

Big lemming populations are important for far more than just predators

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Mountain lemming. Credit: Fährtenleser/Wikimedia Commons, [CC BY-SA](#)

The number of lemmings (*Lemmus lemmus*) in the mountains can fluctuate sharply from one year to the next. Years when populations explode are called lemming years. These population explosions are

important for many other species. More predators and birds of prey, for example, do better and often have more offspring than usual when there are plenty of lemmings around.

"For a number of species, we find that the population size, meaning the number of animals of one species in an area, changes according to a cyclical pattern. We regularly see that there is [population growth](#) up to a peak, followed by a crash, that is a rapid decline in the population size," says Aline Magdalena Lee.

She is a researcher at the Gjørevoll Center for Future Analyses of Biodiversity and an Associate Professor at the Department of Biology at the Norwegian University of Science and Technology (NTNU).

Population growth towards the peak can happen very rapidly or more gradually. The same pattern repeats time after time in a recurring cycle. In lemmings, these fluctuations seemingly occurred regularly three to four years apart with huge peaks and deep dives in fluctuations called cyclic fluctuations.

However, some researchers now fear that more time is passing between each lemming year. But is that true?

Lemming years are not a thing of the past

"It might seem like the time between population peaks has lengthened, but it is actually quite hard to assess. In the 1990s and early 2000s, there was an extended period of no lemming years and a lot of people were worried that the phenomenon had come to an end, perhaps due to [climate change](#)," Lee said, noting that this is not something she has conducted research on herself.

But the cycles have changed again, at least in some parts of the country.

"The fluctuations do not need to be synchronous across Norway as a whole. Often they are not and the peaks might happen in the south one year and in the north another year," Lee said.

There will always be some natural variation in population fluctuations. When peaks happen every three or four years on average, there has to be a fairly long time series, that is many years of data, in order to tell whether the pattern has changed with regard to how frequently the peaks occur or how significant they are.

"There are also greater variations in the number of lemmings in some areas than others and it is hard to predict how things will develop," she said.

Lemming years important for several species

But why are these fluctuations important?

"The fluctuations are part of a complicated natural system that has developed and adapted over a very long period. The system has therefore adapted to the fluctuations and other species can depend on them. If they change, it can affect the entire food chain," Lee explains.

Lemmings are considered one of the key species in Nordic mountains. They are an important food source for many predators.

"Good access to this food source is absolutely essential for many species so that they can raise their young," says Lee.

Some species reproduce almost exclusively in years with large populations of small rodents

Some species, such as the arctic fox and snowy owl, reproduce almost exclusively in years with high levels of small rodents. Other species have more and larger litters in such years.

The snowy owl will often travel over large areas in search of good nesting conditions and can therefore be completely absent in years when there are few small rodents around. As these are species with relatively long lifespans, the population can be maintained with good reproduction years every three or four years.

"However, if the peaks were to vanish completely, it would be difficult for these species to survive. When there are few small rodents around, the predators need to find other prey to survive. This affects the populations of other small prey in the mountains, such as grouse.

Years when there are large amounts of lemming also affect vegetation in the mountains. This can be important for germination and the biodiversity of plants.

Changes in the population fluctuations can therefore have major consequences with ripple effects that can be hard to predict.

Certain predators fluctuate in relation to lemmings, with a delay

In predator–prey cycles, we can see the same pattern for prey and predators or [birds of prey](#) for which the prey is the main food source.

But the fluctuations have shifted in relation to one another and the predator peaks are occurring after the prey peaks. That is not so strange when you realize why.

"This is because a peak in prey population results in a large supply of food for the predator and with it good conditions for breeding. This is why we experience a significant growth in the predator population after such peak years," Lee said.

For the prey, the peak years are characterized by strong competition for food and resources. Many prey will die quickly. Stress and infectious disease can also play a part.

"As the predator population grows, the prey will experience more predation and the overall result is that the prey population crashes," Lee says.

In turn, this leads to food shortages for the predator. And the predator population declines again. With fewer predators and less competition, the prey population grows again and the cycle repeats itself. The [snowshoe hare](#) and lynx in North America are a classic example that has been widely studied.

Many factors at play

In practice, it is still difficult to determine exactly what controls dynamic population fluctuations in various species. There are nearly always multiple species involved and there are many possible factors at play affecting the natural system.

Each prey species constitutes a source of food for several predator species and predators feed on more than just one prey. There are also many things happening at the same time that can play a part.

"When we experience the really big lemming peaks in lemming years, it is often linked to the fact that lemming can breed under the snow and climate and snow conditions can also have a major impact on lemming

dynamics in various areas."

In addition, plants can react to high levels of grazing by producing anti-grazing agents, which can have an additional impact on prey populations.

"I don't have the exact answer as to what it is that controls the lemming cycles. But it is most probably a combination of various factors, with [predators](#) being one of the most important factors," says Lee.

Provided by Norwegian University of Science and Technology

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