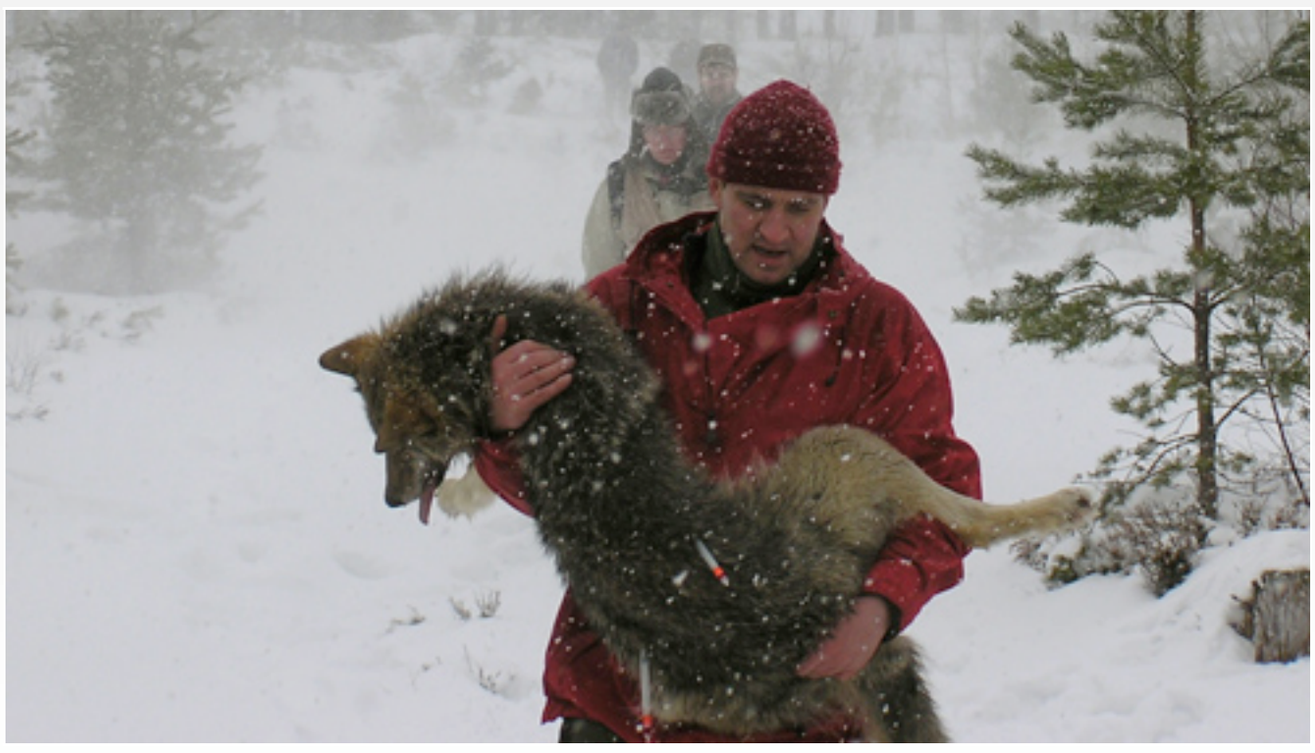
Apple Xgrid runs with the wolves

Profiles in Success: Swedish University of Agricultural Sciences



Using Apple technology, the Grimsö Wildlife Research Station in Sweden is learning important techniques for sustainable management of the wolf population. Based at the Swedish University of Agricultural Sciences (SLU), the station is using an Apple Xgrid cluster system – provided by the Apple Research & Technology Support programme (ARTS) – to understand wolf demography and develop optimal management strategies. Its work will have a deep impact on how mankind interacts with these ancient but troublesome predators.

"Wolf populations are expanding through natural return to past habitats in Europe, or through reintroduction by Government agencies in the US", explains Dr Guillaume Chapron, Assistant Professor, Grimsö Wildlife Research Station at SLU. "They are posing problems, however – to hunters or sheep farmers, for example. So the urgent question is how we ensure wolf populations can survive, while still allowing for some population control. Wolves have a complex ecology and the Xgrid cluster will run simulations faster than any other solution. It is critical to our research".

SLU is a modern university, designed to confront and explore many of today's most compelling environmental questions, "whether it is the food we eat, or the animals we husband on our farms or love as pets, or the forests that we wander through".

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The university delivers undergraduate, master and doctoral courses in subjects ranging from agricultural economics to farm building to urban landscaping. It has more than 4,000 students who work at a network of campuses and research stations across Sweden. SLU is fast developing an international reputation for teaching and research, reflecting the fact that many of its areas of study have global causes and solutions.

Grimsö Wildlife Research Station is part of SLU, and is the focus for research into wildlife such as terrestrial carnivores in Scandinavia, including the lynx, wolverine and wolf. Research into the wolf population is particularly important in Sweden. The wolf population was close to extinction when the species became protected by law in 1966, but it is now growing by 10% per year. That recovery creates cohabitation problems with people, however, particularly hunters of roe deer and moose. Without a clear understanding of the population dynamics, increased poaching could push the already inbred Scandinavian wolf population towards extinction.

Dr Chapron has brought a new dimension to ecological research at Grimsö: simulation modelling of wildlife populations and their management. "We can build a population model to see how wolf numbers would be affected by selective removal in response to people's concerns, for example, and provide a portfolio of sustainable management strategies to decision makers", he explains. "Computer modelling is particularly valuable in studying the wolf demography which is strongly shaped by social interactions at the pack level".

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Cost-effective for future research

Challenges

- Develop management strategies to ensure wolf population viability
- Prevent wolf extinction while allowing for population control
- Address people and decision maker concerns regarding the place of wolves in Sweden
- Provide efficient programming and modelling environment to simulate and understand wolf population ecology
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- Ensure computing solution can be shared easily and efficiently by other researchers

Solution

- Mac OS X Leopard Server
- XCode with native Objective C support
- Apple Remote Desktop
- Mac Pro, Mac Book Pro
- Xgrid

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When they were considering the best technology platform, Dr Chapron and the team favoured an object oriented programming approach, because of the complex modelling requirements. In their simulation models, every wolf is described as an 'object' and characterised by its biological 'patterns' (sex, social status, pack, age, etc.). Packs are also considered as objects with their own patterns. Because the model considers pack dynamics from individual rules, the demographic consequences of sociality are emerging properties of the model, and are not predefined by equations as in more traditional population models. But to run such models, they also needed distributed computing to speed up simulations.

When the team heard that SLU Department of Ecology was inviting proposals for Apple equipment to be supported through the ARTS programme, they saw an opportunity to use Apple Xgrid technology and to exploit computer power in a cluster. The proposal to the University's assessment committee was to build a cluster with five Mac Pro systems at the Grimsö research station, to deliver high speed computing support. The team also wanted laptops to control simulations while on the move.

The proposal was successful, enabling a fast start to the task of solving an increasingly urgent wildlife problem.

> "Apple's Xgrid technology for clustered computing is very easy to set up. It is so intuitive that one doesn't even really need to read the instructions to set up a cluster."
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"It's a solution designed for maximum efficiency and flexibility", Dr Chapron says. "Colleagues and students can work on the Mac Pro systems while they are being used remotely for computations, because Apple's Xgrid doesn't care whose office the system is in. The laptop means that if we are asked to simulate the effects of wolf management in France or another European country, we can connect to the Xgrid controller remotely and launch simulations on the Mac Pro cluster here – getting the results much more quickly from the cluster than using the laptop standalone".

"Apple provides all that is needed to develop a simulation model through its development environment XCode", he said. "Apple's Xgrid technology for clustered computing is also very easy to set up. It is so intuitive that one doesn't even really need to read the instructions to set up a cluster".

The most significant benefit for Dr Chapron's project is the speed with which computations can be executed using an Xgrid distributed system. "I can run simulations in minutes that it would take days to perform using a single laptop", he says. "This means that I can also consider running simulations that would not have been possible before. This is important in providing reliable recommendations for management".

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Benefits

- Apple development environment makes straightforward the use of Objective-C programming language, a perfect choice to model population dynamics of a social species such as the wolf.
- Xgrid distributed computing power reduces simulation time from days to minutes, allowing deeper investigations.
- Mac Pro cluster can be set up quickly and easily without specialist skills or support
- A remote laptop can access the cluster, and use the computing power
- Other research staff and students can easily use systems for their own work and research
- Apple technology is pleasant to use – important for researcher working mainly with computer simulations
- The project's findings can be used for other modelling work with terrestrial predators

Cost-effective for future research

Profiles in Success: Swedish University of Agricultural Sciences

He is pleased with his Apple solution for a number of other reasons. “First, setting up the cluster is very easy. Then, when it’s up and running, I don’t need to have to think about how it all works. I can just get on with my studies and use it as an efficient tool. It just works without any fuss. Everything I want to use is just so easy with the Mac – from sending an email, to viewing attachments, to developing a complex code. And should I need Windows only software, sometimes the software even runs faster on a Mac than on a normal PC”.

“Finally, it’s just pleasant to use. That also encourages others on the station to use the Apple technology, even if they haven’t used a Mac before“, he claims. “We collaborate as researchers, and students have to move between different projects, and moving from a PC to a Mac is easy”.

Like most research agencies, Grimsö needs to operate as cost-effectively as possible. Dr Chapron says that the cluster will make an important contribution to systems efficiency. “Hopefully, it will mean we can avoid investing in some new systems, and save money for research”.

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As an ARTS Laureate, Dr Chapron and the team will also qualify for discounts on Apple products, and be able to access Apple’s systems engineers on a dedicated network to gain expert advice on common and individual technology problems.

The true test of success will of course be in years to come, says Dr Chapron. ”If, in 10 years time, there is still a viable wolf population in Sweden, and people have accepted their presence because they know that wolves can be controlled, my research will have been a major success. It means Apple will have made a big contribution to biodiversity conservation”.

The project is scheduled for two years, and is also expected to contribute to research on wolverine and lynx populations. Meanwhile, the ARTS programme – which backs important research projects across Europe – is reviewing other potential research project Laureates at other science institutions.

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Advice

- Computer modelling is now used for a wide range of challenges in wildlife ecology where it’s been rarely considered in the past
- Computer clusters provide significant user flexibility and increased power
- The speed of modelling enables many different options to be tested
- Researchers using computers heavily need to feel comfortable with their tools – not frustrated