Natural Disturbance as a Rewilding Tool

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A Day of Disturbance

Five centuries ago, the sun rises over a European countryside filled with a mosaic of grassland, thickets and trees.

As the early morning mist clears, a huge, black, auroch bull heaves himself up from his regular overnight resting place, leaving a depressed area of crushed, dying plants and dampness. This is perfect for a variety of species and they have started to move in.

He wanders off towards an area rich in nutrients where he knows there's good grazing. He glances up at some well-covered steeper slopes - he doesn't fancy the effort and moves on - and the vegetation grows denser and denser by his scorning. He leaves a trail of hoof prints, breaking the soil in damper patches so seeds can quickly take advantage, while, in drier areas, pits are created, much loved by the local ground-nesting birds. He wrecks a thicket on his way to join his herd, simply from his bulk and by browsing. Other plants will soon make use of the extra space and light, followed eventually by the accompanying arthropods, birds and mammals. When he reaches one of the richest grazing patches, he contentedly mows through some of his favourite plants, leaving an opportunity for less competitive ones to gain a foothold, with their attendant herbivores and predators not far behind.

Over time, his herd's previous resting area was turned into a wallow from depressing and compacting of the soil. The wetness and the exposed earth created an assortment of new ecological niches. As the day grows hotter, he plods off with the herd towards their wallow, with the occasional pause to defecate and urinate, inadvertently dispersing nourishment and seeds. In a short time, these will show up as more intense patches of vegetation.

A group of wild boars doesn't even look up as he passes. They are more intent on ploughing up large areas of ground in search of tubers. They leave a trail of destruction behind them. Seeds, already present, are freed from the constraints of the more dominate plants, and soon, many rarer species will flourish. These are the favourites of many herbivores which lose no time in moving in. Their predators aren't far behind.

Sadly, one day, our auroch and the boars die to leave significant nutrients for a myriad of species from large scavengers to arthropods, fungi and plants. Years later, these patches will still be visible as denser areas of vegetation.

Even more sadly, by the 1600s, wild boar in the UK and the auroch in Europe will have been hunted to extinction with a corresponding loss of the natural disturbance they and other large mammals caused.

Today

Man's effect on ecosystems has resulted in a significant reduction in global biodiversity. Large mammals have been particularly badly affected and their loss has had a profound effect on the processes and dynamics of ecosystems which further aggravates the problem.

Fire, flood and wind are also key disturbances and, together with the large mammals, have highly complex effects. Each will have detrimental or beneficial influences on individual species and ecosystems depending on how, where and when they occur, their frequency and what has happened historically.

Some conservationists have been using elements of disturbance for decades and one of the most important early papers was published as long ago as 1978. However, it is only recently that its critical importance has gained more widespread recognition.

Disturbance keeps the environmental systems in a continuous state of nonequilibrium. This changes their composition, structure and diversity, and gives rise to more niches, and more species. Now, it is generally believed that, without disturbance, all aspects of a fully functioning ecosystem will be hindered.

In fact, the effects of disturbance are even more far-reaching, as they have undoubtedly been important agents of natural selection.

Distinguishing the different types of disturbance and how they operate is, therefore, a critical issue of ecology, conservation biology and wildlife management.

Types of Disturbance

Fire

Fire has been present since before life began, so some ecosystems have evolved to cope with its consequences. In fact, many species benefit from fire and become more prolific. In these regions, if fire is reduced, so is biodiversity.

Mankind influences the occurrence of fire in a variety of ways, normally to the detriment of healthy ecosystems and biodiversity.

We make use of it in farming to encourage insect-free monocultures. However, fire is generally dangerous to humans, so we take steps to prevent it. Reducing the frequency of fire increases the available fuel, so that, when it does occur, the intensity is increased. We may also see the opposite effect, by increasing the frequency, for example, due to climate change. Either of these changes may go beyond the ecosystem's ability to readily recover and will, therefore, be highly detrimental.

Many regions are not used to fire, so, when it is introduced by mankind, it can cause irreversible damage to species composition and interactions.

Wind

When a tree falls, a host of environmental changes will occur, albeit over a relatively small area. Many species will lose their homes and food, but the reverse is true for others; there will be an exposed rootwad to colonise and provide den opportunities; the depression may create a temporary pond which will benefit specific plants and possibly even amphibians; the decaying trunk will be ideal for hundreds of species; and the increase in sunlight will allow a succession of opportunist plants to flourish, with the corresponding increase in abundance of herbivores and their predators. All this increase in biodiversity derives from just one wind-initiated disturbance.

As well as the more obvious felling of trees, wind also results in redistribution of woody debris and dead plant matter with a corresponding increase and alteration of environmental niches.

However, increased frequency and severity of wind, which is predicted due to climate change, may cause irreversible damage.

Flooding

Areas subject to flooding will change between wet and dry over time, facilitating a turnover of plant communities. Silt and organic matter may be removed or deposited and established plants may be swept away, all of which will alter the distribution of plants and animals.

All these processes create a dynamic environment which is generally beneficial to biodiversity.

However, flooding causes substantial damage to human landscapes, so we mitigate this with flood defences and drainage. The structures themselves damage ecosystems, but, if they succeed in reducing flooding, they will also reduce its beneficial effects.

Climate change is expected to increase the frequency and magnitude of floods which may overwhelm their beneficial effects and eventually reduce environmental variety and biodiversity.

Animal Disturbances

All animals change their environment. Our auroch and wild boars have shown a few effects that they can initiate. Other species will have different feeding habits, behaviour and interactions to further increase the variety of impacts upon the ecosystem. In general though, the bigger the animal, the bigger the effect!

The removal of these larger mammals may be humankind's most damaging influence on nature. Until recently, these losses were mainly viewed as being aesthetic and ethical issues, but now, research has shown their cascade effects on processes are as diverse as disease, wildfire, carbon sequestration and the movement of chemicals around the system. More visibly, there will be less environmental variety and biodiversity, acceleration of local extinctions and the invasion of exotic species. The precise changes will be largely dependent on the herbivore species involved, plant species consumed and climatic conditions.

There is evidence that species richness is greatest where disturbance frequency and intensity are intermediate. Many studies have contradicted this, however, by finding positive, negative, and U-shaped relationships between the levels of disturbance and consequent diversity.

Reintroductions

As we have eliminated most of our large mammals in the UK and now realise that they are an essential part of well-functioning ecosystems, it would seem sensible to put some back. In fact, rewilding with large herbivores has become increasingly popular in Europe, in many cases with much success.

Each large mammal has a highly complex, somewhat unpredictable, effect on the ecosystem. Therefore, reintroductions have extensive consequences and require thorough research before, during and after the process.

Large grazing mammals create irregular patterns of consumption, nutrient deposition through faeces, urine and carcasses, and physical disturbance such as trampling and wallowing. The frequency and density of foraging profoundly affects the composition of plant species. Animals either select the more palatable plants or they consume the commoner ones by chance. At intermediate levels, this will create space which will encourage the growth of less palatable and less competitive species and is important for high floral diversity. Lower levels may have negligible effects, while higher ones are likely to be detrimental. Local

conditions will also affect the outcome; for example, regrowth in arid or nutrient poor environments may be hindered by limited resources causing a lowering of diversity.

In areas of high urine deposition, above-ground biomass can increase fourfold within one year, in turn increasing the likelihood of future grazing in these areas. This further augments the original disturbance in a positivefeedback loop.

Bark stripping by large browsers can induce tree mortality and create gaps in the canopy. This allows more light to fall on the forest floor, stimulating the growth of grass and other plants and creating opportunities for a variety of fauna.

Trampling exposes bare ground for new plant growth, but will also change water infiltration; up, in the case of breaking through the soil or down due to compacting. It can also enhance the breakdown of leaf litter thus accelerating nitrogen incorporation.

Wallowing creates distinctive plant community patches, which can promote local arthropod biodiversity. Dips, with compacted soil, may create ephemeral ponds for breeding amphibians.

Wild boar are popular candidates for reintroduction in ecological restoration projects. They are viewed as ecosystem engineers that create, modify, maintain or destroy habitats and can have strong effects on ecosystem functioning, mainly through their rooting activities. The immediate effect can be a loss of above and below-ground plant cover, but subsequently, the resulting exposed earth provides more niche opportunities and stimulates biodiversity.

At natural densities, wild boar disturb a relatively small proportion of the inhabited area, maybe less than two percent, and reintroductions have generally been beneficial. However, care is essential as higher densities can be destructive so that expensive population control may become necessary.
There is also the risk of damage to plants of aesthetic or conservation significance, such as bluebells. While there are many short-term studies to guide us, the longer-term effects are less well known.

There is evidence, however, that wild boar could be useful for specific tasks. For example, bracken has become an increasing problem as its rhizome network allows it to outcompete other native plants. Rooting reduces bracken frond density (by well over half in one study), although the effects are short lived, so repetition is needed.

Therefore, wild boar can be particularly useful in habitat management by being periodically introduced to an area in order to change local ecosystem processes. While not a reintroduction, it is just as important to understand what impact these animals may have while in the area.

In Conclusion

As we enter the UN Decade of Ecological Restoration, it is vital that natural disturbance is recognised as an integral part of naturally functioning ecosystems.

Large mammals can have profound, beneficial effects, so their reintroduction is an essential consideration for any rewilding project. A significant factor in the feasibility of this is the area of land available, how it connects to neighbouring projects and the potential for increasing the area over time.

Reintroductions have complex and far-reaching effects and require thorough research to ensure the best chances of success.