Summary of the socio-economic effects of the Flying Squirrel LIFE project

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Content

Summary

The purpose of conducting socioeconomic studies on the flying squirrel (*Pteromys volans* L.) conservation in Finland and Estonia was to gain a deeper understanding of public attitudes, forest owners' perceptions, and the economic and social impacts associated with protection measures. Flying squirrels are arboreal and strictly protected in both countries: it is critically endangered in Estonia and vulnerable in Finland. The studies were a part of the Flying Squirrel LIFE project (08/2018-03/2025), and an action D2 Socio-economic effect of the project therein.

As flying squirrel range cover about two thirds of Finland, but only a small corner of North-East Estonia, number of people to be involved with flying squirrel issues and forest areas related to conservation restrictions differ. Thus, the approaches were different. In Finland, studies were many and planned separately to public, citizens and forest owners, whereas in Estonia, one survey was targeted mainly to forest owners and only at a small extent to public.

As the studies were designed specifically for each country, no numeric comparisons of surveys were made. However, at the level of interpretation, we noticed two main similarities in attitudes in both countries. First, attitudes towards flying squirrels vary considerably in public answers but also within forest owners, from positive to neutral, but also up to somewhat negative to negative. The public attitude seems to be more positive and neutral compared to the attitudes of forest owners, which seem to be more often neutral, somewhat negative or very negative. In addition, in Finnish urban areas, there were interesting weak signs that recreation values could sometimes overlap with flying squirrel habitats indicating potential co-benefits for urban land use planning.

Second, a clear difference in attitudes was observed in relation to the amount of forest owned in both countries. Attitudes towards the protection of the flying squirrel were more other positive by owners of small forest areas (estates), whereas by owners of large forest areas they were more negative. The restrictions on forest use due to flying squirrel conservation were seen problematic, and compensation was often perceived as unclear or even unfair. This suggests that economic goals may be more important for owners of large forest areas, as restrictions directly affect their ability to generate monetary gain from forests. On the other hand, if an owner has only a small forest area, it may be easier to consider other goals for the forest, since its economic potential does not play a significant role in the owner's overall economy.

In conclusion, the results suggest that it is important to keep in mind the varying attitudes towards flying squirrel conservation when conservation practices are improved. A sense of fairness regarding restrictions appears to be an important part within socio-economic sustainability. This is particularly relevant for the endangered flying squirrel, for which ecological sustainability requires safeguarding economically valuable forest habitats – sometimes covering large areas. Efforts to increase co-benefits from pursuing multiple goals for forests are encouraged for the future. Although co-benefits may be difficult to identify in forests originally intended primarily for economic use, aspects such as biodiversity, recreational values, and carbon storage may offer potential avenues for further exploration.

Introduction

The purpose of conducting socioeconomic studies on the flying squirrel (*Pteromys volans* L.) conservation in Finland and Estonia was to gain a deeper understanding of public attitudes, forest owners' perceptions, and the economic and social impacts associated with protection measures. In

both countries, these studies aimed to identify stakeholder concerns, assess the adequacy of existing compensation schemes, and evaluate the broader societal implications of conservation-related restrictions.

Findings from these studies provide valuable insights for policymakers and stakeholders, helping to address conflicts, improve stakeholder dialogue, and balance biodiversity conservation objectives with economic and social considerations. The flying squirrel is strictly protected in both countries: it is critically endangered in Estonia and vulnerable in Finland. Breeding sites and nesting places of the species are protected by law, which results in restrictions on the use of its forest habitats. Typically, flying squirrels prefer mature forest habitats, which have a high monetary value - thus, conflicts of interest are inevitable.

There were differences in how the studies were designed in each country, mostly due to differences in landownership structures and in the size of the flying squirrel's range, which affects forest use. In Estonia, the flying squirrel's range covers only a small part of northeastern Estonia, whereas in Finland, it covers about two-thirds of the country. While in Estonia there are just over 100 landowners directly affected by flying squirrel conservation, in Finland the number can range from tens of thousands to hundreds of thousands of individuals, including residents in urban areas. In Finland, it was possible to design various studies tailored to the Finnish context. As the basic situation differed so greatly, a single questionnaire for forest owners would not have served both countries equally well. Therefore, questionnaires were designed separately using country-specific approaches. As a result, any comparisons between the countries are made at the interpretative level, not at the numerical level.

In this document, we open the main findings of key studies done in Finland and in Estonia during the Flying Squirrel LIFE project (08/2018-03/2025), in an action D2 Socio-economic effect of the project. Studies are described in detail in specific project publications, which are mentioned as references, listed at the end of this document and available in project's website (https://www.metsa.fi/projekti/liito-orava-life/liito-orava-lifen-hankejulkaisut/).

Studies in Finland

The Finnish approach included detailed questionnaires for forest owners and for citizens, and a participation study for spatial hotspots of human recreation, biodiversity values and flying squirrel habitats. In addition, flying squirrel problematics were framed using a study collecting perspectives on flying squirrel conservation from the public and from interviews, carried out at the beginning of the project 2019 and again in its end 2023.

Attitudes of forest owners towards the flying squirrel

A survey of opinions and experiences, along with a choice experiment, was conducted in 2023 to better understand Finnish forest owners' attitudes towards habitat conservation and to predict their preferences regarding the implementation of new forest management actions (Juutinen et al. 2024).

The results, based on responses from 1,058 forest owners selected through a stratified random sample (including both those with and without personal experience of flying squirrel protection in their forests), describe the conditions under which forest owners would be willing to implement forestry activities better aligned with the needs of flying squirrels. In general, the higher likelihood of accepting

conservation measures among forest owners was correlated to younger age, higher education, being affiliated with forest management associations, having forests that were fully certified (e.g., PEFC or FSC), being owners with smaller forest holdings, or owners living outside rural areas. **Over 60% felt that flying squirrel conservation should not outweigh the economic benefits of logging. However, a similar proportion viewed flying squirrel protection as a human responsibility.**

To evaluate the potential costs of FS-protection to forest owners, and to evaluate cost-effective forest management strategies to conserve habitats for the vulnerable Siberian flying squirrel in Central Finland, simulations and GIS-based habitat modeling was made. 11 forest management scenarios were developed that aim at balancing timber production and habitat conservation. Results showed that the cost of increasing suitable habitats with improved connectivity for the flying squirrel in three example sites varied from €8,781 to €35,982 per additional hectare. **Some scenarios significantly improved habitat quality and connectivity at relatively low economic cost, especially when adjusted for recreational land-use restrictions and considering the role that protected forests have as additional carbon storage.**

Citizens' attitudes towards flying squirrels

Residents' attitudes and the ways in which different actors frame conservation problems and solutions in Finland were examined through several surveys and interviews during the project (Juutinen et al. 2024).

A quantitative attitude survey was carried out in three cities (Espoo, Jyväskylä and Kuopio) in 2020–2021. Based on responses from 941 residents, the study found that attitudes towards the protection of flying squirrels varied significantly. Four attitude profiles were identified: 1) **Neutral on protection** (33% of respondents): These residents had neutral or ambivalent attitudes towards the protection of flying squirrels. They were somewhat positive but also felt that flying squirrels caused some adverse effects. 2) **Strongly in favor of protection** (32% of respondents): Individuals in this group strongly supported flying squirrel protection and considered protection measures important. 3) **Somewhat against protection** (26% of respondents): These individuals had somewhat negative attitudes towards protection measures and felt that the measures caused adverse effects. 4) **Strongly against protection** (9% of respondents): This group strongly opposed flying squirrel protection and felt that it caused significant adverse effects.

The study also found that women generally had more positive attitudes towards protection than men, and older respondents were more likely to be against protection. City residents who were also forest owners, and those whose property had been negatively affected by protection, were also more likely to oppose it. Additionally, self-selected respondents were more likely to be strongly in favor of protection than randomly selected ones. This indicates that **current participation methods, such as public hearings, may present an overly positive view of public attitudes**.

Spatial hotspots of co-existence of flying squirrel habitat and human recreation values

A study to collect information on places important to residents in terms of recreational use and natural values was carried out (Kangas et al. 2022). A public participatory GIS (PPGIS) survey in 2020–2021 (n = 484) mapped spatial hotspots of ecological (biodiversity) values, social values of forests ("social hotspots"), and potential flying squirrel habitats in three cities, Kuopio, Jyväskylä, and Espoo. Potential habitats of the flying squirrel were estimated with habitat modelling for predictive habitat

maps developed by LUKE in Action A3 in Flying Squirrel LIFE project (a map layer of potential habitats is available and can be downloaded to a GIS system from Laji.fi service and from Paikkatietoikkuna, links in references).

Based on PPGIS survey responses, places with high concentrations of recreational use and natural values were mapped with places of potential habitats of the flying squirrel. The first results were described as maps in Kangas et al. 2022. Detailed results of the overlay analysis will be opened in a scientific research article that is in progress.

Weak synergies between biodiversity values, social values and potential flying squirrel habitats were identified. The spatial overlap between social and ecological hotspots was generally low or very low. The overlap between flying squirrel habitat and biodiversity-rich forests was higher but varied significantly. However, especially in urban areas there were areas where recreational values and potential flying squirrel habitats overlap. These observations are connected to urban green areas within the city, which indicate their importance for both the citizens but also for the flying squirrel.

Framing the problematics of the Flying squirrel conservation in Finland

Project's impact is strongly connected to success in communication efforts, and it is essential to understand how people think about the species and its protection. The general framing of the flying squirrel conservation (i.e. the specific perceptions of conservation problem and their desired solutions) were explored using public surveys and interviews during the project (Juutinen & Pellikka 2024).

Self-selected samples of persons, their perceived frames and associated argumentation (for or against conservation) were collected using online surveys "**Ota kantaa"** two times during the project. The first survey was open for responding 2.1.2019-15.2.2019 (171 answers), and the second 14.9.-28.12.2023 (57 answers), and **an interview of 10 experts** was carried out simultaneously.

The collected data revealed multiple frames that existed both in 2019 and 2023. In the "No Protection" frame, the need for flying squirrel conservation is rejected; protection is seen as excessive and costly, with current measures deemed sufficient. Arguments include the species' abundance in Russia, unclear habitat needs, and scientific uncertainty, used to justify inaction. In contrast, other frames recognize varying levels of conservation need. Arguments stress the species' ecological value, legal obligations, and declining habitats. Frames differ in focus: the "Rural" frame emphasizes forestry stakeholders; the "Urban" frame highlights municipal planners; the "Everywhere" frame calls for targeted actions wherever problems arise.

In June 2024, **a survey** was conducted with a regionally and demographically stratified sample of 2,000 citizens via M3Panel. Based on the results of the M3Panel survey, 93% of adults living within the species' range in Finland consider encountering a flying squirrel to be at least somewhat of an experience, while only about 8% express some level of opposition to the species' protection.

To conclude, there are multiple framings of the issue that should be taken account in communication. Not all citizens recognize the need for (additional) conservation actions, and some will openly challenge the efforts publicly. However, large majority of citizens support the efforts, while some variation exists in the emphasis on focusing efforts in urban green areas or rural forests.

Studies in Estonia

The aim of the study (Naarits et al. 2024) was to find out the mentality of broader public regarding flying squirrel protection as well as the of the forest owners affected by flying squirrel protection restrictions. In addition, the emotional, social and economic impact of flying squirrel protection restrictions on forest owners were analyzed in more detail.

Attitudes of forest owners towards the flying squirrel

For this purpose, private forest owners whose forest land is subject to flying squirrel protection restrictions were interviewed via an online survey. 78 forest owners (53 private individuals and 25 companies) responded to the survey, whose views on the importance of flying squirrel protection differed significantly. Almost a third of forest owners considered flying squirrel protection to be important or very important, while **almost half of them assessed flying squirrel protection as not important at all or of little importance**.

The most negative attitude towards flying squirrel protection was among forest owners managing more than 1000 hectares, of whom only 7.1% assessed flying squirrel protection as important. **Protecting flying squirrels was considered important primarily by smaller forest owners**, those owing up to 10 hectares of forest. Private individuals considered flying squirrel protection to be more important than companies: nearly 40% of private individuals and only 16% of companies responded that flying squirrel protection was important or very important.

According to the owners, the restrictions resulting from flying squirrel protection have a significant impact on forest management. Nearly two-thirds of forest owners responded that the ban on clear-cutting in the restricted area has a significant or very significant impact on forest management. The impact of restrictions on other types of logging on forest management was also assessed as significant, while the impact of other nature conservation restrictions was assessed as minor. Most forest owners manage their forests themselves, and to a greater or lesser extent, they also outsource forestry work (companies 68%, private individuals 35.8%). In the case of smaller forest lands with an area of less than 100 ha, there was also no management of the forest.

The responses revealed that the estimates of the impact of restrictions on forest management depend on the size of the forest being managed. Most forest owners managing more than 1,000 hectares of forest responded that the ban on clear-cutting in the restricted area has affected forest management a lot or very much. Owners of smaller forest land, up to 10 hectares in size, clearly stood out in terms of their assessments. Almost a quarter of them were affected a lot or very much by the ban on clear-cutting, while 58% responded that the ban on clear-cutting either did not affect them at all or had a very little or little impact.

The estimate of revenue lost per hectare of forest land per year due to restrictions on flying squirrel protection varies depending on the form of ownership and the size of the forest land owned. About a fifth of forest owners were unable to estimate the amount of income lost and did not answer the question. On average, forest owners estimate that approximately 600 euros/ha per year is lost. According to private individuals, the loss of income per hectare of forest land resulting from the flying squirrel protection restriction is higher than that of companies: on average 700 euros/ha and 500 euros/ha, respectively.

If we take the average value of forest land per hectare, based on land purchase and sale transactions made under § 20 of the Nature Conservation Act during the year 2024, and distribute it over 40 years as

the basis for the annual loss of income, the value will be approximately 450 euros/ha. According to forest owners, about 600 euros/ha per year will be lost due to the protection restrictions. This difference indicates the need to review compensation measures and the need for better coordination between forest owners' assessments and official valuation methods.

Companies that did not receive Natura 2000 support for private forest land estimated that their annual loss of income was significantly higher than those that received support: an average of 800 euros/ha and 500 euros/ha, respectively. However, there were no major differences in the estimates of loss of income given by private individuals who did not receive Natura 2000 support for private forest land and those who did, which remained at around 700 euros/ha.

The State offers land tax exemption, Natura 2000 support for private forest land and the option to sell the forest land to the state under certain conditions as compensation measures for the restrictions imposed to protect the flying squirrel. It is estimated that the land tax exemption together with Natura 2000 support for private forest land can compensate for up to 38% of the annual loss of income due to the restrictions. Forest owners estimate that compensation measures have a limited impact on compensating for the annual loss of income from forest management. However, the compensation measures offered by the State were considered very important. The most important were land tax exemption and Natura 2000 support for private forest land: nearly 81% of forest owners assessed them as important or very important. The most important alternative measure was the possibility of land exchange, and greater flexibility in the options for transferring land to the State was also considered important. According to forest owners, the unit rates of support are not fair in compensating for lost income and the unit rates must be significantly increased. Nearly 75% of forest owners responded that the compensation measures do not cover the lost income at all or cover it to a very small extent.

The vast majority (81%) of forest owners associate restrictions with social impacts: the most important social impact of restrictions was the reduction in people's income (86%). Almost two-thirds of forest owners also noted the slowdown in economic activity in the region and people leaving the region as social impacts. At the same time, forest owners did not associate the flying squirrel's presence in the forest with any additional benefits or opportunities: 77% responded that conservation restrictions do not bring any additional benefits. Forest owners are also less willing to participate in flying squirrel protection activities. Slightly more than half of forest owners are not ready to contribute to flying squirrel protection, 22% are not ready to participate in volunteer work or activities related to flying squirrel protection. At the same time, it turned out that owners primarily associate contributing to flying squirrel protection with their own property and enduring the restrictions imposed on it and the lost income.

Many forest owners expressed concern and disappointment about the flying squirrel protection restrictions: they believe these **restrictions hinder forest management and cause them direct economic loss**. The restrictions do not allow for sustainable forest management and logging activities, resulting in forests losing their economic value, maturing beyond their prime, and becoming damaged. Forest owners worry that the income lost from the forest represents not only a direct financial loss but also a lost opportunity to renew and maintain the forest's health. The restrictions also cause emotional harm and stress, as **forest owners feel their rights and freedoms are being restricted**. Nor has adequate compensation or support been received to make up for these losses. In summary, forest owners believe that the current nature conservation framework is unreasonably structured and causes more harm than good.

Attitudes of the broader public towards the flying squirrel

A questionnaire directed at the broader public received responses from 455 individuals, mostly residing in Harju or Tartu counties, possessing higher education, and employed in the public sector. Nearly half of the respondents also owned forest land. Most people considered themselves fairly informed about the protection of the flying squirrel, primarily receiving information from media coverage, which is typical in today's information age.

Most respondents considered the protection of the flying squirrel in Estonia to be necessary. **Opinions differed on whether additional measures should be added to the current flying squirrel protection activities**. Forest owners were more likely to oppose adding further protection measures, which is an expected result, as they already feel that protecting the flying squirrel affects their ability to manage their forests as expected. This is particularly evident in their responses regarding lost income: 43% of respondents indicated that, in their opinion, the compensation for income lost due to the flying squirrel protection restrictions is insufficient. The issue of **inadequate financial compensation** was also frequently mentioned in the comments.

Respondents to a public survey had differing opinions on whether measures to protect the flying squirrel are currently sufficient. The most significant protection measures include restrictions on various types of logging in the flying squirrel's range. It was clear from the responses that there is **strong support for limiting clear-cutting in protected zones**. Conversely**, restrictions on sanitary, thinning, and light logging were not considered important**; these types of logging are seen more as opportunities to manage forests while adhering to environmental protection requirements.

Although the protection of the flying squirrel in Estonia is generally considered important, the survey results indicate that **a significant portion of respondents (51%) are not yet willing to personally contribute to its protection**. Financial contributions were supported by 22% of respondents, while 26% expressed a willingness to participate as volunteers in various activities. Comments highlighted that willingness to contribute is significantly influenced by previous negative experiences and the perception that private forest owners are being deprived of the opportunity to manage their forests and obtain the desired income due to flying squirrel protection. It was also pointed out that through taxes or business activities, a sufficient contribution is made to the State, from which the financial resources received can also be directed to nature conservation activities.

Overview

From both surveys and interviews in Estonia, it emerged that private forest owners' primary concern is not the presence of protected species in their forests, but rather the restrictions imposed to protect the species, which they believe are unreasonably strict and detrimental to the condition of the forest, while the compensation for lost income is unfair. The flying squirrel itself does not hinder local life and in some cases, it even thrives in human habitats. New protection restrictions resulting from the discovery of flying squirrel habitats have a direct impact on local governments, primarily increasing pressure on the budget through reduced land tax revenues and increased infrastructure costs. Indirectly, it affects the local economic structure as forestry and transportation businesses may disappear due to management restrictions, with insufficient replacement by alternative activities such as tourism. However, the main issue highlighted by participants is the State's attitude as the enforcer of restrictions, which they described as condescending and frustrating. The solution seen is direct communication with the landowner during the forest inventory and deciding on restrictions in cooperation with the forest owner. State representatives are expected to respect the work of private forest owners and have simple straightforward discussions, making sure that the interaction is indeed a dialogue, not a monologue.

Full version of the Naarits et al. (2024) report on EEB website:
https://keskkonnaamet.ee/sites/default/files/documents/2025-04/Lendorava%20kaitse%20sotsiaalmajandusliku%20m%C3%B5ju%20uuring.pdf

Similarities and differences between countries

The results demonstrate several similarities across countries. Both countries show a range of attitudes toward flying squirrel protection, from strong support to strong opposition. Although most seem to be on the positive side or at least tolerate flying squirrel, some respondents had a very negative attitude towards flying squirrel conservation. The public in both countries shows broad support for flying squirrel protection. However, the willingness to personally contribute - financially or through volunteering - is somewhat limited. Thus, it is not easy to see a common attitude that would describe how majority of people see the flying squirrel conservation.

Among forest owners, the size of the owned forest seems to have an effect. Interestingly, forest owners having a small forest tend to be more supportive of protection than those owning a larger forest in both countries. This may be related to the importance of what the forest has for an owner: if the forest estate is rather small, its importance for an owner's own economy is not very large. On the contrary, if the forest owner has a larger forest, its importance for an owner's economy is also larger. Thus, restrictions on forest use due to the flying squirrel can directly influence the expected income from forests.

Therefore, forest owners in both countries expressed concerns about economic losses due to restrictions. There also is a perception that compensation is insufficient to cover lost income. Restrictions, especially on clear-cutting, are seen as having a significant impact on forest management in both countries. Owners feel that these restrictions limit sustainable forest use and reduce forest value.

However, a very interesting approach was seen in a study of citizens' attitudes towards flying squirrels in Finland. There majority seem to think positively or at least tolerate flying squirrels. Although relationships between flying squirrel forests and other biodiversity or recreation values now seem weak, signs of potential **co-benefits** with flying squirrel conservation and recreation in urban forests were seen. This is an encouraging example that in some cases, increasing co-benefits in urban land use can be possible. However, co-benefits may be difficult to find for forests which are primarily set for economic use by the forest owners.

Specific differences were not easy to observe as the survey scope and analyses used were different. In the future, similar socio-economic analyses could be repeated but possibilities to design common methods to enable comparisons should be investigated further.

Conclusions

In both contexts, the frustration with how the state implements restrictions for flying squirrel conservation is clear. This calls for better communication and cooperation. As forest use continues to be a threat for the flying squirrel, understanding attitudes of forest owners better can be one key in a future process to develop socio-economically better accepted conservation practices.

It is evident that economic use of forests continues in both countries. One possibility could be to encourage searching for simultaneous **co-benefits** from different values within the same forests. For example, biodiversity values, carbon storage, recreation, or other ecologically and socially meaningful values could be defined as goals and linked to ways how forests are managed in the future.

It seems important to continue studying socio-economic approaches, and to monitor the attitudes by repeating questionnaires. These studies in the Flying Squirrel LIFE project were designed separately to Finland and to Estonia, but later, it would be possible to carry out another study covering both countries with similar questions. A common approach would be useful for monitoring purposes, but also enable a better comparison of outcomes, perhaps even at the level of numbers besides interpretations. However, selection on methodology must be done with care.

References

Flying Squirrel LIFE publications:

Juutinen, A. & Pellikka, J. (editors) 2024: Liito-oravan suojelu. Luonnonvara- ja biotalouden tutkimus 103/2024. Luonnonvarakeskus. Helsinki. 54 pages. D2 Report on LUKE's tasks in the Flying Squirrel LIFE project.

Kangas. K., Juutinen, A., Ilvonen, S. & Nikula, A. 2022: Virkistyskäytön keskittymät Kuopiossa, Jyväskylässä ja Espoossa. Luonnonvarakeskus. 21 pages. D2 Deliverable Social value and conflict maps, Flying Squirrel LIFE.

Naarits, A., Matveev, E., Sülla, T., Tiirats, K. & Kirt, K. 2024: Lendorava LIFE-projekti sotsiaalmajandusliku mõju uuring. Maaelu Teadmuskeskus. 51 pages. D2 Report of a socio-economic study in Estonia, Flying Squirrel LIFE.

Links to project website and data services:

Flying Squirrel LIFE: https://www.metsa.fi/en/project/flying-squirrel-life/

Laji.fi (flying squirrel page in Finnish): https://laji.fi/about/5660

Paikkatietoikkuna (map layer Liito-orava): https://kartta.paikkatietoikkuna.fi/?lang=en