REWILDING AS TOOL AND TARGET IN THE MANAGEMENT FOR BIODIVERSITY

– A one day symposium for scientists, managers and stakeholders

Merete Barker Auditorium (building 1253), April 11 2012, 09:30-17:00

Programme and abstracts

AARHUS UNIVERSITY
DEPARTMENT OF BIOSCIENCE

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Programme and abstracts

Aarhus University **11 April 2012**

Editors:
Christopher Sandom, Jens-Christian Svenning and Rasmus Ejrnæs

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AARHUS UNIVERSITY
DEPARTMENT OF BIOSCIENCE

15. Juni Fonden

INTRODUCTION

Organizers
Rasmus Ejrnæs (rej@dmu.dk), Chris Sandom & Jens-Christian Svenning (svenning@biology.au.dk).

Acknowledgement
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Rewilding in practice Cook City Bordering Yellowstone.
Photo by Jens-Christian Svenning.

Rewilding is gaining traction across Europe. Heck cattle and konik horses are prospering, beaver and wild boar are expanding and European bison are being reintroduced. Private funds and fiery souls are taking the lead in rewilding while scientists and policy makers are struggling to keep up. There are plenty of unresolved questions ahead: Can we produce a solid faunistic baseline for North-western Europe? What was lost when the animals went and what will return if we bring them back? Is rewilding an attractive alternative to traditional conservation management? What are relevant criteria and targets for a new introduction? How will re-introduced animals interact with the other drivers and pressures in ecosystems? How do we handle the conflicts between humans and large animals? Here are the proceedings from a one-day symposium at Aarhus University where scientists, managers and stakeholders met to share the most recent knowledge and experiences as well as discussing rewilding and its role in present and future biodiversity conservation.

Can rewilding be used as a tool and target in the management of biodiversity? Numerous presentations highlighted that rewilding is already being put into practice in Europe, however it was also clear that rewilding as a tool and as a target still lacks clear definition. The original founding principles of large core areas, connectivity and keystone species were presented and while these are still relevant today, there was a distinct progression towards discussing rewilding in terms of 'restoring ecological processes and ecosystem function'. In this context the target of rewilding in biodiversity conservation emerged as the restoration of naturally functioning ecosystems with a reduced need for human management, while rewilding as a tool was discussed as the reintroduction of natural processes, typically through the reintroduction deployment, of large mammals. The restoration of processes perhaps most relates to keystone species needing large core areas and connectivity, but thinking about rewilding as a tool also opens for an employment of the principles at smaller scale in more fragmented landscapes. The emphasis on process also served to highlight rewilding as a concept that does not aim at fixed conservation of particular species, habitats or a priori lost landscapes, but rather opens for the continuous and spontaneous creation of habitats and spaces for species.

The Symposium also highlighted numerous areas of difficulty in the practical implementation of rewilding that will require further research and innovation to solve. Five issues of particular note were: ecological baselines, scale, how to restore processes, how to integrate rewilding in cultural landscapes and fences. Baselines easily causes confusion over what rewilding seeks to achieve: Is it recreating the past or learning from it to improve the future? The opinions expressed at the symposium clearly supported the latter and there was general agreement that this understanding needs to be clarified and disseminated. The scale at which rewilding is implemented is likely to vary considerably for practical reasons; there is simply more space available in some regions than others. The smaller range requirements of herbivores compared to predators will make restoring naturalistic

grazing more widely applicable than predation. Under these scenarios it may be necessary for managers to mimic natural predation processes that cannot be restored currently. Another key issue raised was the difference between species conservation and rewilding when both typically follow the same procedure – species reintroduction. To date rewilding projects have attempted to reintroduce processes by selecting keystone species, species that have disproportionally large impact on ecosystem function. However, to ensure the reintroduction of process natural population dynamics must also be restored and further research is needed to explore how this can be achieved effectively, especially in human dominated landscapes. The final issues concern the role of fencing as a tool in the restoration of herbivory, predation and large mammals. The evaluation of fences may come out differently whether you judge them from a population, society or ecosystem process perspective. Today it appears that fences may or may not aid in integrating rewilding with people and this debate will likely play an important role in determining what can be achieved in cultural landscapes in the near future.

PROGRAMME WENDSDAY 11. APRIL

09.30-10.00 Arrival and coffee

SESSION 1: THE IDEA

10.00-10.25 Jens-Christian Svenning, professor, Aarhus University:
Rewilding in evolutionary and historical context.

10.25-10.45 Josh Donlan, founder and director of Advanced Conservation Strategies, USA:
Halting the decline or restoring the potential?

10.45-11.00 Discussion: What are the relevant baselines for future biodiversity?

SESSION 2: INTRODUCTIONS IN PROGRESS

11.00-11.15 Sten Asbirk, biologist, Danish Nature Agency:
Beaver in Denmark – what have we learnt?

11.15-11.30 Anja Vilsholm, biologist, Danish Nature Agency:
Bison in Denmark – what are the plans?

11.30-11.45 Peter Sunde, senior scientist, Aarhus University:
Wolf in Denmark – what is likely to happen?

11.45-12.05 René Krawczynski, Cottbus University:
Beyond Heck-Cattle – the need to go further.

12.05-12.20 Discussion: Wishes, visions and targets of herbivores and predators.

12.20-13.20 Lunch.

12.50-13.20 Parallel lunch sessions:
A. Peter Smith, Wildwood Trust. The Killing Fields:
A documentary over the fragile relationship between wildlife, rewilding, land, taxation and law in Britain and Europe.
B. Ronald Goderie, Taurus Vee. The Tauros backbreeding program: Reinventing the aurochs for ecosystem function and meat production.

SESSION 3: THE VISIONARY IMPLEMENTATION

13.20-13.40 Frans Schepers, Director of Rewilding Europe:
Making Europe a wilder place.

13.40-14.00 Discussion:
Relevant objectives and targets for rewilding.

SESSION 4: A WILDER DAILY PRACTICE

14.00-14.15 Annita Svendsen, biologist, Danish Nature Agency:
Gradual rewilding of high-input grazing systems.

14.15-14.30 Morten Lindhard, biologist, Danish Nature Agency:
Whole-year cattle grazing: effects on vegetation and animals.

14.30-14.45 Alex Dubgaard, Associate professor, University of Copenhagen:
Economy of outdoor beef production in Denmark. No abstract available for proceedings.

14.45-15.00 Discussion:
What can we aim for in a fragmented cultural landscape?

15.00-15.25 Coffee break.

SESSION 5: REWILDING EFFECTS ON BIODIVERSITY

15.25-15.35 Xiaoying Gu, M.Sc. Cottbus University:
New findings in carcass ecology.

15.35-15.50 Hans-Georg Wagner, postdoctoral researcher Cottbus University:
Behind Heck Cattle – cryptogams on dung and bones.

15.50-16.05 Jacob Heilmann-Clausen, postdoctoral researcher, University of Copenhagen:
Rewilding and forest biodiversity – facts and anecdotes.

16.05-16.15 Discussion:
Expected and unexpected effects of rewilding on biodiversity.

SESSION 6: TARGETS AND CONFLICTS IN MANAGEMENT

16.15-16.30 Chris Sandom, postdoctoral researcher, Aarhus University:
Are fenced beasts wilder?

16.30-16.45 Rita Buttenschøn, senior advisor, University of Copenhagen:
The role of fences in Danish deer management.

16.45-17.00 Discussion:
Fences for conservation.

Closing session.

SESSION 1 THE IDEA

10.00-10.25 REWILDING IN EVOLUTIONARY AND HISTORICAL CONTEXT

Jens-Christian Svenning,
professor, Aarhus University.

Nature management typically involves some kind of baseline, thought of as a particular state of nature to be conserved or recreated. This point in time is often placed 100 to 200 years ago, the late pre-industrial or early-industrial cultural landscape as this is the time humans began to think about nature conservation. However, although this period offers aesthetically beautiful landscapes, it is also an arbitrary and atypical point in time to freeze the natural world. In Europe, current mammal species typically stretches back 200,000-400,000 years or more, while the majority of current species of beetles, trees, and vascular plants have existed for more than 1 million years. In contrast, modern humans (*Homo sapiens*) have only been present in Europe for 45,000 years and so it is clear that current biodiversity is not dependent on human management. This insight is crucial for nature conservation, as it points to *a need for understanding how ecosystems function without human interference to provide insight into the conditions and processes that have produced and maintained the present species diversity in the long term.* As no contemporary ecosystems exist without some human influence we must look to the past for guidance. No single temporal baseline is likely to be appropriate everywhere, however, the last interglacial (114,000-130,000 years ago) offers a unique window into a period of broadly similar climate and ecology, but without modern humans (except in Africa). Earlier Pleistocene interglacials are also useful windows, but less ideal due to greater evolutionary differences to the present-day biota. By looking to these periods we study how ecosystems function without human interference, notably how they are structured, how much diversity they maintain, and which factors and processes are involved. Inference based on this paleoecological perspective will be strongest if combined with modern ecological studies of the same factors and processes.

What do we know about European ecosystems in the preceding Pleistocene interglacials?
A key message from the fossil record is the often rich flora and fauna is nearly fully composed of modern species of plants, invertebrates, and small vertebrates (especially in the Last Interglacial), but contains a highly expanded large mammal community, with all the present species represented, but in addition to them a diverse suite of regionally or globally extinct species. For instance, in Northwestern and Central Europe the diversity of late Pleistocene large mammals might be comparable to East Africa today. This severe megafauna loss is essentially a global pattern. There is ongoing controversy over its cause, but also increasing evidence that it is linked to the expansion of *Homo sapiens*. A key point for conservation is that current megafauna-poor conditions are highly unusual, with e.g. rich mammal megafaunas having been present in Europe continuously for many million years.

Little work has been done on assessing the ecological importance of the rich megafaunas, although recent studies from Australia and North America suggest that megafaunal losses caused at least in some cases caused major vegetation changes. Paleoecological studies of interglacial ecosystems Northwestern and Central Europe suggest that some kind of forest constituted an important and generally dominant landscape component, with a mosaic of open areas between and within, notably in floodplain areas and on poor soils. Faunas generally consisted of mixtures of forest species and species depen-

dent on open habitats. Overall, the paleoecological data points to forest-dominated, but highly heterogeneous mosaic interglacial ecosystems. There are at least indications that large herbivores contributed to this habitat diversity, but also for important roles for varied edaphic and hydrological conditions and sometimes also for fires. Much more work is clearly needed before we have a comprehensive understanding of the structure and functioning of ecosystems in Europe in the absence of modern human interference. However, at this point, the emerging message is that if we want to restore ecosystems to self-managing entities capable of long-term maintenance of a rich species diversity we need to look to restore these factors and processes, and that this includes rich megafaunas.

Further reading:

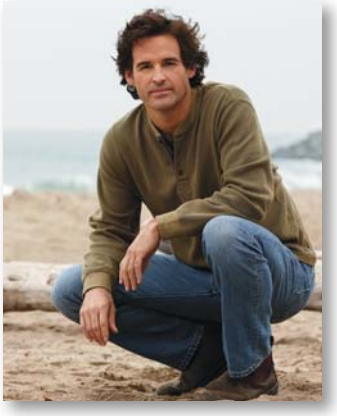
Svenning, J.-C. 2002. A review of natural vegetation openness in Northwestern Europe. Biological Conservation 104:133-148.

Svenning, J.-C. 2007. 'Pleistocene re-wilding' merits serious consideration also outside North America. IBS Newsletter 5(3):3-9.

Bison in the Lamar valley, Yellowstone National Park.
Photo: Jens-Christian Svenning.

10.25-10.45

HALTING THE DECLINE OR RESTORING THE POTENTIAL? REWILDING IN THE ANTHROPOCENE



Josh Donlan,
founder and director of Advanced Conservation Strategies, USA

Scientists interested in drawing attention to the scale of human impact on Earth are now referring to the current geological epoch as the Anthropocene. Whether the "age of man" is a disaster by definition or a much-needed awakening is a topic of current controversy among academics. If nature's definition includes the absence of humans and their influence, then there is indeed no nature left. But, humans have been radically influencing ecosystems for millenniums. In fact, everything we know, or believe to be true, about nature is founded on knowledge of history. Thus, the ability to dominate and transform landscapes is arguably neutral with respect to the biological diversity we will co-exist with in the future. It is not *if* but *how* we choose to impact ecosystems across the globe that will define the Anthropocene as an optimistic or pessimistic time. History, including Pleistocene and Holocene history, can help inform how we might impact ecosystems.

As more pro-active and aggressive approaches challenge traditional strategies of environmental conservation, science will continue to play a central role. Topics such as invasive species management, assisted colonization, and rewilding have now been debated at length in the literature – often strongly criticized. Yet, scientific support for traditional approaches to environmental conservation is plummeting. More importantly, however, scientists are providing little prescriptive support to the minority of practitioners that are implementing these pro-active approaches such as rewilding. Rather, *a priori* ethical judgments cloaked in science appear more common. As active restoration and management becomes increasingly important in our human-dominated world, the roles of ethics and science will need to be clarified and integrated. Place-based restoration efforts should be science driven, but will also be human-centered by design. Scientists could better serve biodiversity conservation in the Anthropocene by providing data-driven prescriptive knowledge and *post hoc* impact assessments to the growing number of rewilding efforts.

Political cartoons published by those for and against Pleistocene Rewilding in the US.

10.45-11.00

DISCUSSION: WHAT ARE THE RELEVANT BASELINES FOR FUTURE BIODIVERSITY?

Moderator: Rasmus Ejrnæs

What is the purpose of baselines and is there a better term?

One key yet prickly issue explored in this session was the meaning, use and importance of "ecological baselines" in rewilding: are they ecosystem recreation targets or an instruction manual from the past to guide future conservation efforts? Although both speakers tackled the issue differently in their presentations both agreed that ecological baselines are a point of reference to guide restoration activities. The point was made that the term baselines often invokes many to assume rewilding is attempting to recreate a point in the past and encourages comparisons with Jurassic Park (Rubenstein et al. 2006). The Oxford English online dictionary definition of baseline is 'a minimum or starting point used for comparisons', highlighting an emphasis on reference point rather than a recreation blueprint. Josh Donlan commented that the term 'Pleistocene Rewilding' might have been an unfortunate choice as it encourages the idea of recreating the Pleistocene. Rather, the point was to encourage conservationist to learn from that enlightening period. Ecological processes were stressed by both speakers and remained a constant theme throughout the symposium. Natural processes are dynamic in space and time, hard to predict and therefore better suited for a forward facing approach than a fixed past reference.

Biodiversity is declining at a faster rate than ever before and if we agree that this is a problem to what degree does rewilding solve this problem?

Both speakers agreed that rewilding is not the ultimate solution to this problem but suggest that the following points highlight why rewilding might be a part of the solution:

1. Where biodiversity has been lost, rewilding offers a mechanism to restore ecosystem function to safe guard what is left and promote future biodiversity through the restoration of key ecological processes.
2. The restoration of naturally regulating ecosystems may also help reduce the need for continued human investment and so free resources that can then be invested in other conservation strategies.
3. Rewilding can directly help maintain the keystone species and ecosystem engineers reintroduced to restore the key processes - species that may otherwise be threatened in their conventional natural range.
4. Rewilding is a proactive agenda that can help get people excited about conservation compared to the somewhat pessimistic agenda of 'slowing the rate of biodiversity loss'.
5. It may also encourage further investment in conservation. Conservation dollars are often non-transferable and so a new idea may attract further investment.

Where does the IUCN species' or reintroduction group fit in to providing guidance to rewilding?

Josh Donlan felt that these groups potentially have a huge role to play in rewilding. Relevant challenging issues such as how to approach moving species outside their conventional native range such as required in assisted colonization and taxon substitution have been thought about for some time, mainly with regard to bird reintroductions to New Zealand. The current difficulty is that reintroduction has typically been used as a species specific tool as opposed to one for ecosystem restoration. The taxon substitution issue still needs to be resolved academically and practically. It was stressed that the IUCN guidelines for reintroductions are currently being updated and now would be a good time to engage with these issues.

Does rewilding, specifically reintroducing African species to North America, provide an excuse for not conserving lions in the Serengeti for example, e.g. building the trans-Serengeti highway?

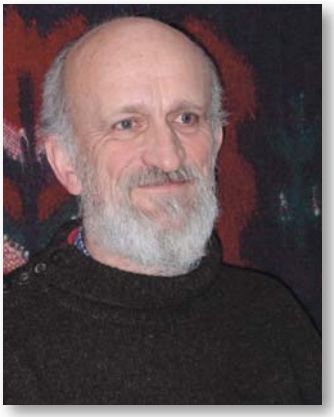
There is currently no answer to this question although considering the risk is essential. In an initial response the assumption is that much more important factors will play a greater role in deciding these schemes than whether large mammals are also present in America. However, such risks must be considered before any such rewilding scheme was implemented.

Do fences alter the public perspective with regard to implementing "Pleistocene" rewilding?

The potential to use fences in rewilding North America was discussed in the longer paper and the general concept was written with fences in mind (Donlan *et al.* 2006). Fences are a difficult subject themselves ecologically, socially and economically. From an economic perspective research in Africa and Australia suggest that fences are expensive but not necessarily cost prohibitive but ecological and social issues especially deserves further exploration.

SESSION 2 INTRODUCTIONS IN PROGRESS

11.00-11.15 BEAVER IN DENMARK – WHAT HAVE WE LEARNT?



Sten Asbirk, biologist,
Danish Nature Agency

The European Beaver was reintroduced in Denmark in 1999.

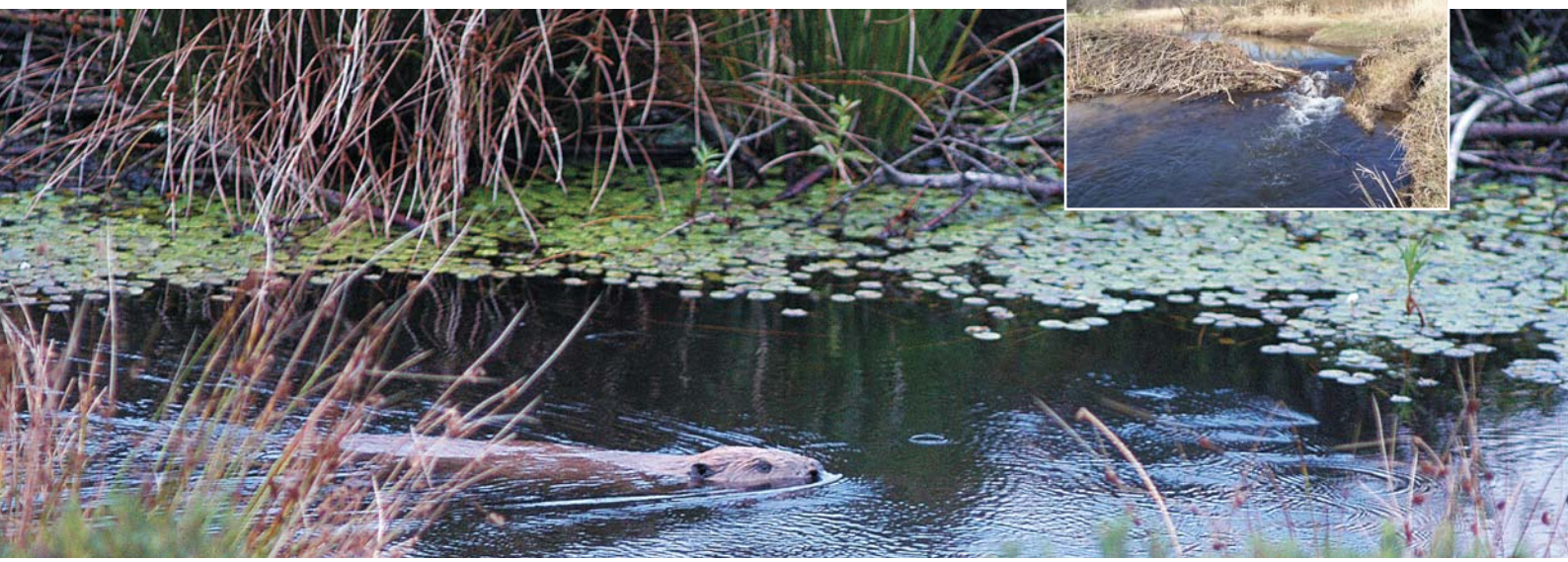
The overall aim was to achieve more wild nature in Denmark. The objectives were to use the beaver as a tool for creating more natural dynamics in wetlands and forests, and to reintroduce the beaver as an indigenous species. Finally the objectives also included exciting nature experiences for the public.

Practical barriers consisted in finding release sites and in getting the necessary permissions from the conservation authorities and the veterinaries. Mitigation of damages to crops etc. was also an important point.

Mentally many scientists were reluctant to deal with reintroductions instead of creating possibilities for natural immigration. A new view of nature had to be formulated. Among land owners habituation to a new wild species creating new dynamics in nature was a challenge.

The beavers have given many benefits to the Danish nature. Wetlands and forests have become more wild and dynamic, and the ecosystems have achieved greater diversity and better conditions for species on the red list, for invertebrates living on dead wood, for amphibians, waterbirds, bats and otter. Thousands of visitors come to experience the beavers and their dams and lodges etc.

We have learnt that beavers are thriving well in Denmark, but also that it takes long time for them to colonize neighbouring river systems. The reintroduction in western Jutland has been a great success, and in 2009 another beaver project was started in north Zealand. Reintroduction of keystone species seems to be a good tool for rewilding nature and to reduce costs of traditional conservation management.



Lower photo: The European Beaver was reintroduced in Denmark in 1999 and its population is thriving. Photo: Jan Skriver. Inserted photo: The Danish beavers and their dams contribute to rewilding wetlands and forests in western Jutland and North Zealand. Photo: Sten Asbirk.

11.15-11.30 BISON IN DENMARK – WHAT ARE THE PLANS?

Anja Vilsholm, biologist,
Danish Nature Agency:

In 2010 the Danish Minister of Environment decided to launch a reintroduction project of the European Bison to Denmark. The chosen area is the state forest of Almindingen at the island of Bornholm in the Baltic Sea. A Nature Agency team was established for project description, design and implementation.

The four main purposes of the project are 1) to increase biodiversity, 2) to provide instructive, high quality nature experiences, 3) to enhance local ecotourism and rural development, and 4) to participate in the international cooperation for protecting a globally threatened species.

Seeking local acceptance and support is essential for the success of the project. This has so far been achieved by successful, preliminary contact to local key stake holders and NGO's, public information through media and website and excursions.

A generous financial donation in October 2011 by the Villum Foundation has made the project possible. 7 bisons from Bialowieza and Pszcyna Forests in Poland are planned to be released within a 200 hectares fence in the forest of Almindingen by the end of May 2012.

The bisons will be living as wild animals within the fenced area, and the public will be allowed restricted access to the fenced area. Information material will be made to inform the public about the bison project and how to behave around bisons.

The bisons will be monitored, to document the impact on the environment, food preference, behaviour and interaction with the public.

After a period of 5 years, the experiences of the project will be evaluated, and the future of the European Bison on Bornholm will be decided: Do the bisons bring about the expected positive impact on nature? How do they interact with the public? Do we wish to remove the fence in order to let the bisons become free living animals on the island of Bornholm?

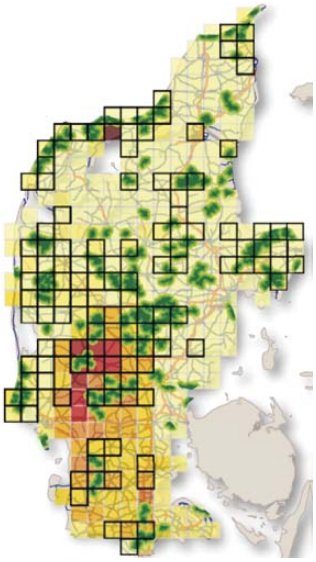
Hopefully, the results and experience of this project will be beneficial to future (re)introduction projects.

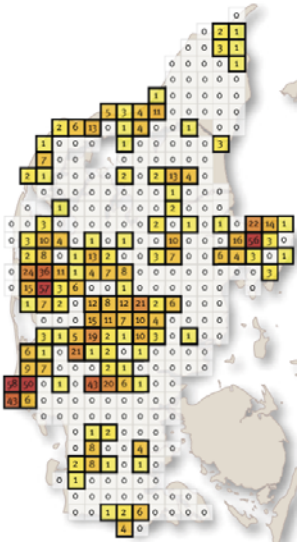
Right: Bison in Eriksberg, Sweden. Left: Bisons in Rothaargebirge, Berleburg, Germany.
Photos: Anja Vilsholm, Naturstyrelsen.

11.30-11.45 WOLF IN DENMARK – WHAT IS LIKELY TO HAPPEN?

Peter Sunde, senior scientist,
Aarhus University.

The wolf is a top predator in communities of large- and medium-sized terrestrial mammals in northern, temperate regions with a high potential for limiting population size, spatial distributions and behaviour of ungulate prey <500 kg. According to historical records, the last Danish wolf was killed in 1813. Recent population recovery patterns in Eastern and Central Europe, following cessation of persecution, indicate that wolves will soon be able to re-colonise Danish habitats given that a German source population continues to increase and the species can adapt to the present Danish landscapes without being killed by humans. Based on experiences from other densely populated, developed countries, it is likely that wolves will be able to find sufficient food resources (ungulate prey) and undisturbed habitats to sustain a number of family groups (packs) in Denmark, given that human caused mortality rates (traffic accidents and deliberate killings) will be sufficiently low to be outbalanced by reproductive rates. However, because of the species' high energetic requirements and large home ranges, a "Danish" wolf population will probably never exceed 100 individuals and will thus be dependent on being in contact with other parts of a Central-European population in order to be viable in the long term. Danish wolves will probably mainly predate on ungulate species, which in practice in most places will be red deer and roe deer. If allowed to establish populations near to carrying capacity, wolves will probably decimate population densities of both these prey species, which might counteract local management goals of increasing the natural grazing pressure from wild ungulates. On a spatial scale, red deer is likely to respond to wolves by adopting a more nomadic behaviour, which in turn might lead to a more erratic distribution of deer (and grazing pressure) in the landscape than is the case at present.





Left: Wolves from the Highland Wildlife Park Scotland.
Right: Maps of potentially suitable forest habitat (upper) and red deer density in Zealand, Denmark.
Photo: Chris Sandom

11.45-12.05 BEYOND HECK-CATTLE – THE NEED TO GO FURTHER

René Krawczynski,
Cottbus University.

Upper: Aurochs-like cattle in oak forest. Photo: Klaus Sparwasser.
Lower: Elephants in snow. Photo: African Lion Safari, Cambridge Canada.

During the last decades it became acknowledged that biodiversity conservation cannot be achieved by conserving a given status. Populations fluctuate due to internal or external causes such as disease or drought. Fluctuation of populations is a dynamic process and is linked to other species which might be positive or negative on species B, C, or D. These dynamic processes are essential part of ecosystems and the only given constant there is change. So every attempt to conserve a desired status in biodiversity conservation must fail. Natural dynamic has to be restored and the dynamic processes so often neglected are those initiated by large herbivores. At last, this had been acknowledged and turned into praxis by using large herbivores like horses and cattle in semi-natural grazing projects. Most projects are located in open areas, but some also in mainly wooded areas. After recognizing the beneficial effects of semi-natural grazing with domestic animals, next step was to use true wild animals like Red Deer, Roe Deer, Fallow Deer, Wild Boar, Przewalski's horse and European Bison like in Döberitzer Heide near Berlin. Since 2000, there is a project in the north of Saxony experimenting with Elk. In many areas beavers are recovering or are actively introduced to areas where they are still missing. By practitioners, Heck Cattle or Konik Horses are viewed as natural substitute for animals once named Aurochs or Tarpan, although some purists might comment on that view.

So things seem to go the right way. However, there were far more large herbivores under similar climatic conditions than we have today. There were Elephants in Europe today believed to be the same species as "Indian Elephant", at the rivers Rhine, Elbe and Danube there were Water Buffalos, and they were often found together with Hippos. The use of Water Buffalo in biodiversity conservation has been successful in spite of conservative conservationist complaining about the exotic species. The positive example of Water Buffalos used in Germany, Greece and the United Kingdom show that it is possible to use even extinct large herbivores to enhance natural dynamic processes. Using as many as possible herbivore species in on area in the sense of multiple species projects should therefore also include Elephants, Hippos and Rhinos.

12.05-12.20

DISCUSSION: WISHES, VISIONS AND TARGETS OF HERBIVORES AND PREDATORS

Moderator: Jacob Heilmann-Clausen

This discussion session tackled some of the difficult practical challenges of rewilding Denmark. The difficulty posed by fences is an issue that was raised here and reappeared in other discussion sessions. The first question in this session related to how fences in the new bison project on Bornholm will impact existing wildlife. The primary concerns with fences from an ecological perspective are perhaps division of populations and direct mortality associated with the fence. The latter is perhaps mainly related to the quality, maintenance, situation, visibility and monitoring of the fence. The former is perhaps a more fundamental issue. However, potential solutions were proposed by the speakers. In Bornholm ditches that run under the fence in places are not being blocked as bison are too large to negotiate them while they offer free passage to roe deer the next largest mammal on the island. Another example provided was a project in Germany that raised a 2 m high fence 50 cm off the ground. This created a fence high enough to keep the target species, European elk, contained and remarkably let animals as large as red deer with full antlers to pass underneath. This suggests that many of these problems can be tackled with fence design.

Another issue when practically implementing rewilding is trying to determine what will happen when a species is reintroduced and then determining if these restored processes are necessarily "natural". It was asked if we really expect dramatic declines in deer numbers when the wolf is reintroduced. This is a difficult issue to address as many factors affect population dynamics of which predation is only one. The issue of trophic cascades has received considerable attention recently with some research suggesting that predators do indeed play a role in prey population dynamics under some circumstances (Sinclair *et al.* 2003, Melis *et al.* 2009, Estes *et al.* 2011). However, even where wolves have been reintroduced and ungulate numbers have subsequently declined it can be difficult to determine if predation is the primary driving mechanism as research from Yellowstone National Park indicates (Vucetich *et al.* 2005, White and Garrott 2005). Modelling population dynamics also suggest that it is at least conceptually possible for wolves to have considerable impact of ungulate densities (Nilsen *et al.* 2007, Sandom *et al.* 2011). Further empirical research is required to determine the effect of predators in a wide variety of environments and rewilding projects may provide that opportunity.

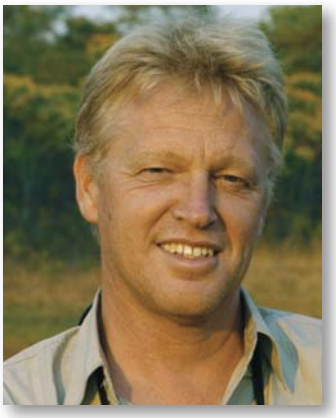
Putting rewilding into practice is often expensive requiring the transportation of large mammals, staff, fences and running costs. Science can also be expensive and so might be under-represented in rewilding efforts. In the Bornholm bison project most of the funds have been invested in the fence but two GPS collars to monitor the bison's movements have also been purchased. Currently a master student has carried out vegetation mapping prior to the introduction and it is planned to monitor the impacts of the bison on the local vegetation. However, funding for a dedicated research programme would also be very welcome which could help better determine the impacts of bison reintroduction and communicate this knowledge to other rewilding schemes. The transfer of knowledge between rewilding projects will be important. The example was given that where Bison were reintroduced to Netherlands five years ago the fences are coming down and being

replaced by three electrified barbed wires. However, it is perhaps the education of the local public that needs to be transferred as the fence is perhaps primarily there for public piece of mind and so the appearance of the fence in terms of how secure it appears is important. The Netherlands is also preparing the public for the arrival of the wolf which has been recently observed for the first time since its extirpation with media coverage that introduces the idea of living with wolves again.

A number of different species and processes were discussed in this group of talks and the question was posed how three different grazers - heck cattle, bison and water buffalo - differ in terms of their impact on the environment? This question raises the issue of whether reintroducing a single herbivore species reintroduces the entire process of grazing. An example from Germany where three grazing species (heck cattle, konik ponies and water buffalo) occupy the same enclosure suggests that the role of each species is slightly but importantly different. In this example the species separated their use of space depending on soil moisture content, with water buffalo using regions much wetter than the other species.

SESSION 3 THE VISIONARY IMPLEMENTATION

13.20-13.40 MAKING EUROPE A WILDER PLACE



Frans Schepers,
Director of Rewilding Europe.

Never in modern history have there been better opportunities for conserving European biodiversity. During the last 30-40 years, Europe has experienced exceptional wildlife comeback and due to large-scale abandonment of farmland, in particular in the mountain areas across the continent, nature is gaining the upper hand. This also provides new opportunities for society and the people still living in many rural areas to shift from a subsidized, natural resource extraction economy to a service economy based on nature and wild values. However, since an estimated 50% or even more of all European species are dependent on open/semi-open landscapes, one of the main challenges has become to stimulate those natural processes which keep the landscapes open: wild herbivores, avalanches, insect outbreaks, wind, floods, erosion, fires, etc.

In 2010/11, a new initiative was launched – Rewilding Europe – to address these new, exciting opportunities. The four initiating organizations – WWF-Netherlands (www.wnf.nl), ARK Nature Foundation (www.ark.eu), Wild Wonders of Europe (www.wild-wonders.com), and Conservation Capital (www.conservation-capital.com) – agreed to build the programme around the three pillars of conservation, communications, and enterprises. Wildlife is at the core – wildlife as a key factor for healthy and self-sustaining ecosystems, as an inspiration and attraction for people and as a source of revenue generation for economic development, allowing wildlife to increase to even higher densities than today and reintroducing missing species.

A key objective is to rewild, at least, one million hectare of land/sea by 2020 spread over ten model sites. In five areas nominated by local organisations rewilding has already started: Danube Delta (Romania/Ukraine), Eastern Carpathians (Poland/Slovakia/Ukraine), Southern Carpathians (Romania), Velebit (Croatia), and Western Iberia (Portugal/Spain). These areas cover a wide spectrum of different protection regimes – national parks, geoparks, natural parks, landscape parks, biosphere reserves, RAMSAR, UNESCO World Heritage and Natura 2000 – and it is already clear that the rewilding concept is applicable irrespective of protection status.

Invitations for the other five model regions have already generated more than 10 nominations from different parts of Europe. By the time of the 10th World Wilderness Congress (WILD10) in Salamanca, Spain in October 2013, rewilding projects should be underway in all ten areas. Using these ten areas as show cases, the objective is by 2020 to have inspired another 100 rewilding initiatives across the continent affecting 10 million hectares.

The objective set for 2013 is to reach out to 100 million European citizens with a "joy of the wild" message. With Wild Wonders of Europe (www.wild-wonders.com) as the principle founder in terms of communications, Rewilding Europe has an ideal partner for the outreach work. For example, in September 2011, the GEO Magazine published a 24-page article "Europe Goes Wilder" for German speaking part of Europe, illustrated by pictures from Wild Wonders of Europe. In February 2012, this article was published in another eleven languages, from Brazil to Slovakia and from Spain to India. An agreement has also been signed with a joint German/Dutch filming group to produce a series of 4-5 one-hour stories featuring the development of rewilding in the selected pilot areas.

Western Iberia, Spanish side.
Photo: Staffan Widstrand, Wild Wonders of Europe.

Building Rewilding Enterprises is a key element. With fading financial support to conservation from public sources across the world, private sector investments are becoming increasingly important. With a part of the revenue stream going directly into support of conservation on the ground, the kind of enterprises foreseen is expected to fill an emerging niche between pure philanthropic and pure commercial finance for conservation. Learning from various nature-based businesses, especially from Conservation Capital's successful work in Africa, local entrepreneurs are currently identified in each of the five pilot areas with the aim of starting the first concrete activities within the coming twelve months.

The combination of innovative conservation approach, mass communications, and nature-based enterprise development has already attracted several larger, private donors. Rewilding Europe's forward looking perspective, inviting all sectors of society to participate and form new conservation landscapes, has the potential to reshape the conservation agenda on one of the world's most crowded continents.

If you would like to learn more, please visit the initiative's website: www.rewildingeurope.com or contact: Rewilding Europe, Toernooiveld, NL-6525 ED Nijmegen, The Netherlands, info@rewildingeurope.com.

REWILDING EUROPE
A new beginning. For wildlife. For us.

Eastern Carpathians, Polish side.
Photo: Cornelia Doerr, Wild Wonders of Europe.

13.40-14.00

DISCUSSION: RELEVANT OBJECTIVES AND TARGETS FOR REWILDING

Moderator: Josh Donlan

This discussion session was centered on the aspirations of Rewilding Europe and their affiliated rewilding projects. Rewilding Europe is associated with large-scale projects, currently situated in areas that are already fairly wild by European standards. They are currently looking to select more projects >1000 km^2 (100,000 ha) projects to rewild. The first question asked related to whether governments were getting involved. The answer is currently no, not directly. Although some regions included within the projects are state owned the impetus is coming from private innovators promoting what is currently perceived as more radical ideas, although the hope is that governments will get increasingly involved.

Funding these large-scale conservation and restoration projects is a significant challenge. Ecosystem services have been touted as a mechanism for conservation projects to charge for the goods and services the natural world provides society. While this and similar ideas are being increasingly discussed and investigated significant progress has yet to be made in marketing these ideas. However, Rewilding Europe is prioritizing economic opportunities arising from the rewilding projects through a partnership with Conservation Capital. To date tourism is currently the most important source of income in many of these regions and rewilding is likely to increase these opportunities.

The question of the role of science in rewilding projects was raised. This led to discussions relating to science as an input to and an output from rewilding projects. Science has a clear role in identifying, understanding and restoring ecosystem function. However, rewilding as a process can also reveal new information about the functioning of the natural world and in this way advance ecological theory. And new empirical evidence would be useful in future rewilding projects. The point was raised that science can also hinder the development of rewilding projects by requiring considerable investment of time and resources into feasibility studies and baseline data collection. In this process there is a risk that science becomes prescriptive, particularly with regard to feasibility studies. Science can perhaps be most usefully employed by identifying ideal starting points for rewilding projects, i.e. the conditions managers need to restore the ecosystem to that will then allow natural processes to function. Once these starting points have been achieved science moves back into a learning phase by monitoring the function of the restored processes.

The question was asked how species were selected for reintroduction in Rewilding Europe projects, and if 'Pleistocene species' were considered too? Frans Schepers reported that the conscious decision was made to avoid the more controversial species that are typically associated with Pleistocene Rewilding. Furthermore, research suggests that grazing has been identified as a severely underrepresented process in Europe making many of the large grazers ideal candidates for reintroduction. This pragmatic approach facilitates action and the restoration of an important process. However, pragmatism must be weighed against the importance of ensuring that mutualistic processes, such as predation, disturbance and decomposition, are also restored despite the greater practical challenges that they can pose.

SESSION 4 A WILDER DAILY PRACTICE

14.00-14.15 GRADUAL REWILDING OF HIGH INPUT GRAZING SYSTEMS

Annita Svendsen, biologist,
Danish Nature Agency:

Resumé:
There are about 300,000 ha hectares of semi natural nature areas in Denmark, which more or less need extensive management by grazing or mowing. Experiences from the Funen Region show that a very big part of these nature areas actually suffers from management or have insufficient management. There is a need for much more animals for nature management purposes in the years to come. Robust cattle (Nature cattle) are good and cost efficient nature managers. Danish Nature Agency in Fynen has good experiences with Nature cattle lending as part of a management agreement. In 2013 a total of about 100 cattle are lent to different farmers and stakeholders. We suggest development of a special concept/regulation for Nature cattle with special rights and obligations for nature management. Such a concept will also from a nature biodiversity, climate and human health perspective be a very attractive solution.

Demands for nature management and needs for grazing animals – Nature cattle
As part of the "Green Growth" political agreement and as part of implementing the Natura 2000 plans 150,000 hectares of semi natural nature areas have to be managed by grazing or mowing during the next years. Extensive cattle like highlander, galloway and hereford cattle will be suitable for managing low productive nature areas. A report from Institute of Food and Resource Economics in 2011 shows that year-round grazing regimes with Nature cattle will be the most cost efficient solution when it comes to the grazing of nature areas. With a year-round grazing regime one cow will be able to manage 2-5 hectares of semi natural nature areas. In Denmark we have about 115,000 suckler cows where most of them are intensive meet cows. There are less than 20,000 robust cattle in Denmark.

Suggestion of a concept/regulation for Nature cattle
Year-round grazing with Nature cattle will also from a nature biodiversity and nature quality perspective be a very attractive solution. We need to motivate more farmers and stakeholders to establish extensive herds of Nature cattle. We will like to suggest development of a concept for Nature cattle with regulations that give the cattle special rights and nature management obligations. Special support schemes and a meet labelling concept could be developed as well. As part of the concept there should be none or only very limited supplied feeding of the cattle and only with hay or straw. No supplied feeding of offspring or animals for slaughtering should be part of the concept.

Danish Nature Agency. From Svanninge Bakker, Fyn. Year-round grazing with robust cattle (galloway cattle). Photo: Annita Svendsen.

Nature cattle lending
To make grazing of nature areas more attractive it can be necessary to deliver different grazing facilities like fencing, roundabout and water access. Here besides the Nature Agency have made agreements about Nature cattle lending as part of year-round grazing regimes

Danish Nature Agency. From Avernakø, Fyn. *Bombina bombina*. Ponds suitable for the fire bellied toad need extensive grazing.
Photo: Leif Bisschop-Larsen.

in EU LIFE projects (LIFE Bombina, LIFE BaltCoast, LIFE Dry grassland II). The agreement principle is lending a number of Nature cattle to a farmer. The farmer can keep the offspring and has all obligations for the cattle according to regulations and animal welfare – as a permanent agreement. The agreement can be terminated by the famer or by the Nature Agency, and the cattle will be returned to the Agency. When the farmer has built his own herd from the offspring, he can those to give back the lending cattle, and they can go for at a new project area as part of a new agreement.

Danish Nature Agency. From Helnæs Made. Mosaik of different habitat nature types, which is dependent on grazing.
Photo: Leif Bisschop-Larsen.

References

Alex Dubgaard og Hanne Marie Lundsbjerg Jespersen, Fødevareøkonomisk Institut, LIFE, Københavns Universitet og Berit Hasler, Leise Pil Christensen, Louise Martinsen, Marianne Källstrøm og Gregor Levin.

Danmarks Miljøundersøgelser, Aarhus Universitet (2011): Rationel naturpleje og drift af beskyttede, vedvarende græsarealer i Natura 2000 områder, DEL B: Økonomiske analyser.

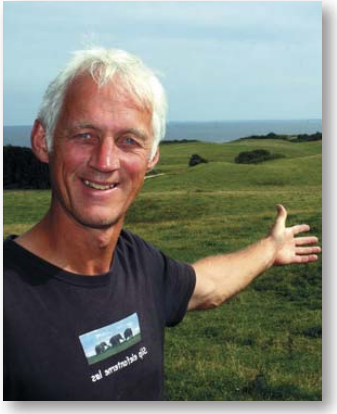
Table 1. Costs of livestock for different suckler cow types, fresh meadow 15 ha, DKR. / mother animal unit

	Robust cattle, nature cattle		Suckler cows, robust		Suckler cows, intensive	
Number of animals pr. mother animal unit	3,61		3,18		2,83	
REVENUE						
Sale of animals for slaughter	5 026	100%	4 752	100%	7 548	100%
Revenue in total	5 026		4 752		7 548	
COSTS						
Feed costs						
Feed	1 906	31%	2 861	23%	4 410	33%
Litter	ir		841	7%	1 070	8%
Minerals	238	4%	343	3%	328	2%
In total	**2 144**	**34%**	**4 045**	**33%**	**5 808**	**43%**
Other costs						
Capacity costs I	1 395	22%	1 598	13%	1 422	11%
Capacity costs II	870	14%	4 162	34%	3 704	27%
Work	1 807	29%	2 452	20%	2 536	19%
In total	**4 072**	**66%**	**8 212**	**67%**	**7 662**	**57%**
Margin for livestock	-1 190		-7 505		-5 922	

Note: Does not include costs for fencing and other fold- and habitat related costs.
Reference: Alex Dubgaard *et al.* (2011).

14.15-14.30

WHOLE-YEAR CATTLE GRAZING: EFFECTS ON VEGETATION AND ANIMALS



Morten Lindhard, biologist,
Danish Nature Agency.

For 3 years since the spring of 2009, 20 herford cows and their offspring has lived on Røsnæs, Kalundborg without supplementary feed or artificial shelter.

Their main 44 ha grazing area consists of:

- 28 ha "new" pasture (last cultivated between 3 and 40 years ago)
- 5 ha old pasture (never ploughed). Core botanical conservation area.
- 9 ha blackthorn, *Prunus spinosa* and hawthorn, *Crataegus laevigata* thicket overgrown with evy, *Hedera helix*.
- 2 ha beach and a natural spring, that never freezes.

The most difficult period for the cattle was the winter Nov. 2010-march 2011 as the ground was snow-covered most of that time. During this winter a neighbouring 27 ha fen was opened with 22 ha pasture, 5 ha beech wood, *Fagus sylvatica* (planted in 1905).

This area had however already been grazed by about 30 studs the previous summer.

The rewilding cattle scraped the snow to reach the dry grass, turned to bramble leaves that dominate the beech wood floor and the evergreen leaves of evy in the hawthorns. In march there seemed to be nothing left for them to eat. The evy has not regenerated its leaves reachable by the cows, so it is unknown if the cattle could survive another hard winter without more land.

In march 2011 the owner tried to call/drive the animals to a pen and take them home to feed them, but they could not be lured, so he abandoned the plan and left them to survive on what they could find. None seemed starved and none died that winter and calfing was normal.

Whole year grazing at Røsnæs.
Photo: Morten Lindhard.

Whole year grazing at Vindekilde, Røsnæs.
Photo: Morten Lindhard.

Each fall the surplus was harvested producing about 2 tonnes of meat (about 3 tonnes live weight).

Effects on vegetation and biodiversity: The cattle did not eat any of the blackthorne, which is a threat to wildflowers like cowslip, *Pulsatilla pratensis*, sunroses, *Helianthemum* sp. and field cow-wheat, *Melampyrum arvense*. Every year new shots of blackthorne in the old pastures has to be manually removed. Pastures lost to blackthorne bushes has never been regrown by the above flowers even if the bushes are repeatedly removed.

Mice and butterflies are clearly more numerous in ungrazed pastures and pastures grazed by horses. (Unpublished observations from my 21 years of natureschool activities in the area).

My recommendation to a better nature management scheme is therefore a lower cattle grazing pressure and more herbivore biodiversity. Herbivore diversity is what characterised original pasture use and original nature. Besides benefitting biodiversity directly and indirectly it will also increase meat production/ha, if that is a desired sideeffect. As the main cost of keeping grazing animals in the standard way is moving and winter feeding them, rewilding may be the most profitable way of producing meat in conjunction with nature management.

14.45-15.00 DISCUSSION: WHAT CAN WE AIM FOR IN A FRAGMENTED CULTURAL LANDSCAPE?

Moderator: Frans Schepers

This discussion session covered some of the practical difficulties of rewilding in cultural and fragmented landscapes. This centred on the issue of the need for human management in nature conservation, the feasibility of replicating human management with wild animals and whether this is actually rewilding. *Bombina bombina* was introduced by Annita Svendsen in her presentation as a species that requires year round grazing. She made the case for the use of wild year-round grazing practices as beneficial in numerous aspects over more conventional management. Morten Linhardt discussed how wild, year-round grazing regimes using cattle could be successfully used in nature conservation although they did not meet all management objectives, in this case controlling the spread of blackthorn which threatens key plant species. When tackling the issue of achieving specific management goals with naturalistic grazing the issue of learned behaviour was raised; the transfer of knowledge between animals is an important trait emphasising the need for a perpetual population that functions naturally with opportunity to evolve biologically and socially in the landscape. This might emphasize the need for humans not only to learn by sharing knowledge between rewilding projects but also move individual animals or small family groups between rewilding projects for the reintroduced species to learn key behaviours.

The term rewilding suggests ecological restoration to a state of natural regulation, i.e. beyond human management. In this sense using native species to replicate human management may not represent rewilding but a new management strategy. This issue was raised by highlighting that *B. bombina* survived in Europe prior to human grazing regimes suggesting nature can provide for this species without human management. If we restore appropriate species assemblages and densities, as well as providing sufficient space then we should allow these natural processes to tell us if species such as *B. bombina* are still suitable for this landscape. However, it was also noted that *B. bombina* is an indicator species whose presence suggests a functioning system. As a result where *B. bombina* thrived within a rewilding project could be seen as a measurement of success and where it was lost failure. Rewilding seeks to restore function, when function has been restored the ecosystem will tell us what is 'natural'. However, if through ignorance or practical difficulties certain ecological processes remain dysfunctional the results of the rewilding scheme may be misleading. Ensuring proper establishment of all ecological processes within rewilding projects is an important task for the rewilding scientific community. However, perhaps one key point in this debate that differentiates rewilding from traditional conservation management is that while traditional conservation has been typically species based (action to preserve a specific species) rewilding is ecosystem based (action to restore an ecosystem). While both aim to help maintain and promote biodiversity they use alternative pathways.

There was an emphasis on promoting the importance of multispecies grazing regimes with a general feeling that implementing these times of rewilding projects would be an excellent start for many regions. There is also the potential connection with the use of grazing animals and agriculture. Is wild grazing more economically efficient than high intensity farming? Figures provided in Alex Dubgaard's presentation suggest that this is the case. However, subsidies distort the system considerably and the current arrangement of closely tying conservation payments and agriculture appears to be unsatisfactory. The question was posed what could we achieve with the Natura 2000 network if these subsidies were put at their disposal?

SESSION 5 REWILDING EFFECTS ON BIODIVERSITY

15.25-15.35 NEW FINDINGS IN CARCASS ECOLOGY

Xiaoying Gu, M.Sc.,
Cottbus University.

Since November 2008, BTU chair General Ecology runs the Necros Project. At a former military training site with abundance of large vertebrate scavengers such as wolf, pine marten, raven, red kite, white tailed eagle road kills of local game are deposited and monitored. For general observation, automatic cameras take pictures and videos. Moreover, pitfall traps collect epigaeic arthropods. Direct observations are few and short when pitfall traps and the cameras' SD cards are changed.

However, direct observations provided us with obviously new observations in carcass ecology. Not only expected and known scavenging insects such as Silphidae use carcasses, but also species which are supposed to be only herbivorous. Female grasshoppers such as *Calliptamus italicus* or *Stenobothrus lineatus* eat directly from the carcasses. We believe this is due to the need of proteins for better egg production. Also at least two genera of bees (Andrena and Megachile) and twelve species of butterflies suck on the carcasses. We interpret this behavior as strategy to compensate the lack of flowering plants especially in spring in the area and to provide themselves with proteins and minerals.

So in addition of fuelling a broad food web of known scavengers by carcasses, other highly threatened species can increase their reproduction success when carrion is available. As European Union allows in regulation 142/2011 the use of carrion of all sources to feed scavenging species of the habitat and bird directive, this new possibility in biodiversity conservation should not only be used much more often but also research is necessary as our new findings show.

Ochlodes sylvanus feeding on badger carcass.
Photo: René Krawczynski.

15.35-15.50 BEHIND HECK CATTLE – CRYPTOGAMS ON DUNG AND BONES

Hans-Georg Wagner, postdoctoral researcher,
Cottbus University.

Behind Heck Cattle – droppings and bones

When talking of rewilding the focus is generally set on the rewilding of single species such as Beaver or European Bison. Their effect on vegetation is generally also taken into mind. What is mostly not considered is the effect of rewilding on other species such as symbionts, parasites or commensals. Such species can be found on the remains of large herbivores. Remains of large herbivores are their daily droppings and finally their carcasses. Both remains are source of complicated food webs which are not totally understood yet. Essential part of these food webs is micro flora. However, micro fungi, lichens and mosses on droppings and bones are even less well known than the faunal part of these food webs. Biodiversity conservation has to consider all species and not only some flagships.

20 year old cattle bone.
Photo: René Krwczynski.

This presentation will drag some cryptogams out of their hiding places on dung and bone. Findings range from species new to the study area, new for the substrate and possibly new to science.

White tailed eagle scavenging carcass.
Photo: Camera trap.

15.50-16.05

REWILDING AND FOREST BIODIVERSITY – FACTS AND ANECDOTES

Jacob Heilmann-Clausen, **postdoctoral researcher**, University of Copenhagen.

Forests are highly biodiverse ecosystems, but are in many parts of the world tamed to answer human demands for timber and fuelwood. In this taming process natural abiotic disturbance agents including storm, fire, erosion and natural hydrological regimes have been eradicated or strongly reduced. The resulting loss of habitat variability and forest biodiversity is well documented. The decline of diversity due to the diminish of megafauna is much older and less well understood, especially in the temperate zone.

There is little doubt that processes maintained by large mammals, such as grazing, tree felling and soil disturbance had an uneven impact on forest structure and habitat diversity in time and space. This unevenness was not only affected by +/- static differences in soil quality, climate and geography, but also by highly dynamic abiotic disturbance agents, as mentioned above. Even in modern forests, it is easily observed that canopy gaps created by storm result in very varied plant communities and succession pathways depending on grazing pressure and soil conditions. Similarly, it is well-documented that beavers have substantial impact on forest openness and hydrology, and may be a key agent in the attempt to restore natural hydrological regimes in forests affected by drainage and ditching.

In a conservation context, it is noteworthy that many untouched forest reserves in Europe are growing darker and denser due to the cessation of previous husbandry grazing or traditional management regimes focusing on hay production, coppicing and pollarding. These forests often witness a decline of species associated with forest edges and other transient habitats, even if they are in a process of growing wilder. The reintroduction of extinct megafauna presents a promising avenue for enhancing the variation in such forest, most likely with substantial positive effects on biodiversity. The same is obviously the case when forests shaped by modern forestry are changed to non-intervention forest reserves. Scientific support for these positive effects are however sparse and research documenting the effects of rewillding on biodiversity is badly needed. In summary, and based on present knowledge, I do not recommend to use rewiliding uncritically as a *solve all* solution to conserve endangered forest species in fragmented landscapes. Rather, I recommend rewilding as a *process catalogue* providing useful tools to enhance forest structural diversity on various scales in time and space.

Left: Forest gap from the Białowieża National Park. Right: Forest gap and heavy browsing from Lille Vildmose.
Photos: Jacob Heilmann-Clausen.

16.05-16.15

DISCUSSION: EXPECTED AND UNEXPECTED EFFECTS OF REWILDING ON BIODIVERSITY

Moderator: René Krawczynski

This session of talks highlighted some of the unanticipated impacts of rewilding, particularly those relating to animal waste products. The question was posed what are other unanticipated impacts of rewilding? Although, no answer was provided this seems to be an important question worth considering further as the complex nature of species interactions are likely to have further impacts. This is an area where rewilding itself may be particularly informative.

The impact of herbivores in forests is another area that has received little attention in the rewilding agenda. To date it is a concept that has met considerable resistance and field experiments are needed. There is a state forest in Germany that is open to grazing and may offer some help in addressing this gap in the research.

When trying to restore function numerous aspects of the animals and how they are going to interact with the environment need to be considered. It was observed that issues relating to disease, parasites and treatment can present problems when reintroducing species that could have implications for the individuals reintroduced and/or species throughout the food web.

The results from the carcass study suggest that insect fauna varies with species, size of species, age of carcass and time of year. Scavengers also use carcasses in a variety of ways with some species consuming the carcass itself and others consuming the insects feeding on the carcass.

SESSION 6 TARGETS AND CONFLICTS IN MANAGEMENT

REWILDING AS A TOOL 3

16.15-16.30 ARE FENCED BEASTS WILDER?

Chris Sandom, postdoctoral researcher, Aarhus University.

We explore the distinction between reintroduction for species conservation (classical reintroduction), and reintroduction to restore ecosystem function (rewilding), using the example of reintroducing wolves to a protected area. Rewilding seeks to restore species interactions that constitute ecological processes and require natural population dynamics to function. Predation is a key process that impacts herbivore densities and behaviour that turn affect vegetation community dynamics. Protected areas are often small and unfenced and so population dynamics of large mammals, particularly predators, within are typically affected by human-wildlife conflict outside, especially where increased mortality rates create population sinks. Using computational modelling we primarily examined the extent to which boundary permeability to dispersal affects wolf population viability and the strength of predator control of prey numbers (top-down forcing). Increasing boundary permeability decreased maximum wolf densities, reduced the strength of strong top-down forcing and increased population viability until the loss of dispersers was too great to support successful establishment. Our model indicated that threshold wolf densities are required to exert strong top-down forcing and that this ecological process was lost at lower rates of disperser loss than were needed to threaten population viability. Where high, threshold population densities are required to exert functional relationships relatively light direct or indirect negative human interactions may prevent the reintroduction of function (rewilding) but still allow species conservation. Fencing out detrimental anthropogenic interactions may be important to restore functional processes within protected areas.

Wolf from the Highland Wildlife Park, Scotland. Photo: Chris Sandom.

Red deer (*Cervus elaphus*) at the Alladale Wilderness Reserve, Scotland. Photo: Chris Sandom.

16.30-16.45 THE ROLE OF FENCES IN DANISH DEER MANAGEMENT

Rita Buttenschøn, senior advisor,
University of Copenhagen.

There are too many – and too small – fenced enclosures in forest and nature areas in Denmark. They are meant either to keep deer out of forest plantings or to control grazing in the fencings. But fences have a negative effect as they act as fauna barriers in general and keep the deer out of some of the most valuable habitats and thereby enhance browse pressure at other parts of the forest. Fences are expensive to establish and maintain and deer might get hurt by the fences (Madsen et al. 2009). But most important; fences add to the fragmentation of habitats by preventing development of interface zones between open land and forest.

Can populations of unfenced deer maintain open habitats in larger mosaic landscapes? We believe so and hope to demonstrate this through integrated forest-, nature- and game-management projects with red and fallow deer at Zealand and Bornholm. Grazing pressure of free-ranging deer – expressed as mean number of animals/area unit – is generally much lower than the grazing pressure of livestock in conservation management. But that might to some degree be compensated in deer grazing. There is a large variation in grazing pressure in fenced as well as unfenced situation due to diet preferences as well as differences in the impact on vegetation by the different grazers. Even a very low density of roe deer at Skovbjerg at Mols has a larger effect at tree and bush regeneration than forest cattle grazing at a 10-fold higher stocking rate (Buttenschøn & Buttenschøn 2011). Preliminary results from a study at Bornholm indicate that fallow deer – at a rather low density, about 20 animals in a 50 ha large enclosure maintain the woodland pastures with a low, fresh vegetation and create seedbeds for light demanding species. Soft rush (*Juncus effusus*), tussock grass (*Deschampsia caespitosa*) are eaten as long as they are growing on a relative productive soil.

Fences may add to the fragmentation of habitats by preventing development of interface zones between open land and forest. Part of the wetland "Kærene" at Læsø is maintained by cattle grazing as open wet *Erica tetralix* heath with light demanding species while the ungrazed part is overgrown with willow and birch.
Photo: Rita Merete Buttenschøn.

A large population of free-ranging reed deer may maintain the dune heaths with a low growing, fresh *Calluna* vegetation as experienced in dune heath close to Grærup Langsø at Oksbøl. In a comparable study in Thy Camilla Kirkegaard-Sørensen (2008) found, that the current density of red deer seem to be able to keep the vegetation, in both dwarf shrub communities and moist *Molinia* communities, in states comparable with the ones resulting from grazing by domestic animals.

Preconditions for management of semi-natural habitats by free-ranging deer

A mosaic ranging from open land to dense forest, forest regeneration based on unfenced game-robust afforestation, woodland meadows kept in a dietary attractive state combined with fodder-fields of bushes for winter browse reduces deer foraging on arable land. Reduction of traditional feeding places to enhance the utilization of a diverse nature-based dietary choice. Besides diverse foraging possibilities deer need dense sanctuaries into which they may withdraw from human disturbance: hunting, cross-country-sporting like mountain-biking.

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16.45-17.00 DISCUSSION: FENCES FOR CONSERVATION CLOSING SESSION

Moderator: Jens-Christian Svenning

The question was posed what are the social and psychological impacts of fencing? The original Alladale proposal of a fenced wilderness reserve was initially developed by owner Paul Lister as a mechanism to allow species reintroduction within a cultural landscape (Sandom *et al.* 2011). The idea is that a tract of wilderness could be created while minimising impacts on society. However, fences are also controversial. Relatively new legislation in Scotland has protected the "right to roam", i.e. the public have the right of access to much of the open land in Scotland with some exceptions. The creation of a large fenced area obviously restricts this freedom to some extent; although a fence does not necessarily prevent access. Finding a suitable balance between the right to access and enjoy Scotland's beautiful landscape but also facilitate landscape scale ecological restoration that is acceptable to the local public is a significant challenge. A similar experience in Germany was reported where former military ground was converted to an area of conservation. Large animals were introduced with fences and access was prevented which upset people. However, access was restricted primarily because of the threat posed by ammunition in the soil. Fences constrain movements of mammals, including humans, and while solving potential conflicts with traffic, farming and recreation, the fences are also being perceived as negative artificial barriers in the landscape.

Fences affect the distribution of large mammals in the landscape and the question was asked if there are too many fallow deer and how they interact with a fenced environment. There is a lack of information regarding fallow deer. However, the point was also made that eutrophication is a much greater problem than overgrazing in Denmark. Furthermore, fences have generally been avoided in Denmark based on a resistance to fence a '"wild" free-roaming population of deer. However, to keep deer away from cultivated fields managers have fertilized fields within the forest which has destroyed natural forest glade communities of extraordinarily conservation interest for especially arthropods, but also vascular plants. In this scenario it is suggested that fences are a more attractive solution than to cultivate the uncultivated habitats.

The point was made that although landscape scale fenced reserves to facilitate predator reintroduction might be appropriate for the Scottish Highlands it is not suitable for mainland Europe where predators are returning naturally. However, although predators are expanding in Europe they may still be effectively functionally extinct as a result of human-wildlife conflict (reported from all wolf populations in Europe, see Salvatori and Linnell 2005) if this conflict suppresses predator density. If this is the case then separating predators from anthropogenic mortality is an important objective in rewilding. In this case fencing, whether physical, biological or ecological, is perhaps warranted. For instance, the use of artificial scent marking and recorded howling at the edges of rewilding zones, simulating a dense wolf population in the surrounding area, may discourage some dispersing wolves from leaving and so reduce the rate of disperser loss. This in turn may increase wolf and pack density within the rewilded zone and so affect the functioning of the process of predation. We should encourage further research into how processes rather than simply species are reintroduced to landscapes.

Support was provided for fences as they can be good at easing the minds of people and so allow a project to be accepted and started. In turn the project may allow the process of education to begin in time a public understanding may allow the fences to come down. The argument was made that maybe fences should not come down in time because of emergent conflicts with agriculture. Farming is generally not compatible with naturally functioning ecosystems. This final point highlights the potential difficulties in determining how and when people and their land uses can be integrated with a naturally functioning wild landscape.

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Rewilding as tool and target in the management for biodiversity