Habitat probability and corridor maps, habitat probability GIS layers (first landscape)

English summary

Flying squirrel LIFE (LIFE17 NAT/FI/000469)

Action D3, Ecosystem function restoration

Deliverable: Habitat probability and corridor maps, habitat probability GIS layers (first landscape): Case Laajavuori

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As part of the EU-funded Flying Squirrel LIFE Project, Natural Resources Institute Finland (Luke) conducted an evaluation in which ecosystem functions and structure were assessed by first mapping the Siperian Flying Squirrel, SFS habitats in Laajavuori, Finland. The SFS habitat suitability was based on indexes describing the stand structure favorable for SFS nesting habitat. Further, to account for connectivity, another set of indexes was calculated for each stand to describe stand's suitability as a corridor for the movements of SFS. Technically, the above-mentioned indexes were analyzed with Geographic Information System (GIS) methodologies and tools, and by applying a Least Cost Path, LCP analysis. In addition, a cost-impact analysis was carried out to discover cost-efficient forest management regimes to maintain habitat suitability and connectivity for SFS. The results of SFS suitability and connectivity are presented as maps, and the outcome of cost-impact analysis is published as a concise table illustrating main results.

SFS suitability maps

Flying squirrels favor mature or old-growth Norway spruce-dominated forests with deciduous trees. Then, the occupancy of SFS in a stand is dependent on the amount of preferred habitat in the surrounding area. To account for connectivity, we calculated another set of indexes for each stand to describe stand's suitability as a corridor by applying a Least Cost Path, LCP analysis. To be able to assess the effect of alternative forest management regimes on SFS habitat availability and connectivity, we estimated stand projections and linked them with SFS habitat models describing favorable SFS habitats. Stand projections were produced according to Motti stand simulator to discover how they affect predicted suitable SFS habitats. In this report four (4) alternative management scenarios (consisting of stand projections) were applied and further analyzed: 1) Business-as-usual, **BAU** (thinnings and clearcuttings according to prevailing silvicultural guidelines, no attention to SFS habitats), 2) **MINOR** (no cuttings allowed in stands with large aspen, but no criteria to maintain connectivity), 3) **MAJOR** (no cuttings in stands with large aspen, the number of connections between habitat patches must exceed 500 and no clearcutting allowed anywhere) and 4) **ULTIMATE** (no cuttings allowed anywhere and number of connections exceeding 500). For each scenario (1-4) a SFS suitability map was created in evolving time, total time horizon being 30 years. For simplicity, in this Deliverable only the starting point (year 0, before any scenario is activated) and end point (at year 30) associated with scenarios 1-4 are chosen to be presented for SFS suitability maps.

Cost-impact analysis

In addition to SFS suitability maps, a cost-impact analysis was carried out. We assessed the trade-offs (timber revenues vs. suitable SFS habitat areas) between alternative management scenarios to reveal the cost-efficiency of protecting SFS habitats. The management scenarios represented alternative goals of forest management – from pure timber production (BAU) to different SFS habitat conservation treatments (MINOR, MAJOR and ULTIMATE). Stand projections (produced by Motti stand simulator) were linked with SFS habitat model and connectivity to assess benefits (i.e., increasing the amount of suitable SFS habitat) while timber production associated with management scenarios was monetized to assess costs (in a form of losses in discounted timber revenues compared to management scenario with the highest net present value, BAU). The results of the cost-impact analysis provide guidelines to protect suitable SFS habitats with a cost-efficient manner. Silvicultural costs and stumpage prices were based on a 14-yr time series and they were adjusted to

inflation according to cost-of-living index. The time horizon for the cost-impact analysis and SFS habitat suitability was 30 years. The cost of additional hectare suitable for SFS for each management scenario is presented in Table 1. The cost-impact analysis revealed that there are distinctive differences in cost-efficiency between management scenarios (Table 1). However, the relevant question would be whether the most cost-efficient management scenarios would eventually provide enough suitable SFS habitats in absolute terms. In other words, do they safeguard SFS populations with the magnitude enabling SFS to survive and even thrive in the forested landscape?

Table 1. Cost of an additional hectare suitable for SFS associated with management scenarios, € ha^{-1}. Interest rate 4%. Area of suitable SFS forests at the end of the time horizon (30 yrs) also presented, in hectares. Total forest area in Laajavuori is 559 hectares.

Management scenario	Cost of additional hectare, € ha^{-1}	Area of suitable SFS forests, ha
BAU	NAN*)	87.2
MINOR	13 398	120.4**)
MAJOR	18 957	139.8
ULTIMATE	19 251	140.3

*)BAU is the base which other management scenarios are compared to (i.e., timber revenue losses are calculated against this scenario),**) 120.4 hectares compared to 87.2 hectares indicates additional 33.2 hectares which each costing 13 398 € ha^{-1}, totaling to 444 814 €.

Data availability

For more information about the data and its availability, please contact Anssi Ahtikoski (anssi.ahtikoski@luke.fi), Natural Resources Institute Finland.

Disclaimers

The producer of maps (Natural Resources Institute Finland) is not responsible for any damage or costs incurred due the use of maps to the user or any other party.

The project has received funding from the LIFE Program of the European Union. The material reflects the views by the authors, and the European Commission or the CINEA is not responsible for any use that may be made of the information it contains.

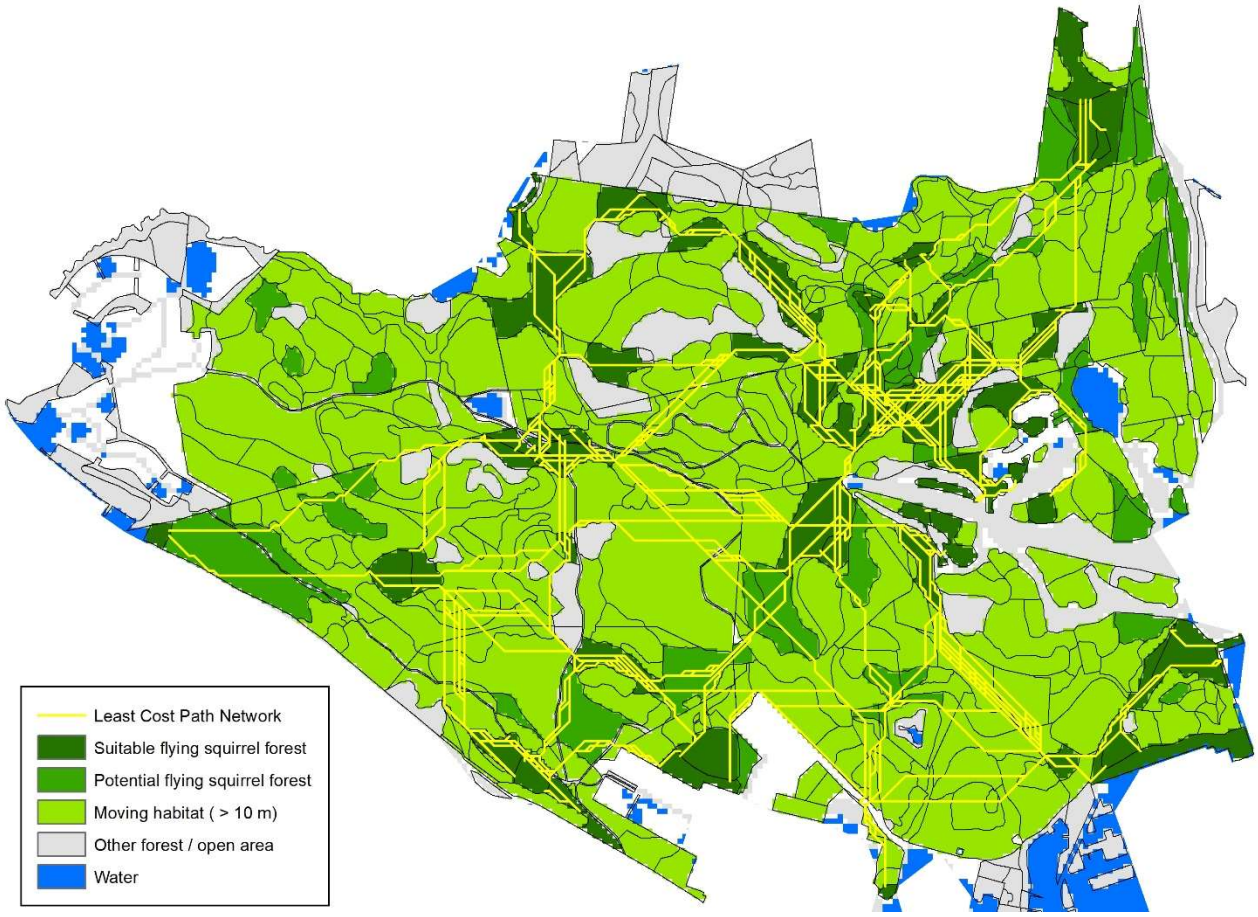
MAPS

Map 1: Starting point (year 0 corresponding to calendar year 2021), a SFS suitability map of Laajavuori. Total area 559 hectares.

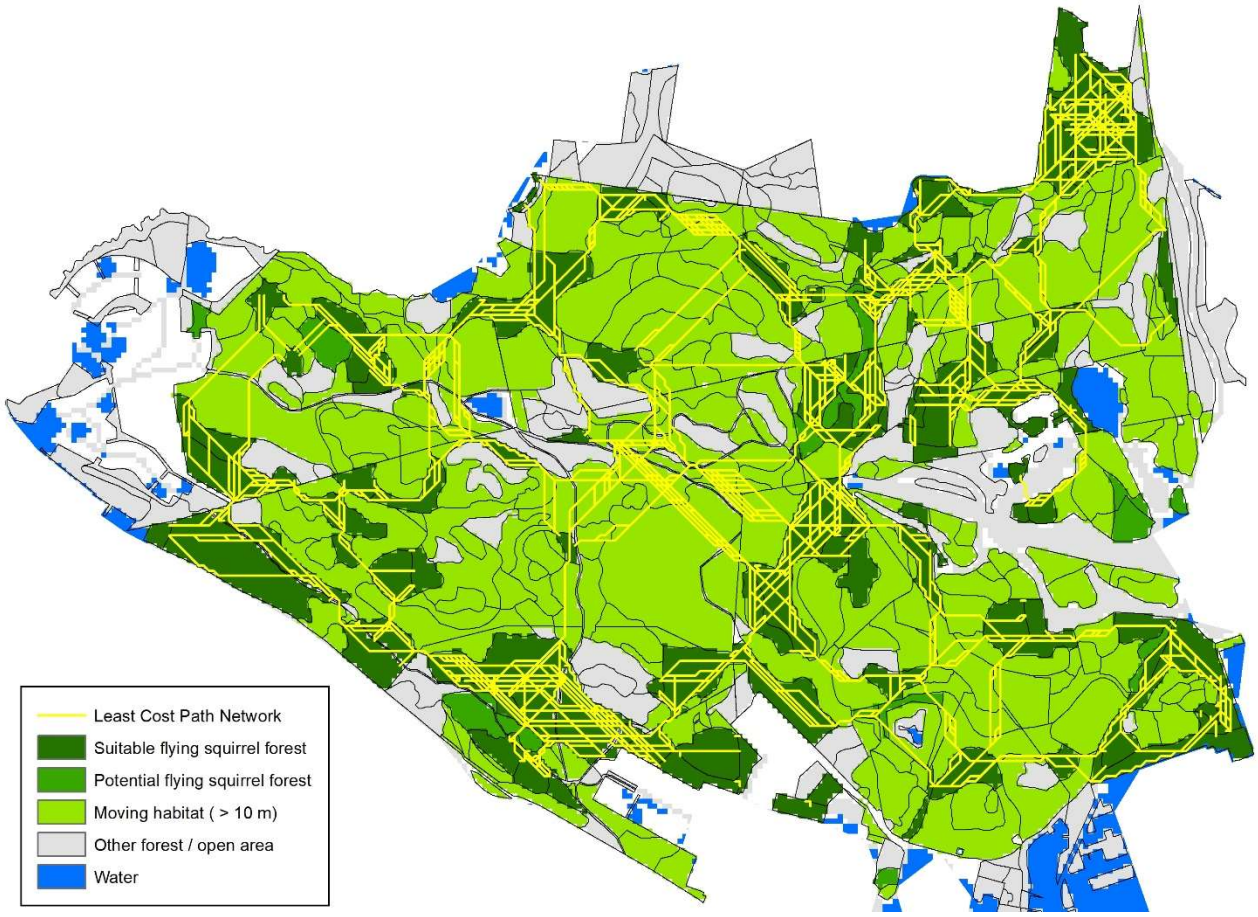
Map 2: A SFS suitability map associated with BAU at end point, year 30.

Map 3: A SFS suitability map of MINOR management scenario, year 30.

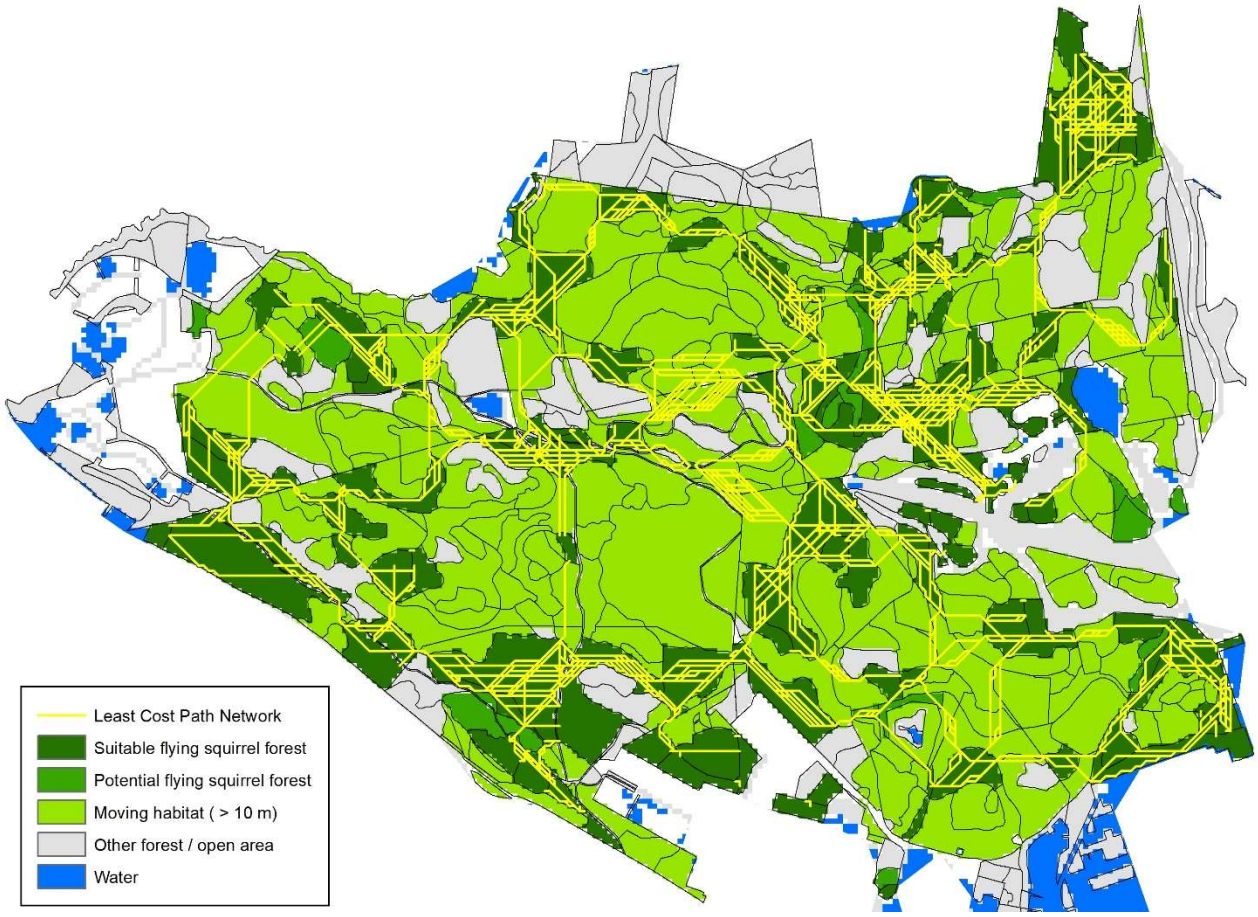
Map 4: A SFS suitability map of ULTIMATE management scenario, year 30.



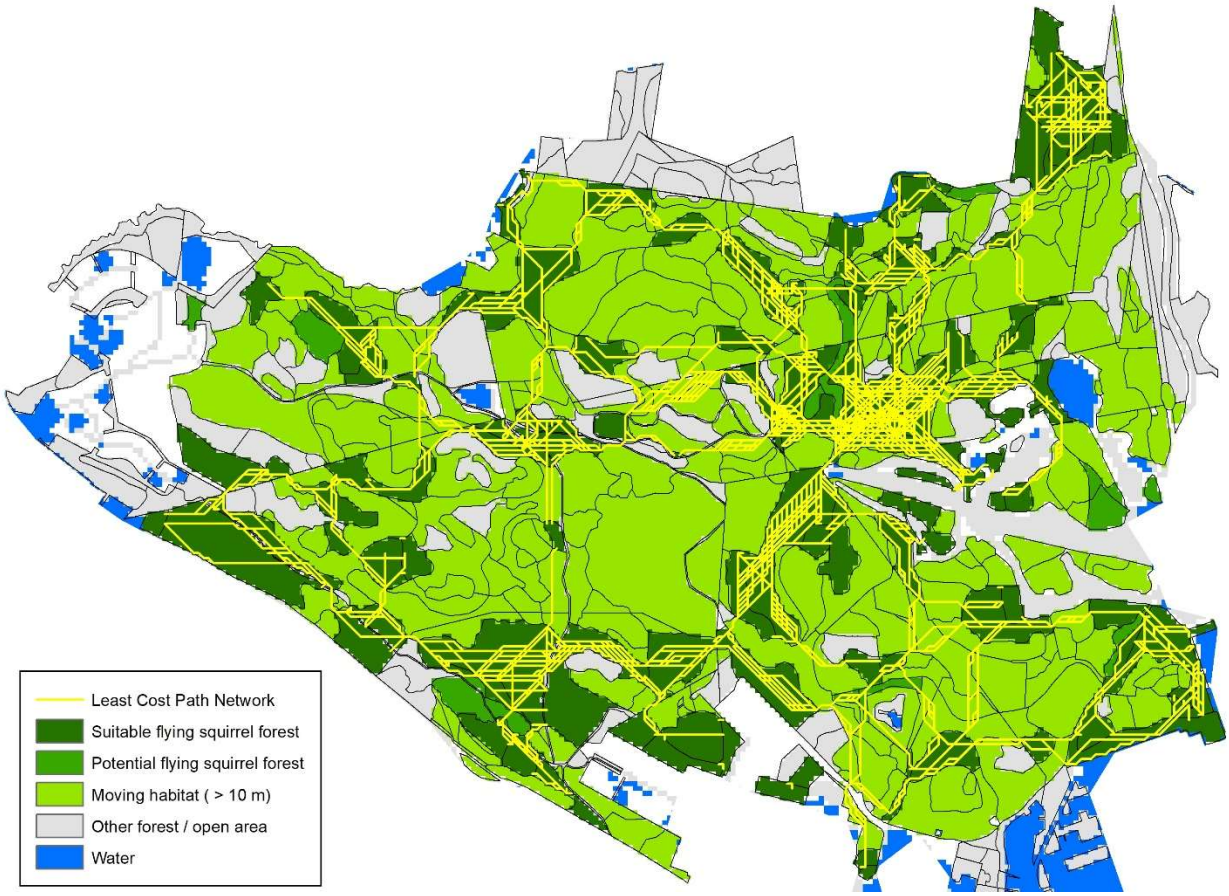
Map 1: A SFS suitability map of Laajavuori at starting point (year 0 corresponding to calendar year 2021). Total forest area 559 hectares. Connectivity lines based on Least Cost Path analysis. (Note that this map applies to all scenarios since the scenarios are yet not activated at starting point).



Map 2: A suitability map associated with BAU management scenario at end point, year 30. In BAU there were no restrictions on management indicating that SFS habitats are ignored.



Map 3: A SFS suitability map of MINOR management scenario, year 30. In MINOR management scenario no cuttings were allowed in stands with large aspen. However, no criteria to maintain connectivity was set indicating quite loose strategy to actually safeguard SFS population in the landscape.



Map 4: A SFS suitability map of ULTIMATE management scenario, year 30. This management scenario ensures that SFS population will survive and even thrive in the landscape. In this management scenario (ULTIMATE) there are 140.3 hectares suitable for SFS while in BAU there are only 87.2 hectares - the increase is substantial (61%). Total forest area is 559 hectares.