



Common vole (*Microtus arvalis*) © Jens Jacobs



Large vole populations often develop in grass rich habitats such as those that exist in commercial forestry, as well as wetlands and road and field verges © Sarah Hoy

POLICY BRIEF

Conservation of small mammals and associated ecosystems: the importance of European policies and actions

Voies and lemmings are often subject to population cycles with alternating periods of high and low density. Plants and animals sharing the environment with these small rodents adapt to and may depend on these cyclic population dynamics. The BiodivERsA-funded EcoCycles project has recorded changes in some rodent population cycles across Europe with direct impacts on the ecosystems they live in. Research results suggest that a common global environmental driver could be responsible for such cycles flattening.

Based on EcoCycles research results, it would be advisable to better address the possible drivers leading to small rodents' cycle variations in EU policies (Common Agricultural Policy, EU Strategy on Climate Adaptation). Further research is also recommended to better identify the factors causing the fluctuations, in order to limit the consequences on ecosystems and agricultural land. These measures could contribute to reach the targets of the EU Biodiversity Strategy to 2020.

Main findings:

- Fewer outbreaks of small rodents' population have been registered across Europe
- Population extinctions and community restructuring of the Arctic endemic predators are highly likely if the rodent population dynamics continue at the current low-density state
- Land use and climate change have been identified as possible drivers for small rodents' population declines

Key policy recommendations:

- Under the **Common Agricultural Policy**, actions to reduce the negative impacts of various farming practices on the studied species would be advisable
- It is suggested to **enhance conservation management of non-intensively managed/grazed grasslands** under the Common Agricultural Policy
- **Precautionary actions in climate change policies (EU Strategy on Climate Adaptation)** could help minimize possible future impacts on the affected ecosystems and their associated species and ecosystem functions
- Early investment in **stakeholder dialogue** could help reduce local conflicts

The context

It is well known that many wildlife populations are subject to temporal variations, with periods of high and low density depending on various factors. When these fluctuations occur over a predictable period of time, they are called “cycles”, meaning that the populations increase and later on decrease in a cyclic fashion at regular intervals. Many research studies have shown that in an ecosystem, some species might depend on another species’ population cycle.

Population cycles of small rodents, such as plant-eating voles, lemmings, as well as associated species like grouse and moths, can undergo serious flattening (dampening), with consequent reduction of the population growth. The collapse of these species’ cycles raises concerns about the direct effects on other species which depend on them, such as predators, alternative prey and food plants, and about the eventual loss of essential ecosystem functions.

Studies have identified a number of drivers of change of small rodents’ population dynamics at local level. A major challenge is to understand whether the

patterns of cycle collapses are only local or if they represent a more general phenomenon. Identifying a common syndrome of change between populations in different areas would demonstrate the existence of shared drivers. Identifying these drivers has important implications for policy.

In this framework, the EcoCycles project has analyzed time series of rodents’ population dynamics from different ecosystems and countries across Europe (United Kingdom, Norway, Sweden, Finland, Germany, Czech Republic, France and Spain), in order to investigate the drivers that bring cycle flattening. The impacts on the predators’ populations caused by cycle dampening in vole and lemming species were also explored and revealed dramatic effects.

As the impact of high densities of rodents can be harmful for some human activities (such as agriculture), EcoCycles also focused on facilitating the flow of information about these species and their management among various stakeholders.

Key results

Flattening of rodents cycles across Europe

EcoCycles research has shown that in various areas of Europe there has been a consistent change in population cycles of voles and lemmings (examples in figure 1). By using a large compilation of time studies on the presence of Common vole, Field vole and Root vole, scientists have managed to identify widespread changes in population growth rates in winter. Fewer outbreaks of the rodent populations were found compared to past figures, resulting in a decrease of the common regular fluctuations.

Out of the 12 vole populations considered in the study, ten underwent at least a twofold decline in population

cycle amplitude in spring and eight did both in autumn and spring. Similar results have been gathered for lemming populations in tundra ecosystems.

Evidence suggests that a common global environmental driver, such as climate change, could be responsible for the population dampening of grass-eating vole species throughout Europe. Although climatic variation is a natural candidate for explaining changes at the European scale and across highly different ecosystems, further research is required to identify the precise factor(s) affecting seasonal population changes.

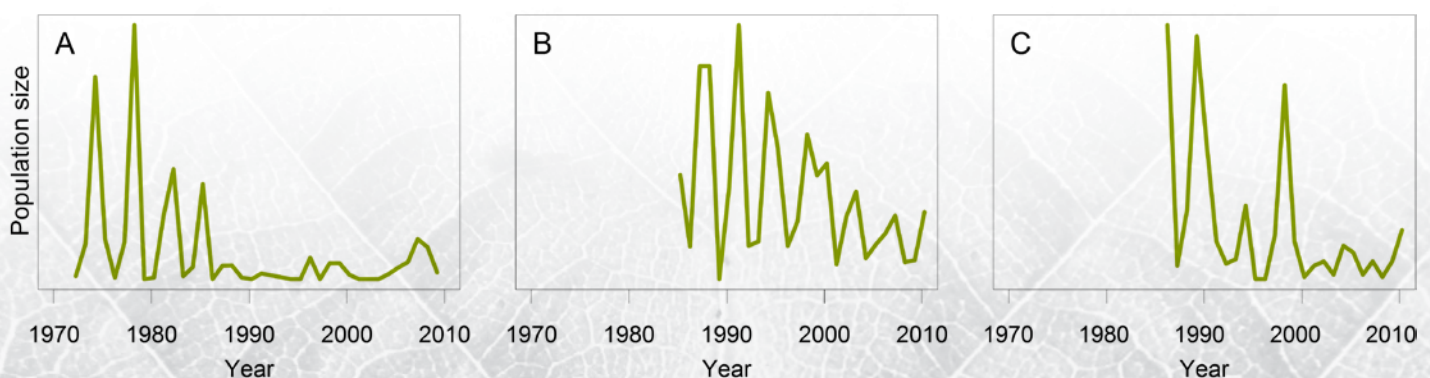


Figure 1: Time series of the abundance indices of the Grey Redbacked Vole (*Myodes rufocanus*) in Umeå, northern Sweden (A), and the Field Vole (*Microtus agrestis*) in Kielder, UK (B) and the Ore Mountains, Czech Republic (C). The green line represents the variations in population density, showing the dampening in the amplitude of fluctuations that happened in the last decades. (after Cornulier et al., 2013, *Science*, 340, 63-66)

Ecosystem impact of population dampening

Collapsing vole and lemming cycles can represent major and ominous changes in ecosystem functioning, with particular impact on rodent-dependent predators, such as Arctic Fox (listed in Annex II of the [EU Habitats Directive](#)), Hen, Montagu's Harrier and other birds of prey (many of them, like the Snowy Owl, are listed in Annex I of the [EU Birds Directive](#)).

The example of lemmings in European tundra ecosystems is particularly illustrative. As these small rodents are keystone species (i.e. species which play a fundamental ecological function in their ecosystem), altered lemming dynamics may convey significant effects for their predators.

Long-term [community-wide monitoring data](#) (1988–2010) from two sites in high-arctic Greenland were analyzed by EcoCycles. The collapse in Collared Lemming cycles affected the population dynamics of their predators living in the same area: Snowy Owl and Stoat. Following the cycle collapse of its prey, the number of Snowy Owl's offspring declined by 98% (see figure 2). Similarly, there were indications of severe population declines of Stoats at one of the study sites. Less specialized species present in the same ecosystem,

such as Arctic Fox and Long-tailed Skua, were more loosely coupled to the lemming dynamics, but the collapses nonetheless had noticeable effects on the reproductive performance of these species.

Population extinctions and community restructuring of the Arctic endemic predators are highly likely if the rodents dynamics continue at the current low-density state.

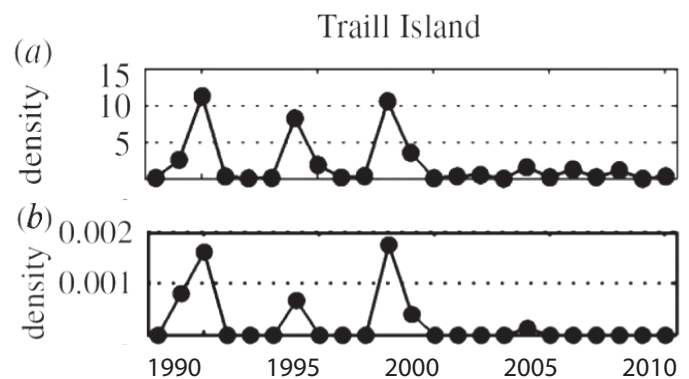


Figure 2: Predator-prey dynamics on Traill Island, northeast Greenland, during 1988–2010. Graph (a) shows the density of the Collared Lemming (prey) and graph (b) shows the density of Snowy Owl (predator) nests. Density is displayed in numbers per hectare. Following the Lemming's collapse at the beginning of 2000, Snowy Owls almost ceased to breed on Traill Island, and the production of fledglings decreased by more than 98%. (after [Schmidt et al., 2012](#))

Land use as a driver of local change in rodent cycles

Changes in land use are often strongly associated with changes in rodent population cycles. Changes in grazing pressure and crop type have been shown to alter vole population dynamics locally. In Scotland, a [long-term experiment](#) revealed that vole abundance in ungrazed areas showed typical multiannual patterns, while higher sheep densities caused less cyclic patterns. These results suggest that changes in domestic grazing intensity can strongly influence the dynamics of vole populations in grasslands.

[Research](#) has also shown that in the short-term, land use can mitigate against the effects of global environmental change. In Spain, changing land use (crop type and irrigation) has increased vole populations despite the changing climate. This suggests that vole dynamics and abundance could be managed by altering grazing pressure or farming practices.

Investment in stakeholder dialogue

Conflicts between conservationists and farmers can arise as a consequence of variation in rodent abundance. Long-term investment in stakeholder dialogue has been shown to promote better understanding of issues among local actors.

In Spain, voles have colonized agricultural areas since the 1980s. This has led to strong societal conflicts associated to epidemic outbreaks and mortality of protected species due to the use of rodenticide. The

National Consultative Fora organized by EcoCycles have improved stakeholder relationships and understanding, and helped turn acrimonious arguments on the impact of vole outbreaks on agriculture into joint collaborative proposals.

Such an approach is exemplified by new collaborative projects developed between researchers, governments and agricultural stakeholders.

Policy recommendations

The research results show that population cycles of small rodents in Europe are changing, with impacts on the ecosystems they live in and on species and habitats which are protected by the EU Habitats and Birds Directives. Although no specific studies were conducted by EcoCycles or during the production of this brief on the effectiveness and cohesion of current policies, the knowledge presented highlights measures which could help monitor the effects of changes in rodents' cycles and benefit biodiversity conservation in Europe.

Research has shown that one of the anthropogenic factors responsible for rodent population changes in farmlands is land use. The EU Biodiversity Strategy to 2020 (Target 3) calls for a strong increase of areas under agriculture to be covered by biodiversity-related measures under the Common Agricultural Policy (CAP). The EU 7th Environment Action Programme emphasizes that all policy areas concerned should fulfil their responsibilities in achieving the decided environmental goals and policy. It is advisable that measures under the CAP reflect the problem of rodents' population declines and include actions to reduce negative impacts of farming practices on the ecologically valuable studied species.

It is also important for the **CAP** to enhance conservation management of non-intensively managed/grazed grasslands, as for example intensive grazing has been demonstrated to have negative impacts on voles' cycles and associated predator populations. It is advised that grassland habitats that host ecologically valuable rodent populations are included as environmentally sensitive (both within and outside of Natura 2000 areas), and are not converted into arable land. They can also be targeted by biodiversity measures within national Rural Development Programmes.

Climate change may be one of the main drivers of change in vole and lemming cycles across Europe. Including precautionary actions in the EU Strategy for Adaptation to Climate Change in order to minimize possible future impacts on ecosystems is recommended. To reduce the human impact on climate, an option is to promote good practices on energy efficiency (i.e. legislation on transport and infrastructure) and the use of renewable energy.

With regard to **Action 3 of the EU Biodiversity Strategy** "to increase stakeholder awareness and involvement and improve enforcement", the research conducted by EcoCycles shows how early investment in stakeholder dialogue can reduce conflict. Further encouraging collaboration between researchers and other stakeholders involved in spatial planning and land use management when implementing biodiversity strategies at all levels is a step towards the solution of environmental challenges.

Further research and improved monitoring of small rodent populations and their predators at the scale of Europe is recommended. For those species and subspecies listed in the EU Habitats Directive, its **Articles 18 and 11** may be applicable. Direct drivers of changes need to be identified and addressed, both at European and local levels.

All the measures mentioned above would contribute to the achievement of the headline target of the EU Biodiversity Strategy to halt biodiversity loss and ecosystem degradation by 2020 and to the EU 7th Environment Action Programme.

Links to sources

EcoCycles information on BiodivERsA website
EcoCycles paper on Science
EcoCycles paper in Proceedings of the Royal Society

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About this Policy Brief

This Policy Brief is part of a series aiming to inform policy-makers on the key results of the biodiversity research projects funded by BiodivERsA and provide recommendations to policy-makers based on research results.

The series of BiodivERsA Policy Briefs can be found at www.biodiversa.org/policybriefs.

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The key research results presented here were validated by Prof. Xavier Lambin, University of Aberdeen (United Kingdom) leader of the EcoCycles project and project colleagues. Input was provided by experts from Birdlife Europe and University of Rome "Sapienza".

The policy recommendations made do not necessarily reflect the views of all BiodivERsA partners, nor of IUCN.