



# The Keystone Concept

*RESTORING POPULATIONS OF SO-CALLED  
“KEYSTONE” SPECIES IS AN IMPORTANT  
PART OF REWILDING. LEARNING MORE  
ABOUT THE IMPACT OF SUCH SPECIES  
ON ECOSYSTEMS WILL HELP US TO  
IMPROVE REWILDING OUTCOMES.*

**H**igh above the snaking, silvery ribbon of the Arda River, the largest waterway in the Bulgarian **Rhodope Mountains**, a squadron of griffon vultures embarks on morning patrol. Launching themselves from cliffside nests, a steady succession of these iconic birds takes to the warming air, their finger-like primary feathers clawing at the cobalt sky as they begin to soar effortlessly above the dramatic landscape.

Natural-born gliders, vultures never fail to provide an aerial spectacle. Yet beyond their ability to inspire awe, they also play a critical role in maintaining the structure and functioning of natural ecosystems. As such, they are what is known as “keystone species”.

“As scavengers, vultures provide a crucial service by disposing of the carcasses of dead animals,” explains Stoycho Stoychev, team leader of the Rhodope Mountains rewilding team. “They play a critical role in nutrient cycling, leading other scavengers to carrion and reducing the risk of disease. The decline of vulture populations can have dramatic ecological and socio-economic consequences.”

Rewilding at its core is about the mass restoration of ecosystems, creating space where nature can govern itself without human intervention. Supporting wildlife comeback is part of this restoration process. At Rewilding Europe, we recognise the critically important ecological role of all wildlife species, regardless of their position in the food chain. But by restoring populations of keystone species – such as vultures and European bison – we can accelerate and amplify the impact of rewilding on European landscapes.

“This isn’t just about wildlife conservation,” says Raquel Filgueiras, Rewilding Europe’s Head of Rewilding. “Fully intact ecosystems perform many essential functions – purifying air and water, turning decaying matter into nutrients, preventing erosion and flooding, mitigating climate change and enhancing people’s wellbeing. Humans need keystone species to maintain the health and resilience of the ecosystems that support us.”



*Because of its impact on the landscape, the wild boar is a true keystone species.*

“NOTHING SUPPORTS THE HEALTH AND RESILIENCE OF ECOSYSTEMS BETTER THAN THE PRESENCE OF KEYSTONE SPECIES IN NATURAL NUMBERS.”

#### **Some animals are more equal than others**

All species play a role in nature, and everything is inextricably linked. But just as in the theatre or in a film, some species play more important roles, punching above their weight when it comes to natural functions, structures and processes.

“Keystone species have low functional redundancy,” explains Filgueiras. “This means that when populations of these species decline or disappear, there are very few or no other species that can fulfill their role. Ecosystems then degrade, and sometimes completely collapse.”

Animals like the sea otter along the Pacific coast of North America and the wolf in Yellowstone National Park are classic examples of keystone species. By restoring a trophic cascade, the reintroduction of the wolf in Yellowstone in 1995 resulted in the return of certain animal and plant species, the restraint of others, and stimulated the recovery of a more balanced and diverse ecosystem.

Released in 2018, *The Serengeti Rules* is a documentary based on a book by award-winning American biologist and author Sean B. Carroll.

# The wolf

a keystone species

Trees grow well near wolf denning and resting sites, because deer avoid grazing there



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www.wolfennederland.nl



This compelling production is essential viewing for anyone interested in keystone species.

One of the central figures in the documentary is Bob Paine (1933–2016), a visionary American ecologist whose experiments in the 1960s involved removing predatory starfish from tidal pools. He discovered that without the presence of starfish, the number of species in each pool decreased dramatically. Contrary to the established idea that animal populations are regulated by their food supply, he posited the theory that keystone species, such as predators, play a pivotal role in maintaining the structure of ecological communities.

While *The Serengeti Rules* paints a stark picture of man’s misguided and hugely destructive impact on wild nature, it also offers hope. Thanks to the work of Paine and other scientists, we now have a better understanding of the “rules and regulations” that govern ecosystem functioning, and how to restore ecosystems that have been damaged.

## A European context

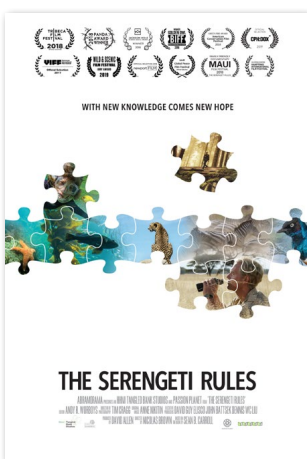
Today Rewilding Europe is reintroducing keystone species in many of its operational areas – from European bison (wisent) in the Southern Carpathians and red deer in the Rhodope

Mountains to Konik horses in the Danube Delta and Tauros in the Velebit Mountains. In other areas, wildlife comeback is seeing keystone species – such as vultures and wolves – return of their own accord.

Yet rewilding and ecosystem restoration should be based on complex interactions between myriad organisms, and not solely on keystone species – after all, habitats are a web of interlocking dependencies, rather than arches held together by one critical “keystone”. Defining what is and what isn’t a keystone species can also be challenging and open to interpretation, and it’s easy to overlook the small and inconspicuous in the equation.

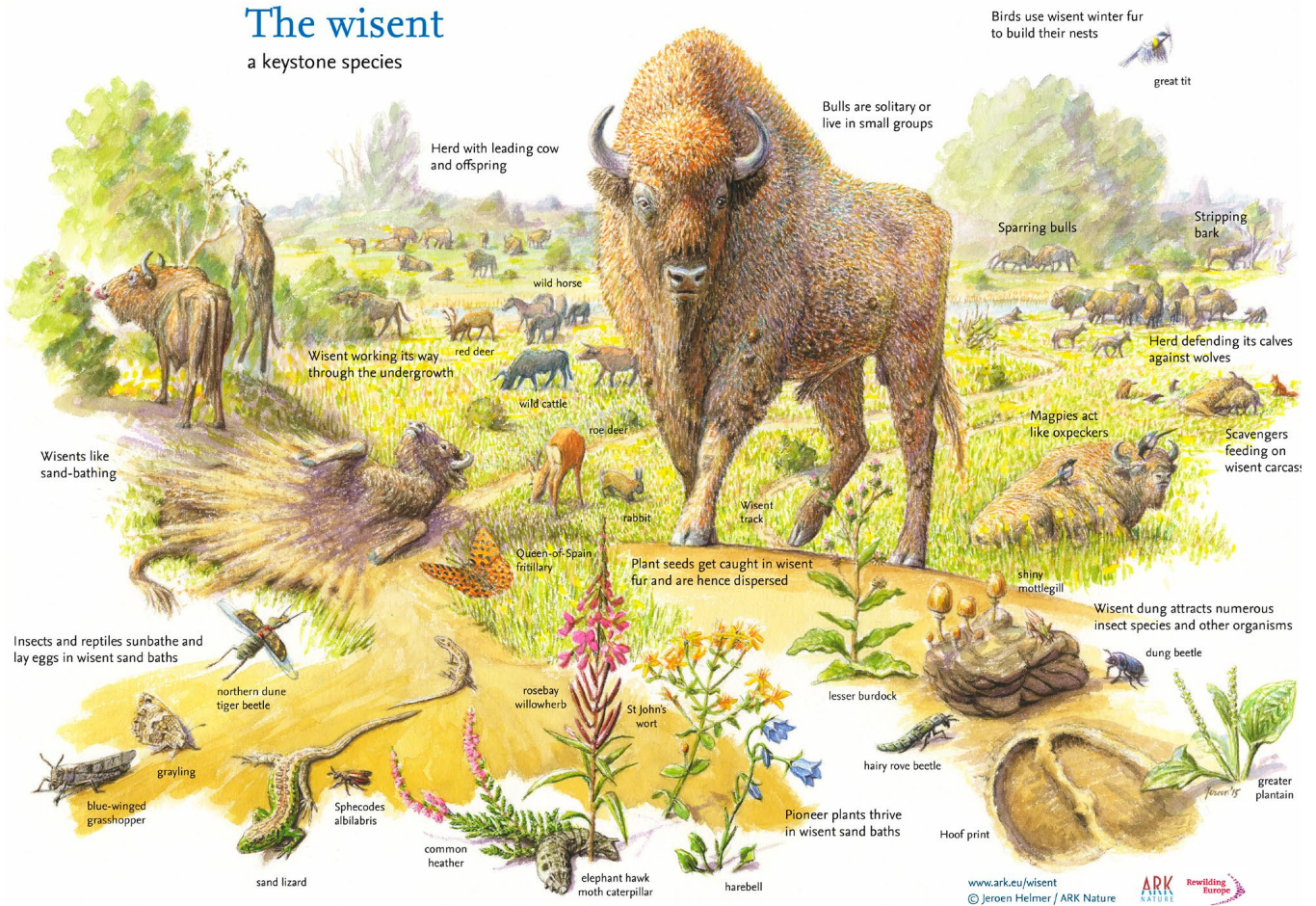
One example of this is the lowly European rabbit, which studies have concluded is a keystone species on the Iberian peninsula. Here it not only forms an important part of the diet of many predators – such as Iberian lynx and Spanish imperial eagle – but plays a vital role as a soil fertiliser and ecosystem engineer, creating extended burrow systems that are used by many other animals.

In recent years, rabbit populations in Iberia have drastically declined due to a highly contagious virus known as rabbit haemorrhagic disease. This, in turn, has negatively impacted



# The wisent

a keystone species



populations of raptors and Iberian lynx. Rewilding Europe is currently conducting research into rabbits in the Western Iberia rewilding area, and working to boost rabbit populations here by reintroducing wild horses to create mosaic landscapes through natural grazing, thereby creating habitat where rabbits can thrive.

## The full picture

We can see that keystone species not only exert their effects downward from the top of the food chain – such as with wolves and lynx – but upward from the bottom (such as with beavers and rabbits). A wide range of organisms – including plants and fungi – can be considered keystone species, although the majority are animals.

Jens-Christian Svenning, Professor of Ecology at Aarhus University in Denmark, believes that further study of keystone species is needed to ensure that rewilding restores ecosystems as completely as possible.

“Many rewilding projects are working to restore natural processes by reintroducing keystone species,” says Svenning. “But such processes also depend on the restoration of natural population dynamics.

“More research and assessment is needed in this area, especially in human-dominated landscapes,” he continues. “Determining the relationship between ecosystem restoration and keystone species requires a better understanding of the intricacies of nature.”



A female Iberian lynx in Sierra de Andújar Natural Park, Spain. Today the world's rarest cat species is making a comeback, but is still vulnerable.