

Rewilded European Bison are Climate Heroes **Q&A to accompany the press release for 16th May**

Q1: How on Earth could a group of 170 bison have such a huge, positive climate impact?

A1: They do so by grazing and recycling nutrients through the release and recycling of body wastes that fertilise the soil.

Q2: You say that the Bison help to increase carbon drawdown by nearly 10 times, yet you also say that “Our work reveals that wild animals could substantially increase an ecosystem’s carbon budget by 60–95%, and sometimes even more, relative to cases where those animals are absent.” 60-95% is not quite a doubling, nowhere near a 10x. How can we explain the big differences?

A2: These statistics are from two different studies. The first one is from a previous review of existing data on animal effects where boosting 60-95% is the same as saying boosting by 1.6 - 1.95 times. Those data largely come from ecosystems that are less productive than grasslands. The large numbers presented in the European Bison report are surprising to us even but show that these animals can sometimes have very large effects. However, you must remember that the numbers in the Report are estimates. They still need to be validated with measurement in the field.

Q3: Isn't the methane production by the bison a negative factor? Has it been considered?

A3: The amount of methane produced by the bison is accounted for in our estimates. When considered in comparison to the overall carbon budget, the amount of methane that is released by the herd (170 x 73.5 kg C/year) is a tiny fraction (0.0005%) of the overall net positive effect the bison have on carbon storage (2.36 x 10⁶ tons per year).

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Q4: What's so special about the Bison? Couldn't the same effects be achieved with domesticated cattle or sheep?

A4: Cattle in some cases can have similar effects as bison. But they are more selective grazers on forage plants than bison creating uneven and patchy grazing areas. Bison tend to mow the grassland more evenly and continuously throughout the year, therefore are more efficient at promoting carbon capture and storage than cattle. Livestock herders also need to earn profits so they tend to stock cattle more densely to the grasslands than one would with bison herds, which can generate overgrazing and soil damage that leads to loss of carbon from the soil. Moreover, replacing domestic livestock with large herbivores, like the European bison, has the potential to achieve other rewilding and conservation goals beyond carbon storage. Bison can reduce competition among plants, aid seed dispersal, as well as increase arthropod diversity. Additionally, reintroducing large herbivores presents an opportunity to address the substantial loss of megafauna in Europe, with 30 species disappearing and only eight species >100 kg surviving. With decreased human pressure in European landscapes, there is significant potential for rewilding efforts to restore more diverse assemblies of large herbivores, thereby assisting the maintenance of semi-natural grasslands, currently threatened by both land-use intensification and abandonment.

Q5: Are there any links to the American bison and how the two species function in their respective ecosystems?

A5: European bison currently living in European landscapes tend to be more similar in size and function to the North American subspecies called Wood bison/buffalo living in northern Canada than North American prairie bison. Like Wood buffalo, European bison forage in grasslands and open-canopy forest patches. The European bison, despite sharing functional similarities with the wood bison, has faced a distinct past. Extinct in the wild, it has been reintroduced into a European landscape heavily influenced by human activity. This situation imposes limitations on the species due to habitat availability and the presence of humans, which restrict population densities to levels conducive to co-existence. Consequently, the European bison's role in European landscapes may vary according to environmental and human pressure gradients. Our study area provides the opportunity to examine the species within an ideal ecological setting. The southwestern Carpathians host the largest non-managed herd in Europe, where artificial feeding is not provided, and offer a vast mosaic landscape characterised by minimal human pressure. Therefore, we anticipate that the European bison in our study context could reflect similarities to the wood bison.

Q6: How does the bison relate to forests? Any positive/detrimental relationships?

A6: The European bison have been commonly associated with forested habitats, considering that all the reintroductions have taken place in such systems. However, it is essential to recognize that forests themselves are diverse, with variations in canopy cover, thereby offering different opportunities for foraging and shelter. In areas where grasslands are absent, or completely monopolised by human activities, studies have shown that bison exert negative effects on forest stands due to intense debarking. Yet, in our study site, this impact is mitigated, likely due to the abundance of foraging resources in open habitats (i.e., grasslands and open-forest canopy). Consequently, we expect bison to bring positive effects on forest ecosystems, influencing both vegetation structure and composition. For instance, through trampling and browsing they help maintain open habitats, fostering an increase in shade-tolerant plant species. Additionally, they also redistribute tree seeds by carrying them in their fur, or by releasing them through their dung. The fertile dung piles can then promote tree seedling regeneration. This process is particularly significant in the case of larger plant species, as larger seeds often rely on them. Recent studies have highlighted the European bison as the second most important ungulate seed disperser, after red deer, in European landscapes.

Q7: How much carbon would be stored in the grasslands in the absence of Bison through natural forest regrowth (option 1) or afforestation (option 2)? Any time factor to be considered?

A7: Natural forest regrowth, which could be facilitated by bison, is generally much more favourable than forest plantations. It has been [shown](#) that natural forest regeneration captures carbon up to 40 times more efficiently than forest plantations. The reintroduction of large herbivores is also very time efficient, and studies have shown that already after a period of 5-10 years measurable, positive differences are detectable in terms of carbon capture, which is faster than for many forests. Grasslands also store 50-70% of all organic carbon on the planet in their soil, a storage much less vulnerable to burning and harvesting than in forests. And the megafauna, like bison, play a critical role in capturing the carbon.

Moreover, grasslands offer more than just carbon sequestration; they boast the highest species richness of any ecosystem on the planet, with Transylvanian dry grasslands holding the record. These ecosystems are characterised by complex unique interactions, many species depending on these systems. For instance, calcareous grasslands in Europe host 274 butterfly species, representing 48% of all European species. These habitats have been maintained for centuries through low-intensity management (i.e., no mechanisation, little or no agrochemicals), and now they face multiple threats from agricultural intensification, abandonment, and afforestation. In light of these challenges, the pertinent question should

be: Can we align carbon sequestration and grassland protection? Rewilding presents itself as a positive solution.

Q8: Is there a point at which a further increase in Bison numbers becomes counterproductive for carbon capture?

A8: When bison become very densely populated in a confined area, they, like overstocked cattle, can overgraze the landscape and cause damage. The trick is to find ecologically meaningful densities for these animals in relation to the goals for the rewilding project. Assuming that the goal for rewilding the European bison in the Tarcu mountains is to maximise carbon capture and storage, our estimates provide ecologically meaningful bison density in terms of the size of the herd that can be sustained over the long term with a balanced carbon budget that promotes long-term carbon capture and storage.

Q9: I thought soil compaction was meant to be a bad thing. How come it is a good thing for carbon when bison causes it?

A9: Soil compaction from animal trampling does two things. It tends to reduce the ability of soil microbes to break down and decompose organic matter, which then lowers the amount of CO₂ released from the soil that comes from the microbial activity. This in turn leads to a build-up of carbon storage in the form of soil organic carbon and the constant trampling helps to stabilise the carbon retained in the soil. Studies have shown, however, that large wild herbivores do a much better job of stabilising soil carbon retention than domesticated cattle.

Q10: You say that the land area could support up to 350 Bison. If 170 Bison cause the stated amount of carbon to be captured, would double the number of Bison cause double the carbon to be captured?

A10: The actual number will depend on the rewilding goals. If the goal is to maximise carbon storage then 170 would be around the number that could be sustainably supported within the hectares of grassland space currently available in the Tarcu Mountains rewilding area. Growing the herd to 350 would require a doubling of the grassland space. Worth noting: Rewilding Europe, which leads the bison reintroduction program together with WWF Romania, has the ambitious goals of increasing the bison area so that it accommodates 450 animals.

Q11: It's all very well doing this in a remote mountain range in Romania where not many people live. What relevance does this have for more populated places?

A11: The principles of animal-driven carbon storage can be applied anywhere where animals can live. The trick is to find the appropriate animals to use in the location to be rewilded. In densely populated areas, where there is less space, you may stock lower densities of the larger animals, or you may choose smaller animals that don't need as much space. In many cases, you can even use insects. For example, grasshoppers are miniature analogues of large mammalian grazers and thus can fulfil similar roles in urban and peri-urban settings.

Q12: What is the potential for more such projects across Europe?

A12: The potential is good. The trick is to align the right species for the ecological conditions of the ecosystems into which animals are to be rewilded.

Q13: What is *Animating the Carbon Cycle*?

A13: Animating the Carbon Cycle (ACC) is the new scientific field that studies the role of animals in enabling carbon drawdown. The new Yale/GRA ACC model, developed at [Yale School of Environment](#) with support from the Global Rewilding Alliance, can characterise and quantify the effects that animals (both carnivores and herbivores) can have on ecosystem carbon budgets.

The model serves as a tool to ascertain the feasibility of using specific on-the-ground trophic rewilding projects to enhance carbon capture and storage. The modelling provides a crucial foundation to assist decision-making aimed at rewilding nature for the purpose of mitigating climate change and biodiversity loss.

*Key reference: Rizzuto, M., Leroux S.L., & Schmitz, O.J. Rewiring the carbon cycle: a theoretical framework for animal-driven ecosystem carbon sequestration. *Journal of Geophysical Research: Biogeosciences* 129, e2024JG008026, <https://doi.org/10.1029/2024JG008026>*

Q14: Is rewilding therefore a good option for offsetting carbon emissions?

A14: There is huge urgency to draw down carbon from historical emissions in order to stabilise the global climate and therefore avoid the worst effects of climate change. We need to remove 440-500 billion tons (Gt) of excess CO₂ from the atmosphere by the end of the century to stay below 1.5°C increase. GRA's position is that rewilding as a significant new

option for carbon drawdown should not be used to facilitate "business as usual", but instead should play a positive role in drawing down historical emissions. This provides a very real option for rich countries - those that have produced the majority of historical emissions - to play their part in addressing the climate emergency at the same time as protecting and restoring nature through rewilding.

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