Generation Climate Europe

Mountains: Wildlife that Defines the Landscape

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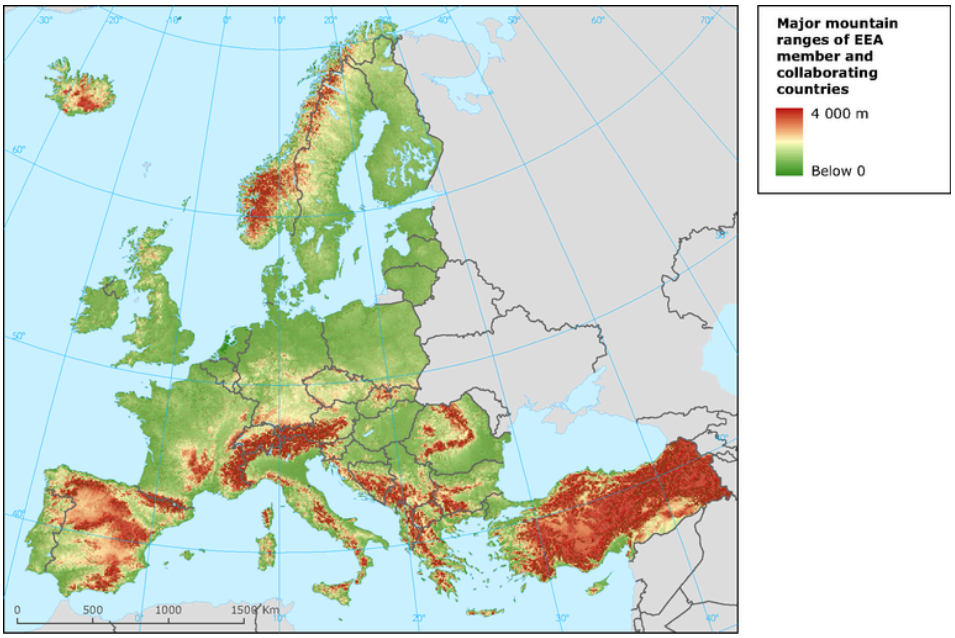
Introduction

Mountains are huge landforms created by pieces of the Earth's crust – called tectonic plates – pushing together. Sometimes, a lot of these landforms are connected together to form mountain ranges. **Mountain ranges in Europe**, such as the Alps, **constitute the highest points in the continent**, while others, like the Scandinavian mountains, are relatively low but very steep in certain places.

The European Alps constitute one of the continent's last wild places. Dominated by pine trees, fir, spruce, oak and beech in the montane forest, and wild flowers in the alpine meadows, the Alps are truly a biodiversity reservoir. They are home to some amazing species like red deer, marmots, chamoix, wolves and lynx.

However, the Alps are **heavily exploited** and thus **face numerous threats**. Human pressures like intensified agriculture, urbanisation, and mass tourism threaten even the most remote natural areas of the Alps. Habitat loss and fragmentation are the main drivers of biodiversity loss.

Let's explore three fascinating species inhabiting the mountains and the role they play in these sensitive ecosystems: the alpine marmot, the Golden Eagle, and the American mink.



The major mountain ranges of Europe
Source: EEA, European Environment Agency
https://www.eea.europa.eu/en/analysis/maps-and-charts/major-mountain-ranges-of-europe?activeTab=a7caf3b5-7254-4a24-8919-693d4115158b

The underground architects of the Alps: the alpine marmot's role as an ecosystem engineer

The alpine marmot *(Marmota marmota)*

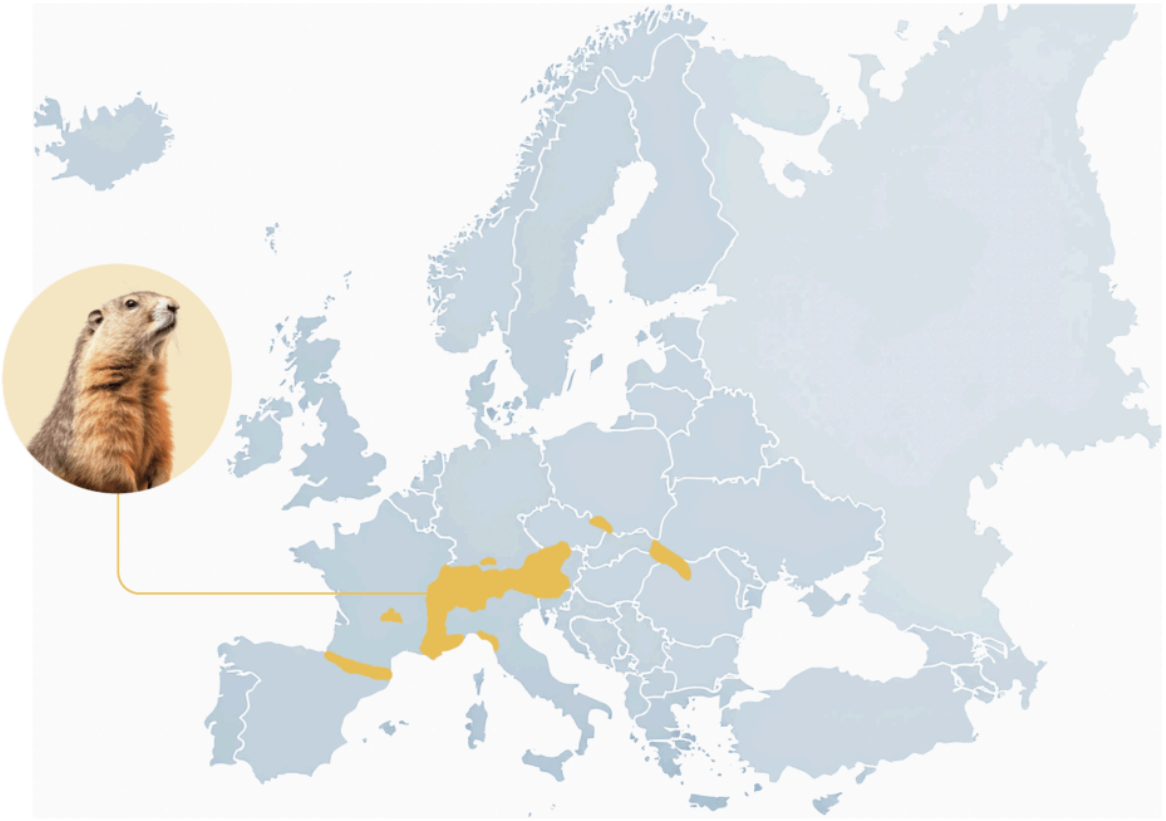
- **Size:** 45 - 65 cm
- **Lives:** 15 - 20 years in captivity, unknown in the wild
- **Habitat:** Central and Western Europe, alpine meadows and rocky slopes
- **Role:** Hibernator and herbivore
- **Why they matter:** An ecosystem engineer for alpine communities

Source: Marmota marmota 48, Saxifraga-Willem van Kruijsbergen index.html

The alpine marmot (*Marmota marmota*) is a member of the squirrel family, and can be found in alpine pastures up to 500m above the tree line. They are mostly vegetarian and feed on grasses, leaves, seeds and wild flowers. Alpine marmots measure between 45 and 65cm long, with their tail adding a further 15-25cm. Marmots spend about **95% of their lives underground**, and their burrows can be more than two metres deep.

Family is important to alpine marmots; they live in groups of about 15-20 individuals. They also spend **six to seven months of the year hibernating**, which means they have to spend a lot of time feeding and fattening up for winter. On average, adults weigh 6.5kg before hibernation but they lose half of this weight by the spring!

According to the IUCN, the alpine marmot is abundant in parts of its core range in the Alps, with populations primarily concentrated there but also extending to other European mountain ranges. Some subpopulations, such as those in the Jura and Germany, may be under threat. Population densities vary, ranging from 24-36 individuals per 100 hectares in Gran Paradiso, Italy, to 40-80 individuals per 100 hectares in Tessin, Switzerland. In the Romanian Carpathians, thanks to reintroduction, the alpine marmot population is estimated at around 1,500 individuals.



Distribution of the Alpine Marmot in Europe.
Source: Botti, Velca (2024). La marmotte alpine: un génome peu variable. *Musée régional des sciences naturelles*. Vallée d'Aoste.
https://museoscienze.vda.it/fr/la-marmotta-alpina-un-genoma-poco-variabile/

Marmots are effective ecosystem engineers who reshape alpine soils, vegetation patterns, and nutrient dynamics through their burrowing, trampling, excretion, and the removal of nest litter and bodies of the animals that have died during hibernation. By constructing extensive burrow systems, marmots aerate the soil, enhance water infiltration, and create microhabitats for plants and invertebrates. Their digging, trampling, and droppings redistribute nutrients, which in turn influences plant nitrogen and soil phosphorus content, and modifies the vegetation structure around burrow sites. Studies show that marmot colonies can measurably affect plant biomass and soil properties, even in harsh mountain environments, demonstrating their capacity to engineer ecological conditions that benefit a range of other species. Through these physical and biochemical modifications, **alpine marmots play a key role in maintaining the functioning and diversity of high-elevation ecosystems.**

The alpine marmot is **a protected species at the European Level** under the Bern Convention, and is a common wildlife attraction for hikers and tourists in the Alps. They are a symbolic alpine species, and their presence contributes to nature-based tourism, local identity, and environmental education programmes. People are sold carrots and peanuts to feed them, and marmot plushies are even sold in stores around the mountains.

Sadly, marmots were once hunted for their meat, fur, and fat (which was used in cosmetics and medicines). For generations, people believed that fat extracted from marmots had medicinal properties, particularly for treating rheumatism (arthritis) and other ailments. In many alpine communities, villagers waited until late autumn, when marmots were heavy with stored fat and slow to react, and then dug them out of their burrows to harvest them. Although this practice aligned with local logic at the time (even if the supposed remedy had no real therapeutic value), today it seems harsh and cruel. Hunting does continue nowadays, for instance in Austria and in Slovenia, where they are considered a game species, and therefore hunting is mostly a recreational activity.

While they are not currently endangered, the impacts of climate change, such as more frequent and intense droughts, are predicted to threaten both the distribution and survival of this iconic species.

The alpine marmot exemplifies the complex and evolving relationship between humans and nature. With climate change threatening alpine habitats, the future of this species increasingly depends on how effectively humans can balance conservation, recreation, and other land-use pressures. The alpine marmot's critical role as an ecosystem engineer means its conservation is not also important for the future of this species, but also for the preservation of the fragile alpine ecosystems it calls home.

The Golden eEgle: an apex predator as alpine bioindicator

Golden Eagle (*Aquila chrysaetos)*

- **Wingspan:** 1.8-2.4 m
- **Lives:** 32-46 years
- **Habitat:** Mountains, cliffs, open uplands, remote areas
- **Role:** Apex predator
- **Why they matter:** Bioindicator and population regulator

Source: Parra, Yvie. 2022. Aquila Chrysaetos - Golden Eagle. https://www.borealforest.org/golden-eagle/

The Golden Eagle (*Aquila chrysaetos*) is widely considered the **'king of the air',** and it inhabits a wide range of flat or mountainous habitats across almost every continent. As an apex predator, Golden Eagles help to **regulate populations of small and**

medium-sized mammals. In the summer, they feed mainly on marmots, while in the winter they often scavenge on the carcasses of hoofed mammals.

European distribution of the Golden Eagle *Aquila chrysaetos,* including resident (green) and non-breeding (blue) populations.
Source: BirdLife International (2021). Species factsheet: Golden Eagle Aquila chrysaetos. https://datazone.birdlife.org/species/factsheet/golden-eagle-aquila-chrysaetos

Did you know that these wonderful birds **faced near extinction** at the beginning of the 20th century? Humans hunted them for generations, but through strict regulations, the species was saved from extinction. The European population of Golden Eagles is now considered to be increasing, or at least stable, but a variety of threats remain. Leisure sports in the mountains can cause disturbances near nests, which can reduce breeding success and affect the population. According to BirdLife and the IUCN, there are other threats still faced by the Golden Eagle today: shooting and persecution, chemicals, power lines, wind turbines.

New threats are also expected to arise as a result of changing land management practices and the impacts of climate change, such as increased frequency and intensity of droughts and fewer livestock carcasses as agriculture becomes more intensive. Conservation efforts should focus on lowering disturbances, preventing illegal killing, and maintaining suitable prey and nesting habitats for golden eagles.

As a **bioindicator,** the presence of Golden Eagles indicates the health of the landscape in mountainous ecosystems. But how does it do this?

Firstly, a stable Golden Eagle population suggests a healthy population of its prey, meaning that the whole food chain is functioning properly. Secondly, this bird is a

long-lived apex predator that accumulates toxins such as mercury and lead from the atmosphere and its prey animals. So by analysing the feathers, it is also possible to understand levels of **environmental toxicity.**

The Golden Eagle is not only a practical indicator of a functioning mountain ecosystem, it can also be an emotional catalyst for conservation. So while the Golden Eagle depends on humans to safeguard alpine habitats and reduce pollution, we in turn need Golden Eagles to inform us about ecosystem balance and pollutant monitoring, and inspire conservation efforts.

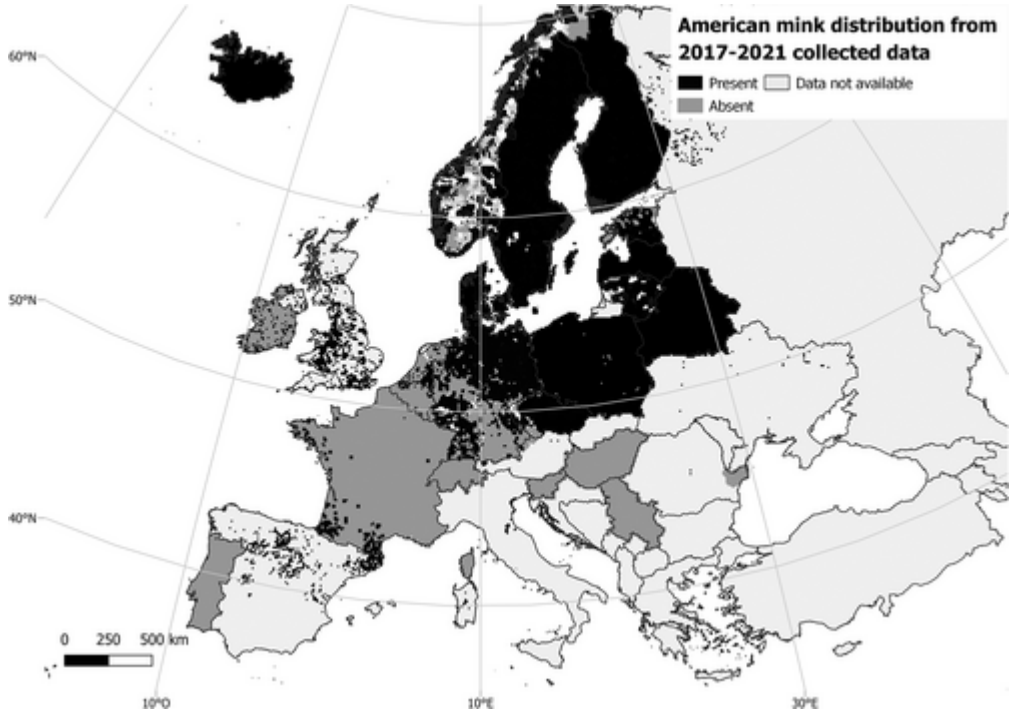
Invasion at altitude: the American mink's disruption of Scandinavian mountains' ecosystems

The American mink *(Neogale vison)*

- **Size:** 30-45cm
- **Lives:** 3-6 years in the wild
- **Habitat:** Semiaquatic environments, wetlands, lakes
- **Role:** Invasive species in Europe
- **Why they matter:** Historically farmed for fur, competition with native species

Source: American mink, NatureScot, Scotland's Nature Agency
https://www.nature.scot/plants-animals-and-fungi/mammals/land-mammals/american-mink

The American mink (*Neogale vison*) is a semiaquatic mammal native to North America, and is one of the **most widely distributed invasive species on the Eurasian mainland.** It was first introduced into Europe in the 1920s for fur farming, but it escaped from the mink farms due to either insecure housing or deliberate release. Since then, the American mink has established wild populations that have reshaped ecosystems and impacted local wildlife. Today, it is **the most populous predator in Scandinavia** and is even found in the Scandes (the Scandinavian Mountains).



Distribution of the American Mink in Europe in 2017-2021.
Source: Vada, Rachele et al. (2023). Feral American mink Neogale vison continues to expand its European range: time to harmonise population monitoring and coordinate control. *Mammal Review,* vol. 53 (3): 158-176. https://onlinelibrary.wiley.com/doi/10.1111/mam.12315

Once established, the American mink has significant impacts on European ecosystems, including fragile alpine habitats, through **predation and competition.** They feed on invertebrates, birds and their eggs, small mammals, fish, and crustaceans, placing additional pressure on these populations and competing with native predators like the European mink (*Mustela lutreola*). Declines in prey species due to over-predation by American mink cascade into changes in insect control, seed dispersal, and the health of stream and wetland habitats. The American mink is also a **transmitter of pathogens** that threaten other wild and domesticated mammal species, and they can host the SARS-CoV-2 virus and transmit it to humans.

The American mink will be officially added to the European Commission's list of Invasive Alien Species (IAS) from August 2027, highlighting the growing awareness of the severity of the American mink's impact on native European ecosystems. However, while many governments and local communities are already taking action to remove American mink to protect native wildlife, some continue to oppose lethal control on ethical grounds or argue that this species is part of a changing natural environment that should be tolerated. Most affected European countries now have control policies and organise **eradication campaigns,** although limited data on population densities and distribution can often hinder the effectiveness of these measures. Despite this, with the banning of mink farming in many European countries, and the culling of 17 million minks in Denmark during the COVID-19 pandemic, it is expected that there will be a **continued decline** in the American mink population across Europe.

The American mink functions as a clear reminder of how human industry can produce lasting and unintentional ecological changes, even in remote mountain valleys. Human-altered landscapes and the absence of natural predators have also facilitated the spread of this invasive species. The resulting ecological pressures and impacts on vulnerable native species demand coordinated, cross-border monitoring and control efforts. This highlights the reciprocal relationship between humans and nature: human decisions enabled the mink's initial establishment, and it is now up to us to manage the impacts to restore ecological balance.

Conclusion

The alpine marmot, Golden Eagle and American mink help us to understand how alpine ecosystems are a living mosaic, shaped by delicate balances and human choices. Marmots demonstrate how even small herbivores can engineer landscapes, influence soils, and anchor cultural identities; Golden Eagles reveal the health of entire food webs and the hidden toxic threats to our ecosystems; and the American mink exposes how quickly an introduced predator can unravel long-standing ecological relationships. Together, they show that **mountain environments are neither isolated nor immutable.** These fragile ecosystems already face a number of pressures, including agriculture, development, and invasive species, and these threats will be further intensified as a result of climate change. Protecting mountain ecosystems means understanding these species not in isolation but as architects, indicators, and disruptors of ecosystem health, and recognising that human stewardship is now inseparable from the future of these high-altitude worlds.

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