.

Department of Urban and Rural Development, unit of landscape architectur

Institutionen för stad och land, avdelningen för landskapsarkitektur

Head of department: Stina Powell

Sustainable transformations require not only new ideas but also knowledge meeting practice. We combine education, research and collaboration to contribute to the societal change needed to meet challenges such as the biodiversity and climate crises.

Subject areas

Landscape Architecture – Design

Landskapsarkitektur – Design

Subject responsible: Helena Nordh

Landskapsarkitektur-Design är ämnesområdet där landskapsarkitektens designfrågor står i centrum. Gruppmedlemmarna arbetar utifrån tre kompletterande perspektiv där forskning, undervisning och samverkan genererar kunskap OM, FÖR och GENOM design.

OM design: innebär studier av landskapsdesignens kulturella och sociala betydelser, och om landskapsarkitekturprofessionens praktik.

FÖR design: inkluderar studier om och hur platser och deras utformning fungerar, upplevs och används i olika kontexter och av olika användare.

GENOM design: omfattar studier som med konstnärliga och designmetoder utforskar och utformar landskap, och reflekterar över hur olika scenarier påverkar såväl landskapet som dess invånare.

Gemensamt för de tre perspektiven är gruppens intresse för utformningen av landskapet som sådant, men också för processerna runt landskapsdesignen och de verktyg, material och metoder landskapsarkitekten använder. Gemensamt är också ett intresse för design i förhållande till tid, där platser och akademiska diskurser studeras ur kulturhistoriska så väl som nutida eller framåtblickande, spekulativa angreppssätt.

Forskning, undervisning och samverkan bedrivs inom följande teman:

Arkitekturkritik, vetenskapligt förankrad kritik av såväl gestaltade projekt som aktuella diskurser inom akademien och den professionella praktiken.

Landskapsarkitektens estetik, studier av landskapets och landskapsarkitektens estetiska värde och vilken roll estetiska värden, upplevelser och smak spelar i gestaltungsprocesserna.

Landskapsupplevelser, utforskande av hur människor förstår, tolkar och påverkas av landskap. Det inkluderar även forskning om hur platser skapar identitet, mening och betydelse i människors liv.

Landskapets historia och kulturarv, studier av landskapets tidsdjup, såväl som dess utveckling och kulturhistoria. Centralt är landskapsförändringar, kulturhistoriska värden och minneslandskap.

Representation, utforskande av hur gestaltungsförslag och analyser kommuniceras i text, bild och genom olika tekniker, såväl digitala som analoga.

Material och teknik, undersöker hur tekniska lösningar och material begränsar och möjliggör landskapsarkitektoniska designlösningar.

Designbaserad och konstnärlig forskning, utforskandet av en stor bredd av konstnärliga och designbaserade metoder, samt utveckling av teori i relation till dessa.

Genom forskning och undervisning om, för och genom design och med fokus på en bredd av teman som alla berör designfrågor som också knyter an till SLU:s strategi om hållbar utveckling, samt fakultetens fokus på att lösa viktiga samhällsutmaningar, så medverkar ämnesområdet till att utveckla professionen och den akademiska disciplinen i landskapsarkitektur.

För att driva komplexa landskapsdesignfrågor framåt samt verka för att uppnå fakultetens strategi om en mångfald av kunskap och kompetens inom olika vetenskapliga discipliner, och inte minst för att stärka kärnområdena i vårt ämnesområde strävar vi efter att samtliga tre perspektiv (om, för och genom design) även i framtiden ska vara representerade i ämnesrådets forskning och undervisning.

Landscape Architecture – Urban Ecology

Landskapsarkitektur - Urban ekologi

Subject area responsible: Marcus Hedblom

Ämnesområdet har en tvärvetenskaplig ansats som kombinerar ekologi, biologisk mångfald, mänskligt välbefinnande med förvaltning, design och planering av urbana grön- och blå områden.

Ämnesområdet har ett starkt fokus på hur vegetation förvaltas, designas, planeras så att den kan bibehålla ekologiska funktioner kopplat till biodiversitet och samtidigt utveckla platser för välmående, lek, rekreation, minskade värmeeffekter, estetik och vattenupptag. Till stor del är det fokus på förvaltning, design och planering av vegetationen inom urbana områden även om ämnesområdet också strävar efter att inkludera landskap utanför städerna.

Ämnet är unikt i den meningen att det kombinerar landskapsarkitektur med flera andra discipliner som ekologi, miljöpsykologi och historia och med stark koppling till praktik.

Praktik: En viktig del i ämnesområdet är den praktiska tillämpbarheten. Flera forskningsprojekt kopplar till t.ex. etablering av regnbäddar, skötsel av skogar, hur lekplatsers vegetation sköts för att barn skall trivas. Flera i ämnesområdet har professionell erfarenhet som landskapsarkitekt eller landskapsingenjör och bidrar starkt till att kompetensen mellan praktik och teori stärks. Det innebär att det finns en direkt koppling mellan praktik, undervisning och forskning.

Syften med undervisningen och forskning inom ämnesområdet är att förändra rådande praxis – där vi kommer utgå från ekologiska principer och naturhärmande planteringar som också tar hänsyn till människor.

En del i ämnesområdet är att arbeta med förändringsprocesser, lärandeprocesser, förankringsarbete och liknande – dvs hur det går till att implementera och etablera nya arbetsätt i olika typer av organisationer.

Förvaltning: inom ämnesområdet undervisar vi i och forskar på hur landskapet skall förvaltas för att gagna både människor och biologisk mångfald. Vi undervisar både landskapsarkitekter och landskapsingenjörer med kursmoment där båda programmen studerar tillsammans både inom grundprogrammen samt på mastersnivå.

Inom undervisningen används landskapet ”som klassrum” för att förstå hur natur och kulturlandskap i ett vidare perspektiv och inte minst färdighetsträning i de processer som styrker landskapsarkitekters och landskapsingenjörers yrkesutövning.

Flera forskningsprojekt testar förvaltning i praktiken, t.ex. i landskap som designade växtplanteringar i regnbäddar, växter i dagvattendammar, gräsmattor/äng; skog; naturlika planteringar; olika planteringssubstrat samt flytt av stora träd.

Välbefinnande och upplevelser: Inom ramen för ämnesområdet undervisar vi hur områden skall förvaltas för ökade upplevelsevärden som t.ex. konceptet Cues to care – messy ecosystems orderly frames.

Inom forskningen kopplas människors upplevelser av grönska till upplevd återhämtning (miljöpsykologi) men även fysiska reaktioner (neuropsykologi). Syftet med kopplingen till psykologi är att få ökade kunskaper kring hur olika typer av grönska upplevs med våra sinnen som syn, hörsel och lukt och utifrån dessa premisser förvaltar, designar och planerar landskap så att det gynnar människors välmående. All forskning på hälsa syftar till förvaltning, design och planering av gröna ytor som också kopplar till övriga ämnesområden på institutionen.

Ekologi: Ämnesområdet betonar betydelsen av att förvalta, designa och planera områden så att de ekologiska förutsättningarna bibehålls. Det är viktigt att våra lokala naturresurser används på plats och att trots att vi designar områden för människor så krävs det att vi har en fungerande ekologi.

Inom forskningen studeras t.ex. evidensbaserad ekologisk förvaltning, hur växter etablerar sig, hur pollinerande insekter i städer fördelar sig mellan inhemska och exotiska växter, hur djur reagerar på ljusdesign samt hur barns lek kombineras med biologisk mångfald.

Ämnesområdet bedriver undervisning med specifika kopplingar till tillämpad ekologi som Studio Urban Ecology, Flora och västekologi, Landskapsarkitektur och ekologi. Betoningen ligger på ekologi i en Urban kontext.

Multifunktionella landskap: Idag ställs högre krav på att landskap skall inhysa många funktioner, och inom ämnesområdet undervisar och forskar vi på balansen mellan gestaltning, förvaltning, planering och de ekosystemtjänster som kopplar till människans användning av landskapet.

Landscape, Planning and Society

Landskap, planering och samhälle

Subject area responsible: Mattias Qviström

Landskap, planering och samhälle studerar landskapet som arena för en hållbar och rättvis samhällsomställning. Ämnet kombinerar landskaps- och planeringsstudier och utgår i första hand från samhälls- och humanvetenskaplig teori och metod.

Särskild tonvikt läggs på kvalitativ och teoridriven forskning som kan bidra med nytänkande och kritiska perspektiv på dagens samhällsutveckling i allmänhet och landskapsplanering och styrning i synnerhet.

Ämnet spänner från rurala till urbana landskap, från internationell till lokal nivå. Studier av landskapsplanering, landskapsanalys, och av landskapsarkitekters- och planerares praktik är centralt.

Ämnet omfattar grundforskning, praktikinära forskning och utforskande genom undervisning. Ett nära samarbete, och gemensamt lärande, mellan forskare, studenter och praktiker är avgörande för ämnets utveckling.

I linje med ämnets tvärvetenskaplighet bedrivs studierna främst i gränssnittet mellan konventionella fält. Centrala gränssnitt för ämnet är:

- Landskaps- och planeringsteori för teoriutveckling och kritisk analys.
- Landskaps- och planeringshistoria: studier av samspel mellan landskap, planering och andra styrningsmekanismer för att förstå förutsättningarna för samhällsomställningar.
- Landskap och stadsbyggnad: kvalitativa, rumsliga landskapsstudier i gränssnittet mellan planering och design.
- Strategisk planering och landskapspolitik: policyinriktade studier på lokal, regional, nationell och internationell nivå.
- Mobilitetsstudier och landskap: studier i gränssnittet mellan mobilities studies, landskapsstudier och planering för ett hållbart vardagsliv.
- Kritisk teori och landskapsplanering: kritiska perspektiv på planering, makt, inkludering och rätten till landskapet.



Fotograf: Jenny Svernas Gyllner

Department of Plant Breeding

Institutionen för växtförädling

Head of department: Dennis Eriksson

Our vision is to make a significant contribution to the efficient and sustainable production of food, feed, and industrial products derived from plants.

- Our research aids the domestication and genetic enhancement of new crops
- We identify how different factors affect end-product quality
- We unravel the regulatory networks of storage compounds in plants

Subject areas

Applied Genetics and Crop Genetic Improvement

Tillämpad genetik och förädling av kulturväxter

Subject area responsible: Kimmo Rumpunen

The subject area Applied Genetics and Crop Genetic Improvement integrates the principles of genetics, molecular biology, and plant physiology to develop new cultivars with enhanced traits – from root to shoot – for both agricultural and horticultural crops.

Advances in molecular genomic technologies, phenotyping, and computational systems now provide powerful opportunities to design more efficient and precise approaches to plant breeding. The full potential of genomics will be realized when combined with other omics disciplines, quantitative genetics, envirotyping, and crop management to enable integrated and comparative analyses of genotypic, phenotypic, and pedigree information for key crop traits.

Research in crop genetics spans a wide range of subfields, each contributing to a deeper understanding of how genetic variation influences plant performance and how these insights can be applied to crop improvement. In a participatory and practice-oriented approach, networks of small-scale and professional growers are also involved in citizen science initiatives for variety selection and field testing, accelerating the advancement of elite selections across diverse environments.

Researchers in this subject area have long been active across these subfields, establishing strong research groups that conduct successful work on both temperate and tropical crops. They also play key roles in education and training at BSc, MSc, and doctoral levels, contributing to national and international programmes.

Key focus areas

- **Transmission Genetics:** Studies the genetic makeup of crops and inheritance patterns to improve traits such as resilience to biotic and abiotic stress and nutritional quality.
- **Population Genetics:** Analyses genetic diversity within and among crop populations, incorporating natural selection, gene flow, and genetic drift to inform and refine breeding strategies.
- **Quantitative Genetics:** Examines traits controlled by multiple genes, applying statistical approaches to estimate heritability and predict breeding outcomes for complex characteristics such as yield and stress tolerance.

Teaching

Courses and teaching activities within the subject area cover: Plant breeding principles and practices, quantitative genetics, applied botany, plant identification and classification, breeding methodology, phenomics, bioinformatics, plant physiology, and breeding for resistance and abiotic stress tolerance of crops

Plant Product Quality Improvement

Växtproduktkvalitet

Subject area responsible: Ramune Kuktaite

Multidisciplinary research in the Plant Product Quality Improvement area focuses on addressing key societal needs by conducting cutting-edge science and to advance the state-of-the-art in innovations related to plant protein and other high-value components, nutrition, health promoting compounds, sustainable use of plant resources, bio-based materials, processing technologies, pre/post-harvest technologies and reduction of food-losses.

Our research is strategically built on the key aspects of plant product quality elements including ‘sustainable raw materials, processes and end-use products’ following the farm-to-fork strategy. This further includes conventional breeding, precision breeding, pre/post-harvest attributes, resource use efficiency and sustainability to deliver plant-based products that benefit both society and the environment. We combine knowledge on quality of plant product components from raw material processing through the production chain, and via conventional breeding and precision breeding we are improving traits, as well as tailoring the characteristics of plant-based products for food, feed, and industrial applications. We strive to develop knowledge in areas related to plant breeding, aiming to improve plant product quality and crop adaptation to a changing environment.

Our research has a strong collaborative character, involving partners from the national and international academic arena, as well as a very broad industrial partner network.

Key focus areas

- Quality mapping for targeted crop breeding: focus on high-value components in stress adapted crops.
- Precision breeding: focus on advanced genetic tools, such as CRISPR-Cas, to study and enhance product quality, environmental adaptation, and productivity at the molecular level.
- Pre/post-harvest quality: focus on sustainable and environmentally friendly pre/post-harvest technologies to improve commercial and nutritional quality of fruits and vegetables.
- Valorization of side streams: focus on sustainable and innovative uses of crop residues/ side streams from plant production systems in order to create higher value products.
- Plant-based innovations: focus on innovative processing technologies, such as the fractionation of high-value components from green biomass and proteins from crops, and structure-function relationships in plant-based systems for food and bio-based materials for improved uses in diverse systems.
- Sustainable plant-based systems: focus on an integrated approach to sustainably use the valorized components of plant-based innovations to improve their bioeconomy and environmental performance.

Genomics and Phenomics of Plant Diversity

Genomik och fenomik av växtdiversitet

Subject area responsible: Cecilia Hammenhag

This is a multidisciplinary subject area focused on exploring and harnessing the full range of natural and existing genetic variation to address current and future challenges in plant production. In contrast to subject areas focusing on genetic improvement or plant–environment interactions, this field centers on the discovery, characterization, and understanding of genetic and phenotypic diversity itself, as the foundation for future breeding, domestication, and adaptation. Domestication and modern plant breeding significantly narrowed the genetic base of many crops, increasing their susceptibility to pests, diseases, and environmental stresses, challenges further intensified by climate change. To counteract this genetic erosion and ensure resilient food- and biobased systems, it is essential to characterize and utilize the rich genetic diversity found across crops, landraces, old cultivars, crop wild relatives, feral populations and breeding germplasm. This is a critical research area dedicated to characterizing the broad genetic variation and uncovering traits that support crop adaptation, resilience, and sustainability. These efforts are especially important for plant breeders working to improve crops in the Northern Hemisphere, where climate change presents a complex array of challenges—including rising temperatures, shifting precipitation patterns, the need for adaptation to long-day growing conditions and seasonal cues, and increased pressure from pests and diseases.

This subject area focuses on generating foundational knowledge and developing tools to investigate genetic and phenotypic diversity across diverse germplasm collections. It provides the knowledge base and data resources that feed into plant genetic improvement, by identifying and characterizing the diversity that breeding programs can later exploit. By bridging classical approaches with cutting-edge technologies, such as population/quantitative genetics, genomics, high-throughput phenotyping and computational analytics, we aim to identify valuable traits and genetic resources across both cultivated and wild materials for future crop improvement. This includes developing predictive tools, such as genomic selection models and breeding simulations to unlock the genetic potential of diverse

populations and guide data-driven decisions in deploying genetic resources for crop improvement. However, the emphasis remains on understanding the underlying diversity and trait architecture rather than on optimization or selection per se. These approaches also enable de novo domestication, where novel or underutilized species are transformed into viable crops through targeted trait selection supported by integrated genomics and phenomics.

Investigating crop evolution, including genomic and phenotypic changes associated with domestication and diversification, represents a central research focus of this subject area. This aims to elucidate the emergence of key traits and their potential introduction or reintroduction to modern agricultural and horticultural systems. Research in this

area contributes to long-term agricultural resilience, sustainability and food security by unlocking the potential of plant genetic resources.

Key focus areas

- Genetic diversity: Exploration and analysis of allelic and transcriptional variation inter and intra-population levels across a wide range of plant materials to understand and preserve the breadth of plant genetic resources.
- Trait discovery and Heritability: Identification of valuable traits related to stress resilience, nutritional quality, environmental stability, adaptation, and estimation of their heritability using tools from quantitative and population genetics.
- Phenomics and Artificial Intelligence (AI): Development and usage of high-throughput phenotyping technologies and AI-based data analysis pipelines for efficient trait screening and characterization across diverse germplasm collections.
- Crop evolution and Domestication: Investigation of genetic and phenotypic changes associated with domestication, diversification, and re-domestication processes. This includes exploring the evolutionary history of crops as well as supporting the domestication of novel or underutilized species by identifying key traits and alleles that can contribute to future resilient and sustainable cropping systems.
- Genomic tools- & resources, and Predictive frameworks: Design and application of genomic resources including markers, reference genomes, and analytical pipelines alongside genomic prediction models and breeding simulations aimed at evaluating genetic potential within diverse populations. These tools primarily serve to describe and make accessible plant diversity as a strategic resource.

Plant Biotechnology and Functional Genomics

Växtbioteknik och funktionell genomics

Subject area responsible: Per Hofvander

The subject area aims to use various methods of plant biotechnology and functional genomics to contribute to a more efficient, sustainable and high-quality production of food, feed, and biomaterials in crops. We contribute to this development using methods of molecular biology, biochemistry, bioinformatics, AI, genetic editing/engineering, tissue culture, and metabolic engineering. Plant biotechnology has provided powerful tools that greatly assist plant-breeding programs worldwide in the development of robust new crops for cultivation in a changing climate.

Key focus areas In national and international collaborations, we leverage collective competencies in pursuing high quality project outcomes. We primarily conduct research in the following sub-areas:

- Development of reproductive and storage organs and the roles of transcription factors and balances of other genetic factors for the induction of organ differentiation and sink development including understanding of environmental effects to improve yield and robustness of crops.

- Lipid biosynthesis and signalling research on the two neutral lipid storage compounds, triacylglycerol and wax esters. The aim is to understand the complex regulation and interplay of the biosynthesis and to use this knowledge to create improved oil crops with new qualities for various applications.
- Carbohydrate biosynthesis and signalling research with a focus on starch including signalling for induction of starch biosynthesis and factors of importance for starch granule initiation. Findings from basic research are leveraged to applications for increased yield and quality.
- Storage protein biology research on storage protein composition and genetic factors contributing to storage protein content leading to applications for the improvement of quantitative and qualitative parameters in crops.
- Plant inflorescence/flowering research on meristem transitions from vegetative growth to the induction of inflorescence and flowering is crucial for plant architecture and earliness impacting adaptation and yield of crops in diverse environments.
- Functional genomics of bioactive compounds employing a wide range of methods/tools to map out gene networks related to bioactive compounds. We identify genes crucial for desired and undesired compounds in a range of crops.
- Plant cell totipotency and tissue culture research allowing propagation and regeneration from tissue or cell samples of diverse crop species. Findings are applied for somatic embryogenesis, organogenesis and introducing genetic modifications in plant breeding and crop improvement.
- Plant gene editing/genetic modification methodology research for extending the gene editing toolbox is a central theme where we are developing methodology to improve efficiency and designing exact outcomes of introduced genetic variation.

Teaching

We are responsible for teaching plant biotechnology, plant biochemistry, plant physiology and related areas including regulatory and legal aspects at Bachelor, Master and PhD levels. We actively support capacity building as main and co-supervisors of master and PhD students, furthermore in the supervision of postdoctoral positions.

Societal interaction

Many industry and other societal stakeholders have an active involvement in our projects. In addition, we have an extensive engagement in the public debate and media on the future development of agriculture in a sustainable direction. A third area of activity is that we are often called as experts or giving opinion to referrals and policies on the legislation and use of plant biotechnology.

Plants and the Environment

Växten och miljön

Subject area responsible: Larisa Gustavsson

This subject area investigates the genetic, physiological, and molecular mechanisms that enable plants to respond and adapt to biotic and abiotic environmental challenges. The overarching goal is to enhance crop resilience and secure sustainable food production under the growing pressures of climate change. We focus on both short-term responses and long-term adaptations across annual and perennial crops, including cereal and horticultural species, using interdisciplinary approaches that bridge plant physiology, breeding, molecular biology, and agroecology.

Key focus areas

- **Genotype × Environment (G × E) Interactions** A core research focus is on understanding G × E interactions, which determine how the same genotype performs differently across variable environments. By using advanced genotype-to-phenotype modelling, we identify traits that promote stability, yield, and stress tolerance under fluctuating and extreme conditions. This is vital for developing cultivars suited to Nordic and global agroecological zones.
- **Traits and Mechanisms of Adaptation** We investigate key traits such as disease resistance, drought and heat tolerance, flooding resilience, and frost tolerance during critical growth stages. This also includes responses to historical, ongoing and future selection scenarios. Our research applies omics, high-throughput phenotyping, and molecular tools to uncover the genetic, physiological, and epigenetic mechanisms underpinning these traits. This includes exploration of stress-induced plasticity and long-term memory in perennial and annual plants.
- **Molecular Regulation and RNA Biology** Central to this subject is RNA biology and the regulation of plant traits via transcriptional, post-transcriptional, and epigenetic control. We study regulatory RNAs, signaling proteins, and environmental cues that modulate gene expression. Special emphasis is placed on cross-kingdom RNA and protein communication between plants and microbes or pathogens, which plays a crucial role in development, immunity, and resilience.
- **Innovative Tools and Green Technologies** The subject area leads research on sustainable, non-GMO molecular technologies such as Spray-Induced Gene Silencing (SIGS). SIGS enables targeted and reversible trait control, allowing precise regulation of plant defense, productivity, and environmental responses. Together with nanoformulations and emerging delivery technologies, SIGS offers new avenues for environmentally safe crop protection and trait enhancement.

- **Microbiome Interactions and Agrobiologicals** Microbial communities are key environmental components that shape plant phenotype. We explore how beneficial microbes and microbiomes influence plant regulatory networks, support nutrient acquisition, and enhance stress resilience. This knowledge feeds into microbiome-assisted breeding and the development of agrobiological products like biostimulants, biocontrol agents, and RNA/protein-based treatments.

Teaching and Strategic Importance

This subject area trains future experts in sustainable agriculture and resilience, supporting SLU's mission to advance the green transition and climate adaptation. Sub-topics include adaptation traits (biotic/abiotic stress) and their response to selection; genetic, physiological, and molecular mechanisms of resilience; G × E-based genotype-to-phenotype modelling; RNA biology and epigenetics; cross-kingdom molecular signaling; SIGS and RNA/protein-based biocontrol; plant-microbiome interactions; agrobiologicals; AI and nanotechnology for crop improvement.



Fotograf: Jenny Svennås Gillner

Department of Plant Protection Biology

Institutionen för växtskyddsbiologi

Head of department: Kristina Karlsson Green

We are an interdisciplinary constellation aiming to enhance our understanding, sustainable use and management of our biological resources.

Subject areas

Integrated Plant Protection

Integrerat växtskydd

Subject area responsible: Johan Stenberg

The raison d'être of this subject area is to explore fundamental factors from an ecological and evolutionary perspective, from genes to ecosystems, that determine the degree to which plants experience illness, e.g., resulting from disease, pest damage, abiotic stress and lack of pollination, under current and future climate conditions, and to manipulate these factors in cropping systems to obtain high cropping security while minimizing the need for chemical input.

Integrated Plant Protection tackles these factors from a conceptual and holistic system perspective by integrating all relevant IPM elements and all biological levels of organization. Ecological and molecular plant-microbe interactions (Eco-MPMI)

At the molecular, ecological and mechanistic level, we study both microbe-microbe and plant-microbe interactions, at either the plant microbiome level or in the context of individual disease interactions, where we study individual genes and proteins that are important for the establishment of plant disease or biocontrol.

The goal is to understand and develop healthy plants in the context of the plant as a holobiont, connecting the plant pathobiome, and the plant symbiome with plant traits and within an environmental context.

Our focus is on the role of the microbes themselves and on connecting fundamental knowledge to biocontrol strategies for plant health. By taking a holistic approach combining ecological approaches with MPMI the IPP group are pioneers of new knowledge in this area.

Ecology and evolution of plant-biotic interactions Plants experience simultaneous biotic interactions with pestilent and beneficial organisms. Understanding the ecology and evolution of these complex interactions makes it possible to determine which traits that maximize plant fitness under current and future climate scenarios. Such understanding also makes it possible to identify trait weaknesses in current crop cultivars and to obtain improved traits from crop wild relatives. The IPP group is world leading in this area.

Pre-breeding for biocontrol and IPM Plant breeders have traditionally focused on improving resistance traits to reduce plant illness. The IPP group has pioneered – and is world-leading – in developing the science for breeding other traits that contribute to plant health. Pre-breeding for plant traits that facilitates biocontrol is one such area that we believe is very important to equip plants to combat pests and pathogens in the absence of chemical pesticides.

Evolution of tolerance to pesticides and abiotic stress

1. Pests and pathogens frequently evolve tolerance to plant protection products (PPP), including both chemical pesticides and biocontrol products. Durable use of PPPs requires filling fundamental knowledge gaps regarding how these products inflict selection on the pathogens and how the pathogens, in turn, adapt. The selection pressure may be relaxed by certain IPM measures and establishment of evolutionary refuges. The IPP group leads important work to fill these knowledge gaps and thus contribute to sustainable use of PPPs.

2. Cultivated plants experience heat and drought stress resulting from climate change. The IPP group is involved in important work elucidating how crops can be designed for increased tolerance to abiotic stress.

Epidemiology Pest and pathogen outbreaks can be local or develop into pandemics. The IPP group develops conceptual knowledge on the factors that lead to outbreaks locally and globally. Development of fundamental concepts requires a broad scientific interest and is important for the holistic understanding that the IPP group aims to achieve.

Resistance Biology

Resistensbiologi

Subject area responsible: Erik Andreasson

The objective of the Resistance Biology Unit is to meet the need for reduced use of chemical fungicides and reduce the effects of climate change on crop production by combining basic and applied research. The aim is to increase plant health. This will be achieved by creating foundations for the reduction of plant diseases, and for an increase in abiotic stress resilience, mainly in potato and cereals.

Hypotheses are tested in model plants, such as *Arabidopsis thaliana* and *Nicotiana benthamiana*, by changing candidate genes via genome editing or transformation, as well as through classical biochemistry and cell- and molecular biology.

Field trials, often with crops engineered by genome editing or cisgenesis, are used to validate gene functions and agricultural potential. We strive to integrate data from controlled and field conditions.

Our competencies can be divided into the following sub-categories:

Resistance and susceptibility mechanisms – To improve crop plant resistance, there is a great need for increased understanding of novel mechanisms behind plant susceptibility and resistance (immunity). The resistance and susceptibility mechanisms are investigated by identifying and characterising new genes and proteins that are part of the interaction between the pathogen and the host and non-host plants. In addition, we study the balance between plant defence and growth. A focus area is potato blights caused by *Phytophthora infestans* and *Alternaria solani*, but we are also working on interactions with other pathogens.

Abiotic stress – We work on different abiotic stress factors, such as drought, heat and flooding, in individual and combined stress conditions (abiotic–abiotic or abiotic–biotic) to identify traits and improve crops for better survival and productivity in future climates. We focus on pre-breeding and understanding the mechanisms of tolerance/resistance by analysing stress physiology, as well as by high-throughput phenotyping, advanced omics analyses, and comparative genomic approaches. The identified tolerant or resistant genotypes for selected traits and candidate genes and pathways can be utilized in breeding programs and targeted crop improvement through gene editing. We also study the environmental effects on seed germination and vigour.

Plant resistance inducers and biologicals –To achieve effective crop production strategies, different methods most often need to be integrated. For example, we conduct applied experiments with induced resistance and biologicals in the greenhouse and field. We are also interested in combining host plant resistance with minimal use of fungicides and novel plant protection products with low toxicity and biologicals.

In summary, we have long experience in generating and processing omics datasets. For example, we host the SLU infrastructure Proteomics Facility in Alnarp. We also have strong competence in different microscopy methods and coordinate the Alnarp confocal microscopy and Horticum Alliance light microscopes. We have performed field trials, with potato cultivars and genetically modified potato, for many years.

Chemical Ecology

Kemisk ekologi

Subject area responsible: Rickard Ignell

The field of chemical ecology concerns the ecology, ethology and evolution of chemical communication. Our research is focused on basic biological questions, combining our competences in chemical ecology, neuroethology and chemistry. We identify the chemical signals used between animals, plants and microorganisms, and describe the physiological and behavioural mechanisms of chemical communication.

Our goal is to strategically plan and promote basic research in accordance with societal needs, nationally and internationally. We apply this know-how and develop insect control techniques for agriculture, horticulture, forestry and urban environments, as well as veterinary and medical well-being, with the overall aim to develop more efficient, innovative tools and to reduce pesticide use.

Our main research topics are:

Insect plant interactions: We study the ecological and evolutionary interactions between plants and herbivorous insects, such as herbivores and pollinators, where chemical signals are important. The interactions are also studied in a multitrophic context, where the influence of other organisms (pathogens, symbionts and natural enemies) associated with plants and insects are investigated. Studies are conducted in collaboration with low-income countries with the aim to increase the knowledge of pests and invasive species, and to solve specific problems in these countries, for example to develop new and further develop existing control methods based in IPM.

Microbial interactions: Microbes connect chemical communication across kingdoms. We study the role of microorganisms in modulating ecological interactions through the production and transformation of chemical signals. Our research aims to identify microbially derived metabolites, that influence insect behaviour, plant health and pest dynamics. This knowledge forms the basis for the development of microbe-based biocontrol and communication disruption for use in IPM.

Pest management: In a changing climate, crop production is increasingly challenged by pest species, both native and exotic, threatening rural livelihoods and food security worldwide. To mitigate these effects, we research novel strategies that utilize insect sensory systems to reduce pest populations in a targeted and sustainable manner. An extensive research focus is on the identification of attractants from sensory physiological studies for use in the selective removal of pests from agroecosystems. Moreover, research is conducted to gain novel knowledge concerning pesticide resistance.

Biological control and ecological intensification: We study chemically-mediated interactions between pests, beneficial insects and microbes, with the goal of enhancing biological control strategies. We explore how habitat design, such as the use of flower strips, can influence the effectiveness of natural enemies and suppress pest populations. This includes studies on how behavioural cues and competitive interactions among organisms can be manipulated. For example, diverting antagonists or modulating multitrophic interactions to strengthen natural pest regulation. Application horizons include the suppression of plant pathogens, control of plant pests by entomopathogens, and enhancing impacts of natural enemies through ecological intensification.

Human and animal disease vectors: We study the chemical ecology, ethology and evolution of the chemosensory systems of disease vector insects and how these are affected by climate change. We plan and promote basic research on the chemical ecology of disease vectors in accordance with societal needs, nationally and internationally, and apply this know-how to develop novel surveillance and control tools to be used within the integrated vector management framework.

Our multidisciplinary approach, to study how odour- and taste-mediated behaviours of disease vectors are modulated by external chemosensory cues, internal physiological states and basic genetics, is directed towards the identification of targets for reducing host-vector interactions.



Fotograf: Jenny Svemmas Gillner

ISBN: (tryckt version) 978-91-8124-173-0

ISBN: (elektronisk version) 978-91-8124-174-7

Utgivare: SLU, LTV-fakulteten

Ansvarig: Dekan Christina Lunner Kolstrup

Produktion: Kommunikationsavdelningen och Grafisk service vid SLU.

Tryckdatum: 2026