How does landscape structure affect butterfly abundance and diversity in agricultural environments – case study in the Åland islands

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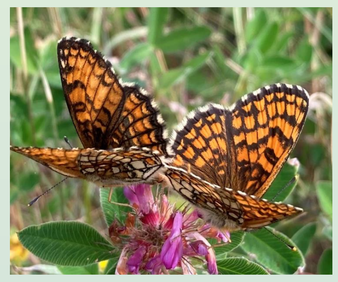
Introduction



- Land use is one of the major factors driving the current biodiversity change[1,2]
- Butterflies are often used as indicator species, and many of them are found in agricultural environments[3]
- This study aims to:
  - establish the current situation of the butterfly community in agricultural environments in Åland for further studies
  - determine potential correlation between butterfly abundance/diversity and land use at different spatial scales

Methods

- We repeated a butterfly survey (previously conducted in 2002, 2011 and 2017 by SYKE) using standard butterfly transect methods in 10 study areas during the summer of 2022 in the Åland islands, SW Finland (fig. 1.)
- Each study area had a transect line of 1 km in total length which comprised of 20 50-metre-long segments (fig. 2.)
- Landscape structure was analysed using the most recent (2018) CORINE-database landcover classifications (fig. 3.)

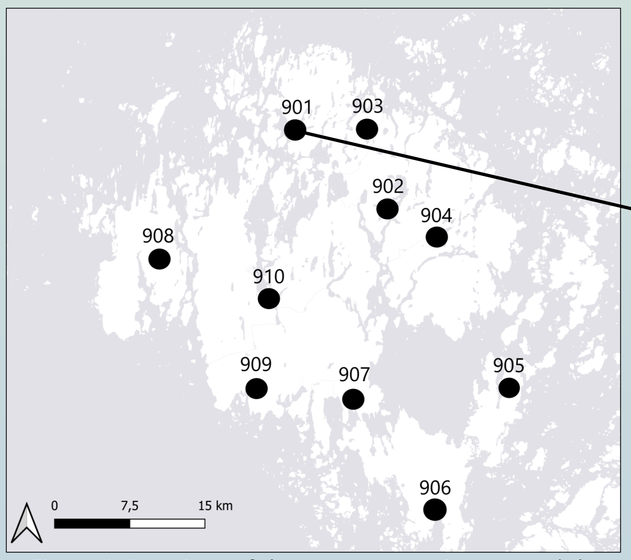


Figure 1. Locations of the ten transect sites around the Åland islands.

Figure 2. Transects were comprised of 50-metre-long segments placed within the 1 km² study area.

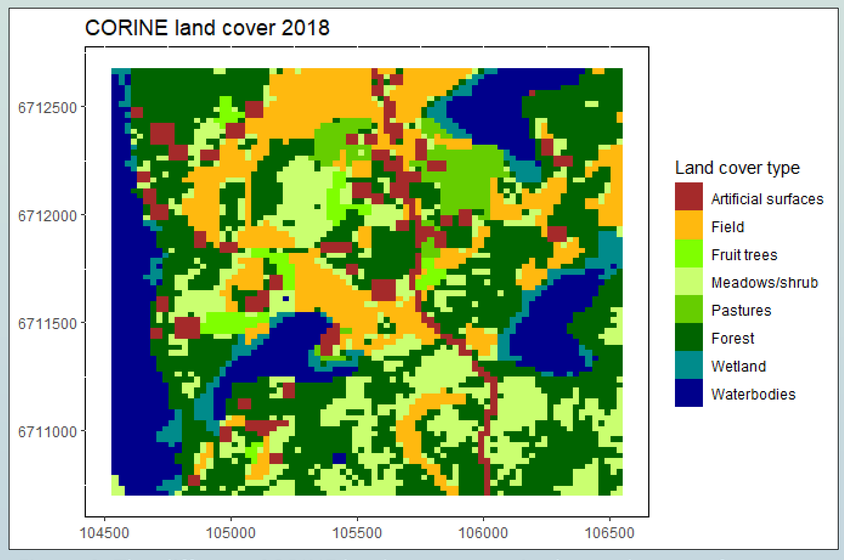


Figure 3. The different CORINE land cover types in the study area of transect 901.

Results

- Total numbers of butterflies in each year and in each transect in 2022 are shown in figures 4. & 5.
- Land cover varied little between the transects with most study areas comprising mainly of forest and field with 0.5 km buffer (fig. 6.)
- The proportion of field cover correlated negatively (-0.66, $p<0.05$) with species richness (fig. 7.), no correlation was found between other land cover types and butterfly abundance or diversity
- No significant correlation was found between habitat heterogeneity, connectivity or fragmentation and butterfly abundance and diversity at this spatial scale
- Next step in the analysis is to continue the analysis with larger buffers (1,5km & 2,5km) on a transect level but also on a smaller spatial scale within the separate segments of transects (fig. 8. & 9.)

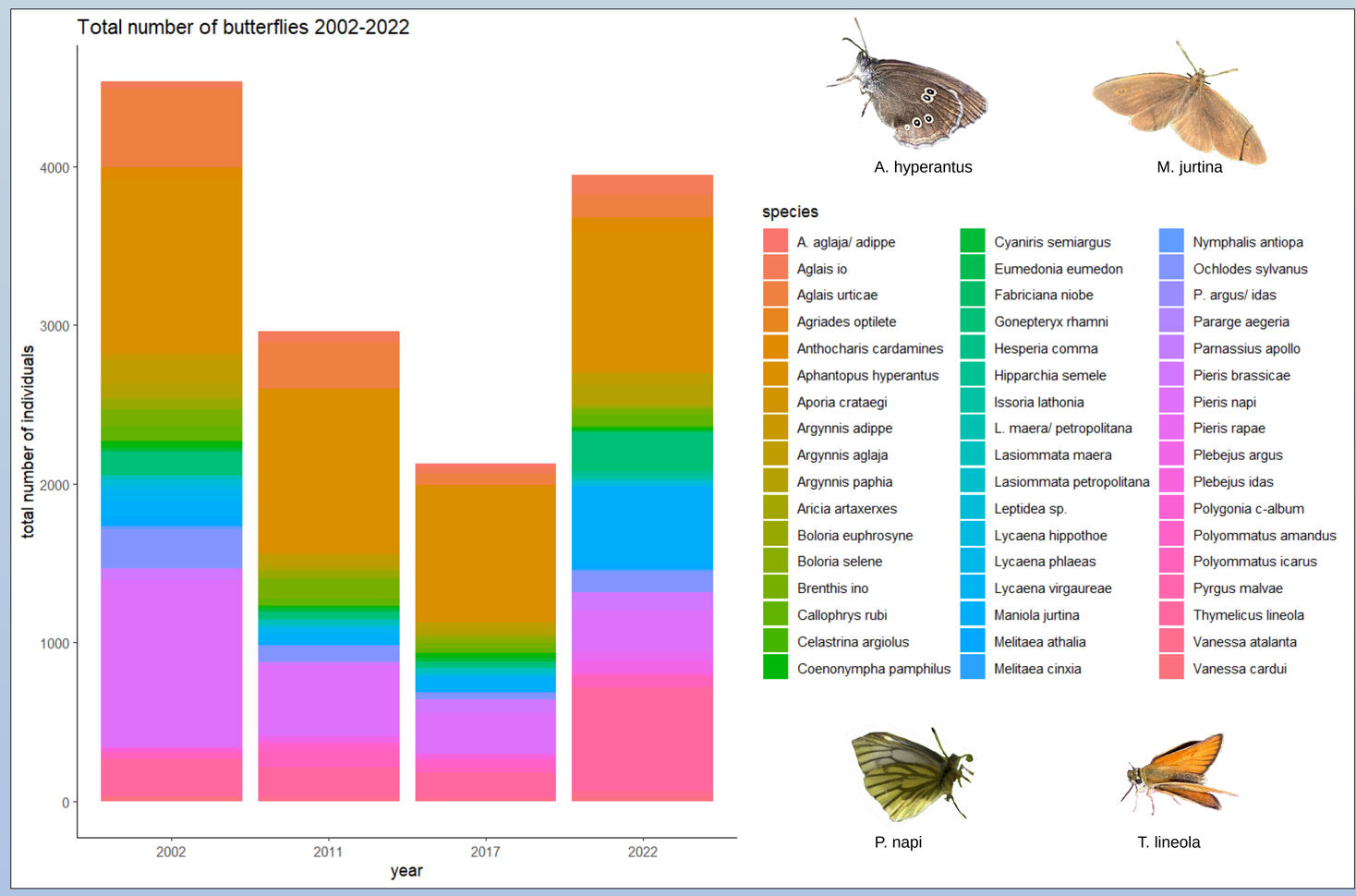


Figure 4. Total numbers of butterflies recorded between 2002 and 2022 showing the proportions of different species in the total number.

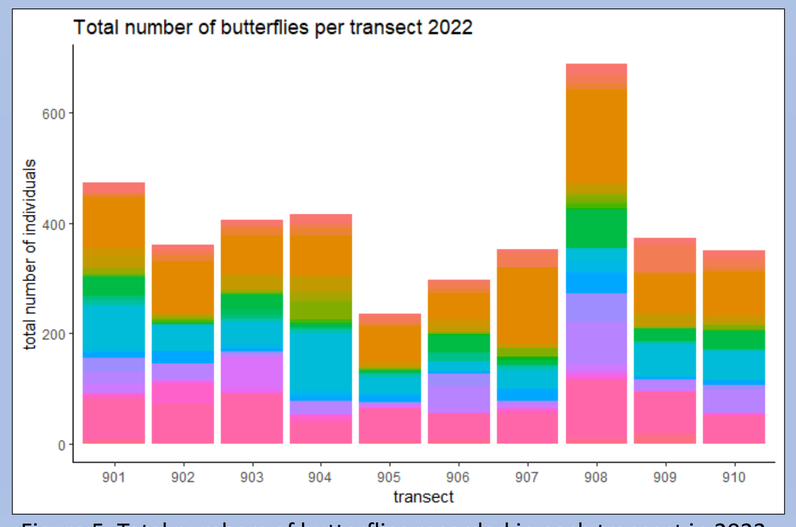


Figure 5. Total numbers of butterflies recorded in each transect in 2022 with different species proportions (for species legend see figure 4.).

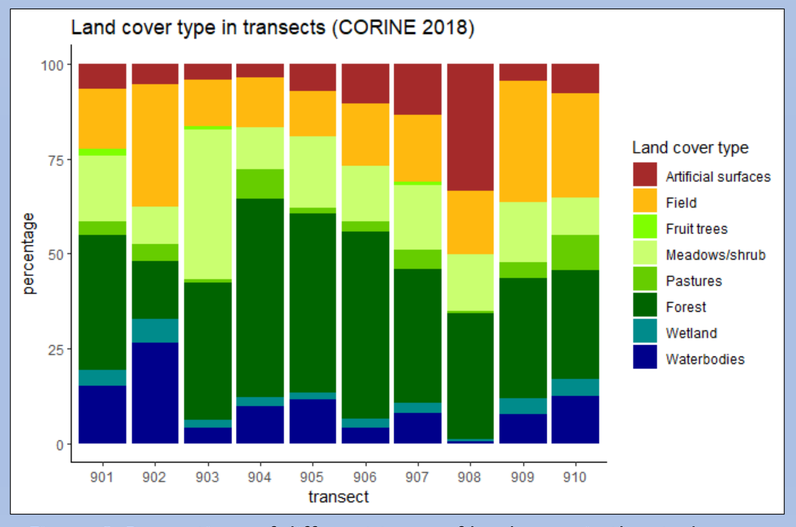


Figure 6. Proportions of different types of land cover in the study areas with 0.5 km buffer.

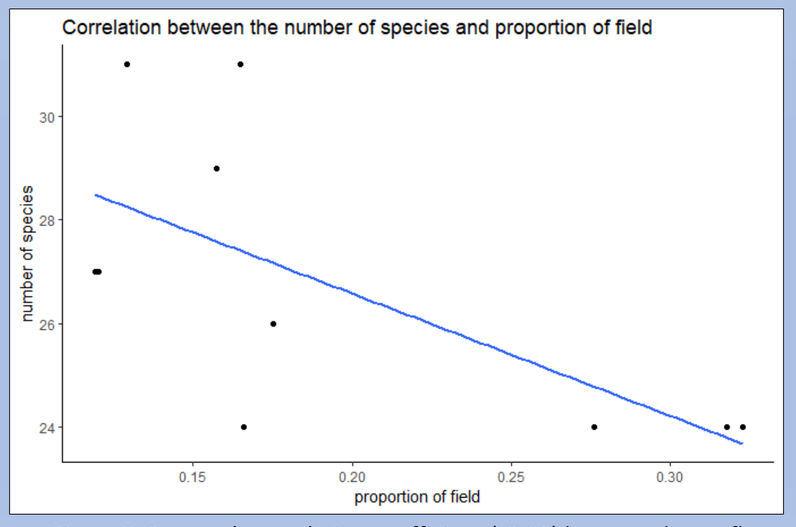


Figure 7. Pearson's correlation coefficient (-0.66) between butterfly species richness and proportion of field cover in the study areas.

References: 1. Raven, P. H., & Wagner, D. L. (2021). Agricultural intensification and climate change are rapidly decreasing insect biodiversity. *Proceedings of the National Academy of Sciences*, *118*(2), e2002548117.
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3. Thomas, J. A. (2005). Monitoring change in the abundance and distribution of insects using butterflies and other indicator groups. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *360*(1454), 339-357.

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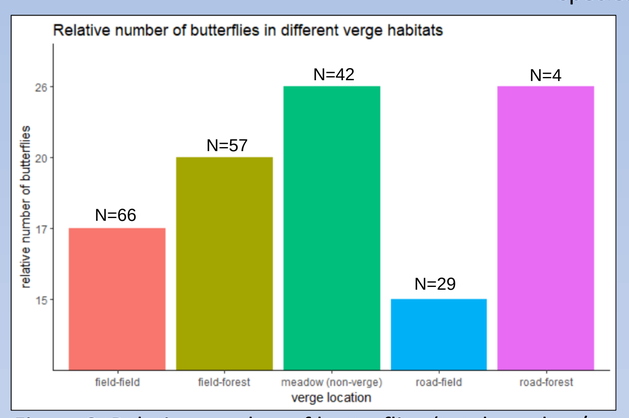

Figure 8. Relative number of butterflies (total number/ number of segments(N)) in each habitat type.

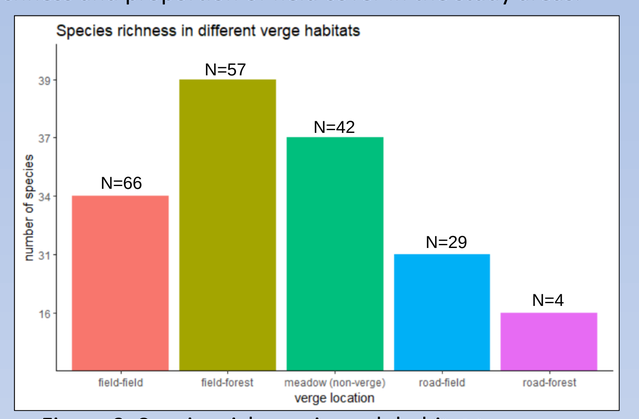

Figure 9. Species richness in each habitat type (N=number of segments).