Large-scale nature development – the Oostvaardersplassen

Konik ponies and Red Deer grazing on the Oostvaardersplassen. Ruben Smit/www.rubensmit.nl

Frans W M Vera

Once, Europe was one large natural area, across which species of animals and plants were able freely to move and disperse. Today, a satellite image of Europe looks like a Persian carpet cut into millions of small rectangular pieces, each fashioned by the plough and the spade over thousands of years of cultivation. The consequence of this change is that species have disappeared. For example, animals such as the Aurochs *Bos primigenius* and the Tarpan *Equus przewalski gmelini* (wild progenitors of our domestic breeds of cattle and horse) have become extinct. Species that have survived have disappeared from large parts of their natural range. Examples include Red Deer *Cervus elaphus*, Elk *Alces alces*, Wolf *Canis lupus*, Lynx *Lynx lynx*, Common Crane *Grus grus*, White-tailed Eagle *Haliaeetus albicilla*, Pedunculate and Sessile Oak *Quercus robur* and *Q. petraea*, Large-leaved and Small-leaved Lime *Tilia platyphyllos* and *T. cordata*, Wild Pear *Pyrus pyraster* and Wild Service-tree *Sorbus torminalis*.

The shifting baseline syndrome

The remarkable thing is that many nature conservationists seem not to mourn this loss. At least that could be concluded from the fact that they protect the cultural landscapes that have caused the species to disappear; they even preserve them as nature reserves. Why do nature conservationists seem so tolerant of this loss of biodiversity, while at the same time maintaining that their efforts are aimed at preventing a loss of biodiversity?

The answer perhaps lies in a phenomenon known as the 'Shifting Baseline Syndrome', which was formulated by the fisheries scientist Daniel

Pauly in 1995. It arises when:

- each new generation does not know what nature may have looked like before mankind started to cultivate;
- the cultivated landscape and the wildlife within it changes almost imperceptably for each generation;
- each new generation defines what is 'natural' according to its own experience of the (changed) cultural landscape it has encountered, and uses this as a baseline against which to measure changes in the environment.

Lacking an understanding of a baseline of 'undisturbed nature', every new generation defines cultural landscapes and forests where there is some wildlife as 'nature' or 'natural', not being aware that compared with the experiences of former generations the wildlife has changed as a result of developments in agriculture and forestry. The consequences are (Pauly 1995; Sheppard 1995):

- each new generation tends to view as 'natural' the environment it remembers from its youth;
- the perception of ecological change alters from generation to generation;
- there is a continual lowering of the benchmark for what is 'natural';
- a degraded natural state is considered as normal;
- society as a whole becomes very tolerant of the creeping loss of biodiversity;
- a large educational hurdle is created to reset expectations and targets for nature conservation.

An example of shifting baselines can be seen in the way that many nature conservationists and laymen look to cattle in relation to nature, and the consequences that this perception has had for the baseline for nature conservation.

When scientists started to reconstruct the baseline for nature at the beginning of the 19th century through to the early 20th century, mankind with his plough, cattle and other livestock was considered to have altered the natural vegetation. German and Swiss foresters such as Cotta (1816) and Landolt (1866), as well as later British foresters and plant geographers such as Forbes, Moss, Tansley and Watt all assumed that if mankind ended ploughing and grazing livestock 'Mother Nature' would take over again. What developed on old fields and pastures abandoned by domestic livestock was considered as the return of the natural vegetation. Illustrative of this is what the British forester Forbes wrote in 1902: 'There is little reason to doubt, therefore, what the result of leaving land entirely to Nature would be. So far as indigenous species [of trees] are concerned we have only to fence off a piece of ground from cattle, sheep, and rabbits, and quickly get a sample of indigenous forest of one or other types mentioned above. . . . Even when unfenced, thousands of oak, ash, beech, and other seedlings spring up in every pasture after a good seed year, and where seed-bearing trees are within a reasonable distance. Such instances prove the capability of Nature to reassert herself whenever she gets the opportunity, and there is little doubt that this country would regain its original conditions in a hundred years or so if men and domestic animals were to disappear from it.'

The closed canopy forest as the baseline for the undisturbed, natural vegetation

So, at the beginning of the 20th century the common belief was that in an undisturbed situation forest covered Great Britain, as well as the mainland of Europe. This forest had been destroyed by ploughing and the grazing of livestock (Forbes 1902; Moss 1913; Moss *et al.* 1910; Tansley 1911). The forest would regenerate by the replacement of dead and windblown trees, either in gaps in the canopy or in large, open, windblown areas. Here, daylight would penetrate down to the forest floor where seedlings and saplings were waiting for the opportunity to get the amount of light that they need to grow successfully and fill in the open area with their expanding crowns, once again closing the canopy (Watt 1947; Leibundgut 1978).

At that time, it was very well known that large ungulates such as cattle and deer could prevent the regeneration of trees in the forest and change it slowly to grassland or heath. This process was called a retrogressive succession (Moss *et al.* 1910; Tansley 1911). Therefore these animals were considered as potential threats to the forest. The grazing of commoners' livestock in unenclosed forests that were part of a wood-pasture system was considered by foresters to be a particular nuisance. Foresters and plant geographers alike considered the livestock to be exotic species introduced by man, and therefore not belonging to nature (Forbes 1902; Tansley 1911; Moss 1913). Grasslands were considered to be artificial prod-

ucts, 'stolen' from the forest (Warming 1909). The sight of thousands of seedlings of oaks, Ash *Fraxinus excelsior* and Beech *Fagus sylvatica* springing up after a good seed year in grazed pastures, was interpreted as demonstrating the capability of the forest to return if the grazing was stopped. In this way, a closed-canopy forest became the baseline for undisturbed, natural vegetation. Tansley wrote about this: 'Grassland and heath have no doubt originated mainly from the clearing of the woodland, and the pasturing of sheep and cattle. . . . In some cases where grassland is not pastured, the shrubs and the trees of the formation recolonize the open land, and woodland is regenerated' (Tansley 1911).

As a consequence of accepting the closed-canopy forest as the baseline for natural vegetation, Red Deer and Roe Deer *Capreolus capreolus* were characterised as forest animals. They were supposed to have lived in a natural state in such numbers that there was an equilibrium between the seedlings that are eaten and the regeneration of the woodland. The situation was considered unnatural if the densities were so high that the regeneration of the forest was threatened (Tansley 1953). This meant that, under natural conditions, all known wild ungulates lived at very low densities, such as 0.5-3 Red Deer per 100ha or 4-5 Roe Deer per 100ha (Wolfe & von Berg 1988; Remmert 1991).

The shifted baseline for indigenous large ungulates

When scientists first constructed a baseline for natural vegetation in Europe, it was not known that the Aurochs was an indigenous species, nor that it was the wild ancestor of domestic cattle. It became extinct in 1627 and it was only in 1827 that the Aurochs was scientifically described. However, it was then considered to have been a species that lived in Europe in the Pleistocene and had become extinct around 15,000 years ago, when the present warm period, the Holocene, started. It was not until 1878, after the study of old historical sources, that it was concluded and published that the Aurochs lived in Europe during the Holocene through to historical times. It was not until 1927, after extensive studies of bone material, that the Aurochs was recognised as the wild ancestor of cattle (Van Vuure 2005). By then, the closed-canopy forest in Europe was already widely accepted in science as the baseline for natural vegetation.

An important confirmation of this view that forest was the natural vegetation of most of Europe came from palynology, the science that reconstructs past vegetations by means of identifying pollen found in sediments. From 1916 palynologists interpreted their pollen diagrams as the reconstruction of the history of the forest (Vera 2000). The concept of forest as a baseline for the natural vegetation was so strongly supported by the scientific fraternity, that when the existence of the Aurochs became widely known and accepted, the species was characterised as a forest animal, like Red and Roe Deer. As with deer, it was postulated that the Aurochs would have lived naturally in such low numbers that there was an equilibrium such that the survival of the forest was not jeopardised (Tansley 1953).

Until recently, the horse was not considered part of the indigenous fauna of Europe. The reason was that the only known (and still extant) wild horse, the Przewalski's Horse *Equus przewalskii*, as well as its relatives, Burchell's Zebra *Equus burchellii* and Grevy's Zebra *Equus grevyi*, and the Asian wild asses, the Kulan *Equus hemionus kulan* and Onager *E. h. onager*, all live in open grassy landscapes. All horse species were therefore considered to be open grassland species. The common view among palaeo-ecologists and archaeologists was that the wild horse disappeared from western and central Europe around 10,000 years ago, when the (reconstructed) forest invaded the area. Since this was not the natural habitat of the horse, it disappeared from these regions, surviving only in the steppes of eastern Europe and Asia.

What contributed to this view was that, initially, all the fossils of horses that were found in western and central Europe dated back to the Neolithic and later, the period when agriculture was established in Europe. Therefore, they were interpreted as being the remains of domestic horses, introduced by man (Van Wijngaarden-Bakker 1975). However, since then, fossils of horses have been found dating back to the time before agriculture, and doubts have arisen. The frequent occurrence of Aurochs and, to a lesser extent, of horse in the Atlantic and Sub-boreal periods – when a primeval dense forest is supposed to have been present – has recently led to the suggestion that their presence is an indication of a more open landscape

Konik ponies grazing amongst willow scrub and trees on the Oostvaardersplassen. Ruben Smit/www.rubensmit.nl

(Zeiler 1997; Laarman 2001; Peeters 2007). This horse would have been the Tarpan, a wild horse known from Europe in historic times.

Circular reasoning

The baseline of a close-canopy forest for the natural conditions has greatly influenced the view of both foresters and nature conservationists on the role of large indigenous ungulates in nature. It meant not only that under natural conditions wild ungulates live in very low densities, but also that they follow vegetational succession, as in theory the outcome of unhindered succession without large, wild ungulates is no different to that with them. However, the reconstruction of dense forest as the baseline for the natural vegetation and the influence of large wild ungulates is a example of circular reasoning, namely: the forest vegetation that develops in the absence of any influence of indigenous large ungulates is the natural vegetation, and because the natural vegetation is a forest, the indigenous large, wild ungulates do not have any influence on the development of the natural vegetation.

Oostvaardersplassen

In The Netherlands, the Oostvaardersplassen changed all this. This nature reserve arose in 1968, when the South Flevoland polder was reclaimed from Lake IJssel. Oostvaardersplassen consists of 6,000ha of open water, marshland, wet and dry open grasslands and flowering communities with trees and shrubs. The soil is very fertile calcareous clay. The reserve has revealed that nature is highly resilient and has demonstrated a baseline for a more species-rich and more complete naturally functioning ecosystem. Bird species, such as the Spoonbill *Platalea leucorodia*, Bittern *Botaurus stellarus*, Marsh Harrier *Circus aeruginosus* and Bearded Tit *Panuris biarmicus*, that had become very rare in The Netherlands, established themselves as breeding birds in numbers that were high in comparison to other nature reserves in north-western Europe (Vera 1988). The area also attracted species which had disappeared as breeding species from The Netherlands, such as the Greylag Goose *Anser anser*, Great White Egret *Ardea alba* and White-tailed Eagle *Haliaeëtus albicilla*, a pair of which established a territory in the area and has bred since 2006. A pair of Ospreys *Pandion haliaetus* built a nest in 2002 but did not breed.

A paradigm shift

Up to 30,000 (non-breeding) Greylag Geese retreat to the marshes to moult their wing feathers

Heck cattle and Greylag Geese amongst the extensive reedbeds of Oostvaardersplassen.
Ruben Smit/www.rubensmit.nl

(Van Eerden *et al.* 1997). They graze the marshland vegetation, especially the Common Reed *Phragmites australis* and the bulrushes *Typha*, to such an extent that closed reedbeds have turned into open water, something which up until then it was thought only human management could achieve. The Greylag Geese have created a mosaic of open water and marsh vegetation from which countless species of wild animal and plant have benefited, enabling them to continue to exist in the area. Contrary to the common belief that herbivores follow only the succession of the vegetation, the Greylag Geese were instrumental in driving it.

Fluctuations in the marshland's water level, influenced by precipitation and evaporation, and by wet and dry years, also affected the behaviour of the geese. When the marshland is dry, the geese seek out other areas in which to moult. Sightings of birds with specific coloured rings showed that the Greylag Geese switched between the Oostvaardersplassen, the Danish island of Saltholm and the Swedish island of Öland (Zijlstra *et al.* 1991; Nilsson *et al.* 2001). During the geese's absence from the Oostvaardersplassen, the grazed vegetation recovered.

Because of the grazing of the geese, in combination with fluctuations of the water level, the traditional human management of reed-cutting was not needed. But, as a result of the geese grazing, up to 45 pairs of Bittern and more than 1,000 pairs of Bearded Tits are present. This example of the role of a large herbivorous bird in directing succession has caused a shift in the thinking about the potential for creating conditions where ecosystems can function naturally.

A more complete ecosystem

Greylag Geese also need open grasslands on dry land adjacent to the marshy areas in which to congregate before and after the moult. Without grassland Greylag Geese could not congregate before and after their moult, which in turn would prevent the Greylag Geese from creating a mosaic of open water and marsh vegetation, and countless animal and plant species would disappear from the marsh. In order to develop and maintain the grassland, it was proposed by some that farming should be incorporated into a dry area adjacent to the marsh. The reasoning was that domestic cattle were needed to create and maintain open grasslands. Others, myself included, argued that if this was so, their wild ancestor, the Aurochs must have also been able to do this (Vera 1988; Vulink & Van Eerden 2001). This also applied to that other indigenous specialised grass-eater, the Tarpan. But as the Aurochs and the Tarpan are extinct, suit-

able replacements were sought among these species' descendents, namely breeds of cattle and horse which could act as proxies for their wild ancestors. Heck cattle and Konik ponies were chosen, because they have undergone very little selective breeding and may therefore have many of the characteristics of their wild ancestors. These natural characteristics could then be redeveloped by allowing the animals to live in the wild and become feral (Vera 1988).

Nature conservationists, as well as scientists, opposed this approach, arguing that a closed-canopy forest would then develop, because – as the reconstructed natural vegetation forest proved – wild, large indigenous ungulates would not be able to prevent a closed-canopy forest from developing. In their opinion, grassland could only be developed in an artificial way through farming. After much discussion, the argument was settled in favour of the wild cattle and horses.

Great White Egret feeding with Koniks at Oostvaardersplassen.
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The Heck cattle and Koniks live in the nature reserve year round. This means that the number of animals grazing during the growing season is determined by the number of animals that have survived the preceding winter. During the winter, part of the population of animals dies off as a result of the lack of food. This causes undergrazing during the following spring and summer, as the remaining animals are unable to eat as much plant growth as would a larger herd. The animals do not graze every part of the reserve equally intensively (Cornelissen *et al.* 2004). The areas which are not grazed or are grazed less during the growing season turn into long grass and forbs, which benefits mice and the birds which feed on them, such as Great White Egrets, Marsh Harriers and Buzzards *Buteo buteo*.

More species of ungulates

However, the natural environment was home not just to grass-eating wild ungulates, such as horses and cattle, but also to animals which feed on a combination of grasses and the leaves of trees and shrubs, such as Red Deer, or specialised browsers such as Roe Deer and Elk. All these animals have different effects on the natural vegetation, because of their different food preferences (Van de Veen & Van Wieren 1980; Van Wieren 1996). The specialised grass-eaters generally promote the establishment of trees and shrubs through grazing, while mixed feeders such as the Red Deer that browse and debark shrubs and trees slow down this effect. The range of feeding strategies of the different species of ungulate constitute a system of checks and balances, preventing any single type of vegetation from becoming totally dominant. Together, all the herbivores ensured a varied vegetation, which enabled the continued existence of a full range of wild species of plants and animals (Vera 2000; Duffy 2003). Like the Greylag Geese in the marsh, at the Oostvaardersplassen the large herbivores similarly play a key role in maintaining diversity in the dry areas (Sinclair & Norton-Griffiths 1979; Vera 2000; Vera *et al.* 2006). In order to augment the effect of horse and cattle grazing at the Oostvaardersplassen as described above, Red Deer were introduced.

These large ungulates nowadays create open grassland, where, besides the 30,000 Greylag Geese, up to 14,000 Barnacle Geese *Branta leucopsis* winter, and more than 10,000 Wigeons

Anas penelope also graze. More than 10,000 Lapwings *Vanellus vanellus* and Golden Plovers *Pluvialis apricaria* can regularly be seen there, the former breeding successfully in the grassland. These are all bird species that, because of shifted perspectives in nature conservation, are supposed to need pastoral farming for their survival. They certainly do not. They need an ecosystem on fertile soils that is complete with indigenous, wild large ungulates, as had been the case before farming took place.

In other parts of the dry areas of the reserve the large ungulates create the conditions for the establishment of thorny shrub species such as Blackthorn *Prunus spinosa* and Hawthorn *Crataegus monogyna*. These spiny so-called 'nurse' species make it possible for seedlings of larger trees to grow up successfully in the presence of very high densities of large ungulates. In this way, large wild ungulates can create a park-like landscape known as wood-pasture (Vera 2000; Vera *et al.* 2006, 2007). To what extent this will happen in a fertile young area such as the Oostvaardersplassen, is a question that has yet to be answered. Seedlings of Blackthorn and Hawthorn have already been found in parts of the area that the animals use only during the winter, that is, outside the growing season of the plants. Tree and shrub species such as oaks, elms, Ash, Elder *Sambucus nigra*, roses and Hazel have also established themselves in a thorny scrub that originated from Blackthorns that were introduced to the area. The remarkable thing is that once these spiny species were established, other woody species grew spontaneously in the scrub in an area with densities of three Red Deer per ha during the winter, when they browse trees most intensively.

Regulation of the number of large ungulates

Animal numbers have increased steadily in the Oostvaardersplassen. Over the summer they can put down enough fat to last them through the winter. Eventually, however, the increase in numbers comes to a halt when food sources run out. Animals become emaciated and some die through lack of food (Gill 1991; Mduma *et al.* 1999; Grange *et al.* 2004; Höner *et al.* 2005). This sequence of events takes place in natural areas such as the Serengeti and the Ngorongoro crater in Tanzania, Africa. In, for instance, the Serengeti, where there are also large predators such as Lion *Panthera leo* (average density: 1 per 1,000ha) and

The death of large herbivores on the Oostvaardersplassen has highlighted the problems of adapting animal welfare concerns with naturalistic grazing regimes. Ruben Smit/www.rubensmit.nl

Spotted Hyena *Crocuta crocuta* (average density: 3 per 1,000ha), it is the amount of food that regulates the numbers, not large predators. Research has shown that only 25% of Wildebeest *Connochaetes taurinus* deaths were caused by large predators. This means that the remaining 75% of deaths were the result of malnutrition. What is also remarkable is that only 6% of the animals in poor shape that died were killed by large predators (Sinclair *et al.* 1985; Mduma *et al.* 1999; Kissui & Packer 2004). But at the Oostvaardersplassen it was considered that animal welfare in the nature reserve was being compromised, as the animals were becoming thin and some were dying. Also, there was a fence around the area preventing them from migrating to areas where there was still food.

Once again, the situation at the Oostvaardersplassen became victim of a different type of shifting baseline. Animal welfare was being compared against an agricultural benchmark. The Dierenbescherming, an animal welfare NGO, sued Staatsbosbeheer, the government agency responsible for the reserve. In court, the deteriorating condition of cattle and horses in winter was compared by them with the condition of farm livestock. With the disappearance of wild cattle and horses, an understanding of their welfare has disappeared, and, for these species, has been redefined according to experiences with domesticated animals on farms. The fact that wild-living cattle and horses in the Oostvaardersplassen had a completely free life with a natural social order, that the calves and foals stay with their mother, and have a natural social order like that of other large bovine ungulates and equids living in the wild, did not seem to matter. This aspect of their freedom is forgotten or ignored. The animal welfare group lost, appealed and lost again. The most remarkable part of the verdict was that the judge said that Staatsbosbeheer introduced the cattle, horses and Red Deer without the intention of getting them back under its disposal. Therefore, Staatsbosbeheer has lost the animals as its 'property'. They belong to nobody and so are *de jure* 'wild animals' (*res nullius*: nobody's object).

The percentage die-off at the Oostvaardersplassen over the last four years, when, according to the numbers without supplementary feeding, saturation densities seem to have been reached, varied in cattle between 6% (2008) and 34% (2005), in horses between 15% (2008) and 24% (2007) and in Red Deer between 10% (2008) and 25% (2009). The numbers of cattle have more or less stabilised, horses have almost stabilised, and the Red Deer population seems to have stabilised, with only 10 less compared with 2008, after the winter of 2009.

The die-off figures cannot be deemed exceptional, and are, according to an international commission (International Committee on the Management of Large Herbivores in the Oostvaardersplassen – ICMO) definitely not unnatural (Young 1994; ICMO 2006). Although there is a fence around the reserve, there is no difference in die-off percentages when compared with natural functioning ecosystems without a fence. Staatsbosbeheer does, however, intervene for the sake of animal welfare on the basis of the advice of the commission (ICMO 2006). It is a reactive management, which means that if an animal's behaviour indicates that its death is impending, it is shot. This almost always occurs at the end of the winter, so the amount of food is regulating the number of animals, as is the case in natural functioning ecosystems (ICMO 2006).

The Red Deer carcasses, which, according to the Dutch Law on the destruction of animal carcasses, may be left where the animals fall, serve as food for large birds of prey such as the White-tailed Eagle. Since 2006, a pair of White-tailed Eagles have bred in the area (they raised one young in 2006 and 2007 and two in 2008). With Europe's largest eagle as a breeding bird, the Oostvaardersplassen has disproved the conventional wisdom that eagles cannot breed in densely populated countries such as The Netherlands. On 16th March 2005, a Black Vulture *Aegypius monachus* arrived in the area and stayed there for months. She may still have been there had she not been killed on 15th August by a train on the railway that borders the nature reserve.

The future

The Oostvaardersplassen represents an option for the future for nature and nature conservation in Europe. Are we going to base our plans on the benchmark of the cut-up Persian carpet (Quammen 1996)? If so, the agricultural man-made landscape will be the only baseline for nature and its management, and consequently the standards and values applied to the biodiversity that has survived on agricultural land and the welfare of domestic

livestock will be the baseline applied to the wider natural world and the welfare of large ungulates living in the wild. If we follow this path it will be impossible for many plant and animal species that disappeared as a result of the introduction of agriculture to return.

The other option is to develop large, natural-functioning areas where natural processes get the chance to evolve. In that case, a new baseline for nature as well as for the welfare of wild-living large mammals, including wild cattle and horses, alongside that in existence for domestic livestock will need to be developed. We shall then also have to learn to co-exist with animals living a truly wild existence, periodically losing condition, and a number dying off as a result of lack of food. If we are unable to do this, we run the risk of making the presence of unfettered nature impossible.

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Dr Frans W M Vera, Wageningen University Research, Wageningen, The Netherlands