



FUTURE
ONE HEALTH



One Health - the interaction between animal health, human health and ecosystem health

SLU's wide range of competence within the field of One Health

Photo front cover: Cow nr 736 with her calf at SLU Swedish Livestock Research Centre. In the background professor Sigrid Agenäs.
Photo by Jenny Svénnås-Gillner.

Right spread: Grazing sheep in Winchelsea Beach, East Sussex, England. Photo by Julio Gonzales.



SLU Future One Health - a research platform to stimulate new knowledge and solutions for good health and welfare for animals and people in sustainable ecosystems.

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One Health - the interaction between animal health, human health and ecosystem health

The global movement of humans and animals increases the risk of spreading infectious diseases. Indoor and outdoor environmental contaminants may have negative effects on livestock, wildlife, pets and humans.

Sustainable use of natural resources, and how climate change affects the production of food for humans and feed for animals are important issues for our survival. Protecting antibiotics and limiting antimicrobial resistance is central to human and animal health and well-being.

The One Health approach is important for solving the complex challenges. In One Health, researchers from different fields collaborate and contribute knowledge from their respective disciplines.

Within this area issues related to health are studied at the interface between

animals, humans and ecosystems using an interdisciplinary approach.

One Health is an important research field, both nationally and globally, where the Swedish University of Agricultural Sciences (SLU) has a large potential to contribute with new knowledge. Research within One Health is to a large extent based on collaboration between key disciplines in SLU, such as veterinary medicine, agronomy, economics, biology, ecology and social science.

This folder presents a selection of SLU's wide range of activities within the field of One Health. Research in this field is conducted in all of SLU's faculties: Landscape Architecture, Garden and Plant Production Science, Natural Resources and Agricultural Sciences, Forest Science, Veterinary Medicine and Animal Science.



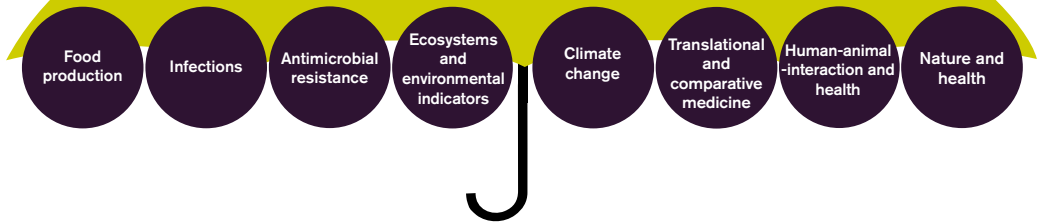
One Health is a term that is used frequently in a number of different fields. In this context, One Health describes the interaction between animal health, human health and ecosystem health.

ILLUSTRATION: FREDRIK SAARKOPPEL



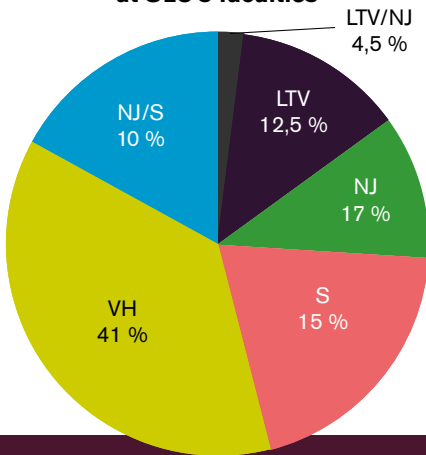
Production loss poses a threat to global food supplies particularly in those parts of the world where there is a lack of high-quality animal protein.

SLU's One Health umbrella



Below, the distribution of researchers working within One Health at SLU's four faculties is shown. We have more than 150 researchers in 20 departments working in One Health-

One Health researchers at SLU's faculties



The pie chart shows the distribution of One Health researchers at SLU's faculties Veterinary Medicine and Animal Science (VH), Natural Resources and Agricultural Sciences (NJ), Forestry Science (S) and Landscape Architecture, Garden and Plant Production Science (LTV).

(This compilation of data was conducted on behalf of SLU Future One Health)

related projects, and the research platform SLU Future One Health supports research collaboration within the field. SLU's One Health research can be divided into eight different areas that are presented here.

Food Production and One Health

SLU conducts One Health research on food production. Safe food is an important aspect of this area where SLU can contribute with, among other things, knowledge on spread of food-borne infectious agents. Modern food production is a complex process and it is essential that sustainable and climate-friendly cultivation and production systems are developed.

The objective is to produce safe food for humans and safe feed for animals while ensuring that the production of milk and meat is based on sustainable use of resources. Good animal health is a prerequisite for long-term sustainable animal husbandry. Healthy animals yield higher profits and do not need medicines such as antibiotics. Environmentally friendly alternatives for combatting microbial plant diseases, instead of pesticides, will be important for a sustainable food production in the future.

Infections and One Health

SLU can contribute with valuable knowledge on how infectious diseases affect animals and humans. Some infectious agents are also zoonoses, diseases that can be transmitted between animals and humans. Outbreaks of infectious diseases cause suffering of animals and can also lead to major economic losses because



PHOTO: JULIO GONZALEZ

Zoonoses are diseases that can be transmitted between animals and humans.

of reduced production.

Production losses represent a threat to global food supplies, particularly in those parts of the world where there is a lack of high-quality protein, and animal-derived food products are needed for an adequate nutritional supply.

Antimicrobial Resistance and One Health

One of the biggest threats in the future is the loss of effectiveness of medicines against infectious diseases. SLU plays an important role in the development of sustainable systems for good animal health and profitable animal production with a restrictive use of antimicrobial drugs. Antibiotic resistance is a threat to both animal and human health because bacterial infections are becoming increasingly difficult to treat. Some of the projects conducted by researchers at SLU aim to find new future antibiotics in fungal and bacterial cultures, and antibacterial fabrics and coatings are developed to promote healing of wounds. Just like bacteria, parasites have developed resistance to



Sofia Boqvist

Docent at the Department of Biomedical sciences and Veterinary Public Health. Conducts research on One Health with a focus on veterinary public health.

Addressing the problem of food-borne diseases is extremely important from a global perspective. In order to reduce the impact of such diseases, our work must be based on a One Health perspective. Previously, the significance of infectious agents that are spread via food (primarily in low-income countries) was underestimated. But in recent years, this problem has been highlighted by, among others, WHO. Such infections cause a lot of human suffering and also major financial losses for both individuals and society.

Another important field is how we can prevent the spread and occurrence of antibiotic resistance. This is a crucial issue in order for us to be able to treat bacterial diseases in humans and animals in the future.

As a university, SLU is unique since it covers all the fields included in the concept of One Health. This means that SLU has an obvious role in the future development of One Health.

medicines, which is a growing problem for global animal health.

Research at SLU aims to understand how parasites develop drug resistance, and to find biomarkers for resistance that can be applied in future sustainable control programs for monitoring of resistance. In addition, SLU is conducting a number of research and development projects to produce vaccines to prevent and counteract different infectious diseases.

Ecosystems, environmental indicators and One Health

It is important to find safe alternative sources of protein, for example insects, in order to secure the production of food and animal feed in the future. It is also important to find ways of developing sustainable biological cycles, such as the biodegradation of waste, to reduce levels of pathogenic microorganisms and pharmaceutical residues. We need to take a holistic approach to the sustainable use of natural resources, humans as consumers and



PHOTO: PIXABAY

SLU is contributing to the development of future sustainable animal husbandry systems.



Stefan Bertilsson

Professor of Functional Ecology in Limnetic Systems at the Department of Water and Environment.

I investigate the spread of water-borne infectious agents and how it is controlled by environmental factors, biological interactions and processes. How should water supplies be planned in order to reduce vulnerability? Securing the supply of water now and for future generations is one of society's greatest challenges and in order to succeed, we need to take a holistic approach that integrates knowledge from environmental research, veterinary medicine and infection biology.

Through its research profile and role in this sector,

SLU is a key player in water research and this enables us to lead efforts to secure society's future water supplies. In combination with advanced sector-based veterinary and animal science and close collaboration with leading research environments in infection biology, this enables us to really make a difference!



PHOTO: MICHAEL KVICK

Cats can be used as an environmental indicator of exposure to chemicals in indoor dust and occurrence of endocrine-disrupting effects on the thyroid. Exposure to chemicals can be analysed with the help of a blood sample.

entrepreneurs, and sustainable food consumption. Knowledge on how to increase the use of plant nutrients and reduce leakage in cultivation systems as well as animal husbandry is also needed. We need strategies to preserve and restore biological diversity in areas that are dominated by human activity. To a large extent, pets share the same indoor environment as humans which means they can be used as indicators to study the effects of environmental chemicals. For example, cats have been used as an environmental indicator for exposure to chemicals in indoor dust and for the occurrence of endocrine-disrupting effects on the thyroid.

Climate Change and One Health

Climate change has a significant impact on human and animal health and constitutes an acute global health problem. At SLU, researchers are working on various projects to



Rickard Ignell

Professor at the Department of Plant Protection Biology who conducts research on chemical ecology and disease vectors.

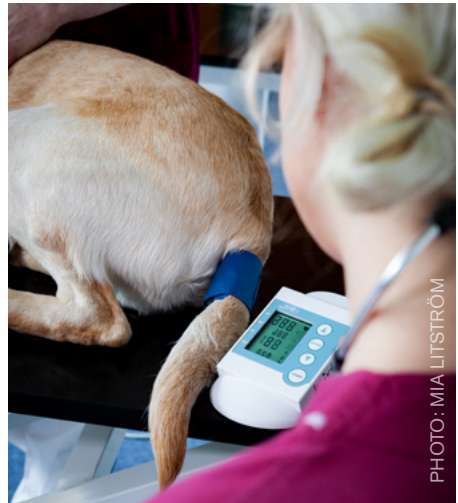
Since 2015, the measures that were implemented at the turn of the century to combat malaria have been losing their effectiveness in a number of vulnerable countries in sub-Saharan Africa. A major contributing factor is an increased physiological and behavioural resistance in the mosquitoes that spread the disease. To solve this problem, an interdisciplinary analysis of the factors that drive the spread of the disease is needed. We are working on identifying the factors that control the heterogeneous spread of mosquitoes and malaria from a local landscape perspective. In addition, we are developing new methods that can be used to tackle species of malaria mosquitoes that currently cannot be combatted using conventional measures.

By allocating senior career support and with support from the Max Planck Centre, next Generation Insect Chemical Ecology (nGICE), SLU has demonstrated a keen interest in the questions linked to this subject area. The platform SLU Future One Health creates opportunities to increase interdisciplinary interaction which in turn opens up for new ways of solving the problem of vector-borne diseases.

find sustainable solutions to reduce emissions of ammonia and greenhouse gases from livestock buildings. This includes projects investigating whether emissions of methane from dairy cows can be reduced by substituting some of the concentrate feed with oats. Climate change and warmer water may drastically change the size, structure and dynamics of fish populations, possibly increasing the number of fish in some populations but reducing the numbers in others. This could be crucial for understanding the limits for how much fishing a certain population can withstand.

Translational and Comparative Medicine and One Health

Translational research and comparative medicine is when a problem that has been identified clinically, for example diabetes, is used as the basis for preclinical research and development within veterinary medicine, in order to better understand and treat or prevent disease in both humans and animals.



A veterinarian from the University Animal Hospital (UDS) checks a dog's blood pressure. Together with UDS, SLU is conducting research on animal health for the sake of the animals themselves, and to detect diseases that afflict both humans and animals.



Eva Skiöldebrand

Professor of Pathology at the Department of Biomedical Sciences and Veterinary Public Health.

Osteoarthritis is a common disease in the horse and they develop lameness and pain at an early age. Approximately 10 % of the world's human population aged over 60 suffer from joint pain associated with osteoarthritis, which is serious since the illness can lead to an increased risk of cardiovascular disease, diabetes and dementia. One of the biggest problems is that the disease is not detected until the patient begins to feel pain, which is late in the disease process, when the articular cartilage damage is severe and cannot be repaired.

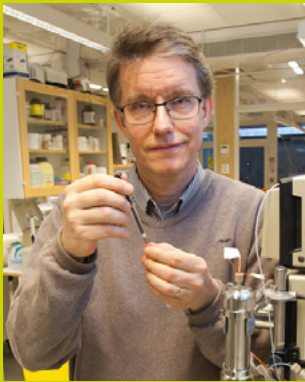
The US Food and Drug Administration has recently approved the horse as an experimental animal for studying osteoarthritis in humans. We are able to study the early pathological changes in cartilage cells from the horse and can identify early mechanisms of osteoarthritis and study pharmacological substances that inhibit the development of the disease in both horses and people. We work in an interdisciplinary project based on close collaboration between four higher education institutions, with great potential for solving the question on how arthritis can be diagnosed and cured in horses and people.



Antibiotic substances in microorganisms could be the antibiotics of the future.

A number of researchers at SLU use animals as a model for humans in order to understand diseases such as cardiovascular disease, obesity, osteoarthritis, diabetes and cancer. Pets such as dogs or cats are good models since they live in the same environment as their owners and are exposed to the same lifestyle.

SLU is also conducting research that aims to develop surgical self-locking devices (which prevent bleeding in surgical procedures) made of resorbable material which decomposes over time. The interaction between microbiota and gastrointestinal health is another subject in translational medicine. The aim is to identify useful microbes and microbe-encoded functions in the bowel in order to improve the intestinal health of animals and humans.



Anders Broberg

Professor of Natural Products Chemistry at the Department of Molecular Sciences. Conducts research on secondary metabolism and is searching for future antibiotic substances in fungi and bacteria.

We are striving to detect new antimicrobial substances in microorganisms, that could be developed into new antibiotics. The development of these substances into new drugs requires an interest from the pharmaceutical industry but because it is hard to make a profit from developing new antibiotics, there is currently little interest. It has been suggested that rewards should be given to companies that develop new antibiotics which could perhaps rekindle the

pharmaceutical industry's interest in this field.

It is essential to find a solution to this problem in order to be able to develop new antibiotics for the future. This research requires access to pathogenic bacteria or testing systems that enable researchers to study bacterial strains that are difficult or dangerous to handle.

SLU could play an important role in contacts with other authorities, for example, the Public Health Authority or national reference laboratories which currently offer testing of effects against prioritised bacteria on a commercial basis. Another important role for SLU is to continue to support the purchase and maintenance of the expensive instruments that are needed for studying and characterising substances in different biological contexts.



Henrik Rönnberg

Professor of Small Animal Internal Medicine in the Department of Clinical Sciences. Conducts research on comparative medicine specialising in oncology.

In my research, I study spontaneously occurring cancer in pets in order to learn more about the development, prevention, diagnosis and new forms of treatment of cancer in pets and humans. Cancer is a widespread disease and the illness with possibly the highest rate of mortality in both pets and humans. As the average lifespan of humans increases, unfortunately cancer also increases. The illness itself and the different forms of treatment have a huge impact on quality of life and function. Therefore, it would be

highly beneficial if the clinical knowledge we gain when dogs and cats are subjected to cancer treatment could also improve life for humans.

SLU holds a key position as the only university in Sweden with both veterinary science education and opportunities for advanced clinical research. The unique concentration of interdisciplinary expertise in clinical practice, molecular biology, protein chemistry and animal welfare makes us an outstanding collaboration partner with both universities that conduct research on humans and with the medical industry.

Pets like dogs and cats are used to understand illnesses like obesity, diabetes and cancer. Because our pets live in the same environment as we do, they have similar lifestyles and are therefore good models.





Knut-Håkan Jeppsson

Researcher at the Department of Biosystems and Technology. Conducts research on animal husbandry systems with a focus on ventilation, thermal environment, air environment and emissions of ammonia and greenhouse gases.

We are developing housing systems with good thermal environment and air quality for both animals and humans, and with low levels of emissions of ammonia and greenhouse gases. Thermal environment and air quality affect animal health and work environment. Floors and resting areas are also of great importance for animal health and welfare. That is why we are designing floors and resting areas and new

technical systems that can limit emissions of ammonia and greenhouse gases.

Another important matter is the impact of climate change on animal husbandry systems with regard to animal environment and animal welfare.

SLU will contribute to the development of future animal husbandry systems and is an important actor when it comes to the analysis of animal husbandry systems from a sustainability perspective.

The importance of animals for humans and One Health

Interaction between humans and animals can be positive for the welfare and wellbeing of both parties. International research has shown that both pets and livestock have a positive effect on health and can contribute to reducing human healthcare costs. Pets and livestock contribute to both leisure activities and animal-supported healthcare measures. At SLU, research is performed in the field of anthrozoology, which concerns the interaction between humans and animals. Among other things, animal-assisted interventions that can reduce stress and contribute to increased well-being for elderly in retirement homes are studied, as well as how horse-assisted activities can affect everyday life, quality of life and health in the neurologically ill.

SLU researchers also study how the relationship between pet owners and their pets, such as cats, dogs and horses, affects the well-being of both humans and animals, and which values of cats and dogs owners think

are most important, and how these values relate to human health. An important aspect is, for example, the animals' positive impact on the physical health of humans, through exercise and outdoor activities. Animal welfare is important in One Health and SLU researchers participate in developing international guidelines to ensure animal welfare and increase human safety in human-animal interactions.



Social therapy dogs can help people facing different kinds of difficulties in life feel better. However, the dogs' welfare must also be taken into consideration.



Ann Dolling

Senior Lecturer at the Department of Forest Ecology and Management. Ann's research focuses on forest environment and human health.

My research includes interdisciplinary studies on how human health is affected by a forest environment and on how knowledge related to this can be used in, for example, nature-based health interventions and forest management policies, during lifestyle changes and when deciding on forest management methods.

It is important that the public and healthcare professionals understand and trust the scientific evidence that exists within this area and what potential nature has to improve human health. By using nature for preventive

measures we could reduce the number of people that fall ill in lifestyle and stress-related diseases. Society must improve health promotion in urban planning and provide easy access to nature. Here SLU can contribute with significant competence.

With our broad competence in nature related issues, SLU should take the lead in collaborations with universities that are strong in human medicine, to build a prosperous interdisciplinary research environment.

Nature experiences and One Health

Contact with nature promotes both physical and mental health, by offering physical exercise, relaxation, and reduced stress. Research at SLU includes interaction between different natural environments and human health. For example the impact of “just being” in nature, without the need for activity, is studied in relation to recovery from exhaustion syndrome, depression and traumatic experiences. Our researchers also study how nature and gardening can be used as a tool for rehabilitation and work training.

The urban outdoor environment, its form, function, and significance for health, quality of life and well-being, is investigated from different perspectives. Among other things, the effect of peri-urban forests on people’s opportunities for everyday exercise is studied. SLU also runs a center, together with the Swedish Environmental Protection Agency, with the objective of developing opportunities for positive nature experiences and to help people find their way out into nature.



PHOTO: PEXELS

Collaboration between researchers, private actors, nature conservationists and healthcare professionals is important to identify future perspectives and find solutions in order to promote human health and well-being.



PHOTO: MARTEN SVENSSON

Nature-based interventions is a term used in this research field where the focus is on outdoor environments. Nature is the main factor for the intervention and includes natural environments such as forest, farm, garden, mountains, lake and beaches.



PHOTO: JENNY SVENNÄS-GILLNER

One of the biggest threats in the future is a lack of drugs to combat infectious diseases. Researchers at SLU are working on projects to find new antibiotics.



Johanna Lindahl

Docent at the Department of Clinical Sciences Conducts research on infectious diseases, One Health, food safety and antibiotic resistance.

The aim of our research is to understand how we can stop the spread of infections and antibiotic resistance from animals to humans in future animal production. This is particularly important for securing future food supplies.

SLU plays a major role in the development of sustain-able animal production that does not increase the risks for public health. To address the risk of infections spilling over from animals to people, collaboration with a number of disciplines

is required, including human medicine.

SLU's wide range of disciplines is an advantage for this type of research. We also collaborate with many other universities and research institutes, both in Sweden and abroad.

SLU's One Health Research and Agenda 2030



SLU's One Health research can be directly linked to the global sustainability objectives shown above.

Agenda 2030 with 17 objectives for sustainable development has been adopted by 193 countries around the world in order to bring about socially, environmentally and financially sustainable development in the world by 2030.

SLU's One Health research contributes towards at least seven of the Agenda 2030 global sustainability goals: No hunger, Good health and well-being, Clean water and sanitation for everyone, Sustainable consumption and production, Combat climate change, Sea and marine resources, Ecosystems and biological diversity.

SLU is a world-class international university. We take on fundamental issues that affect all of us and our knowledge creates conditions for a sustainable, thriving and better world.

SLU has important knowledge on biological natural resources, veterinary medicine and animal science and can thereby able contribute important research in the field of One Health. The goal is to limit the spread of diseases and antimicrobial resistance, contribute expertise on food safety, and use natural resources in a sustainable way.



Frauke Ecke

Docent who conducts research on rodent and disease ecology at the Department of Wildlife, Fish and Environment.

I investigate which factors drive the transmission of pathogens from wildlife to humans. This knowledge is crucial in order to predict and prevent the spread of infectious diseases. Driving factors include environmental conditions, biological interaction, animal and human behavior, and (immuno-) genetic properties of pathogens, host animals and humans.

SLU has extensive experience in monitoring and conducting research on several key wildlife populations and their zoonoses. This creates excellent conditions for increasing our knowledge on how climate and landscape change affects the transmission and outbreaks of zoonoses.

