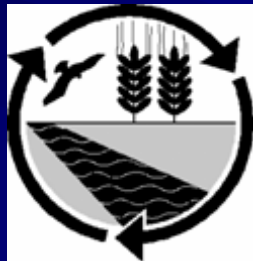


The importance of landscape structure for biodiversity: results of long-term study in an unique, mosaic farmland in western Poland



Krzysztof Kujawa

Institute for Agricultural and Forest Environment,
Polish Academy of Sciences, Poznań

(formerly : Research Center for Agricultural and Forest Environment)

Institute for Agricultural and Forest Environment, Polish Academy of Sciences Poznań



Department of
Environmental
Chemistry

Department of
Environmental
Biology



Field Station
in Turew

Department of
Agricultural
Systems

Department of Climate
and Water Resources

Recent most valuable achievements of the Institute

1. Detection of **climate change** (warming, precipitation) in observations and projections for Wielkopolska Region, Poland and Central and Eastern Europe.
2. Demonstration that **climate extremes** (intense precipitation, flood flows in Europe, droughts) are getting more extreme.
3. Three contributions as Co-ordinating Lead Author (prof. Z. W. Kundzewicz) to **IPCC reports** and technical papers.
4. Defining of multiple benefits (biodiversity, biogeochemical bareers, crop protection) of **shelterbelts in rural landscape**: theory and implementation (expert's reports, cooperation with local authorities in landscape planning and managing).
5. Demonstration of **importance of landscape context** for deeper understanding spatio-temporal variability of biodiversity.

Framework of recent study on biodiversity

Topics:

- Effect of landscape structure on biodiversity
- Long-term changes in biodiversity in an agricultural landscape
- Prey-predator relationships as factor affecting diversity of selected taxa.

Taxa studied:

- vascular plants
- macrofungi (visible in field without equipment)
- insects
- spiders
- amphibians
- birds
- mammals

Study area – the Dezydery Chłapowski Landscape Park



Small fields



Wooded patches



Shelterbelts

Methods (main) – insects



For flying insects – motor-net:

- 1975-79 and some other years
- ca. 900 samples/year
- ca. 120000 ind./year



For epigeic insects – quick trap:

- 1980 – up today
- hundred or thousands samples/year
- several thousands ind./year



For migrating insects – tower (Turew):

- passive trap
- 1995-2001, 2009-?
- several hundred ind./year

In contrary to many research teams, we apply **fully quantitative techniques** (quick-trap and motor-net)

Methods – other organisms

Birds:

- 1960s and since 1988 until now
- ~100 sampling plots, hundred points and tens km of transects
- Mapping methods

Fungi:

- Since 1997 until now
- 50 permanent sampling plots (wooded patches, road verges etc.)
- Long routes across a variety of habitats
- Cooperation with amateurs

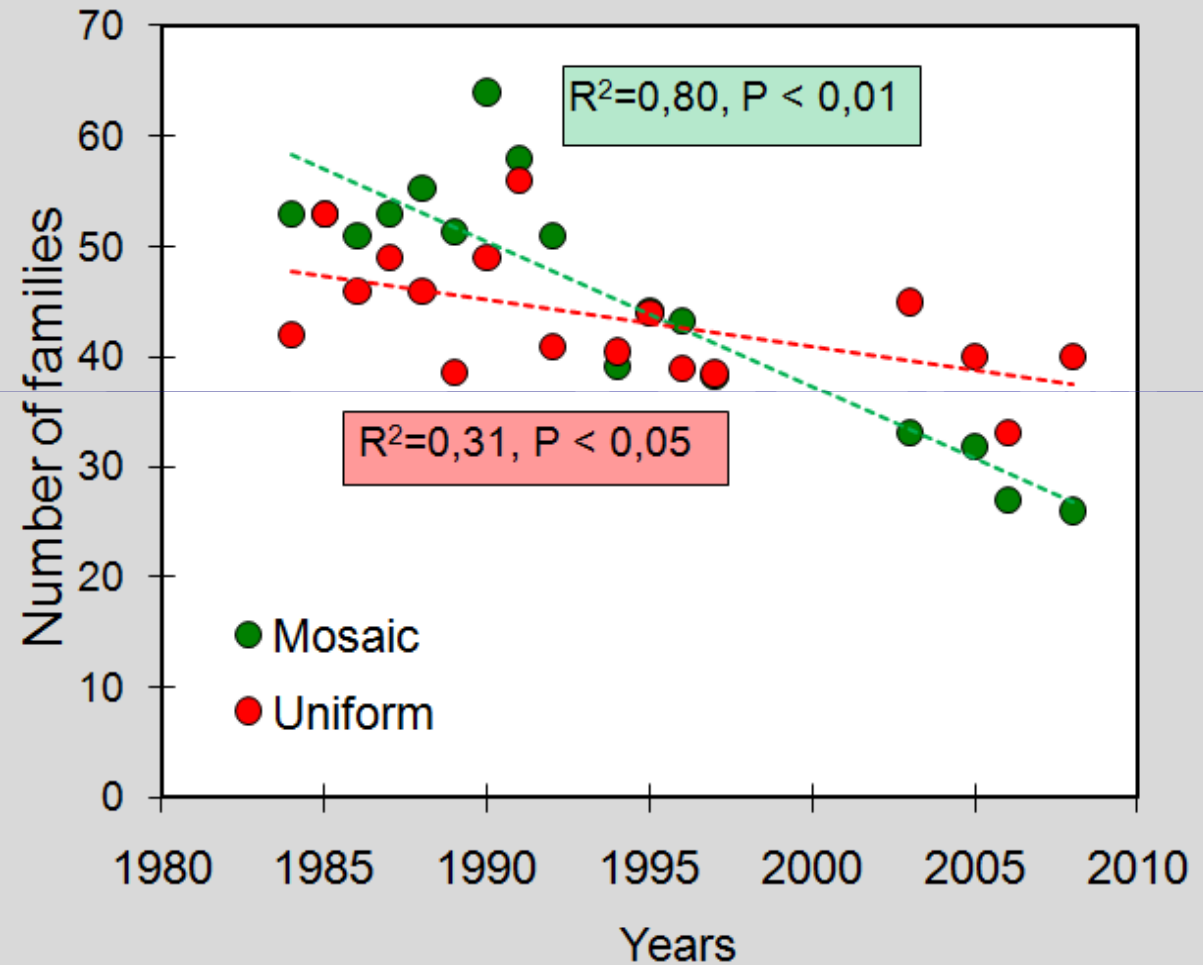
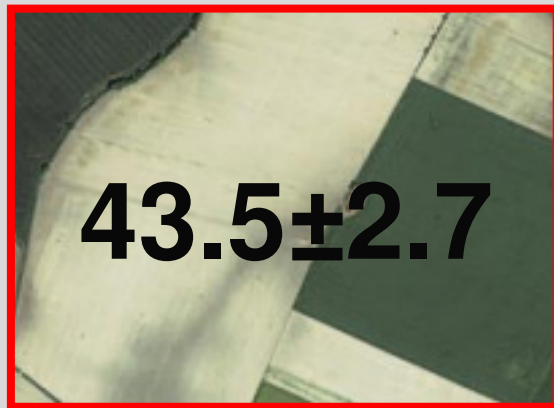
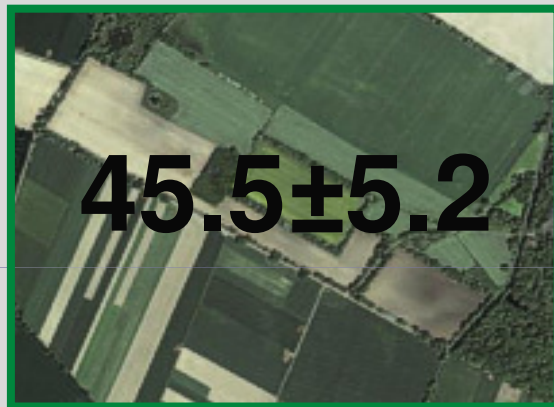
Plants :

- Since 1980s until now
- Several tens sampling plots
- Long routes across a variety of habitats

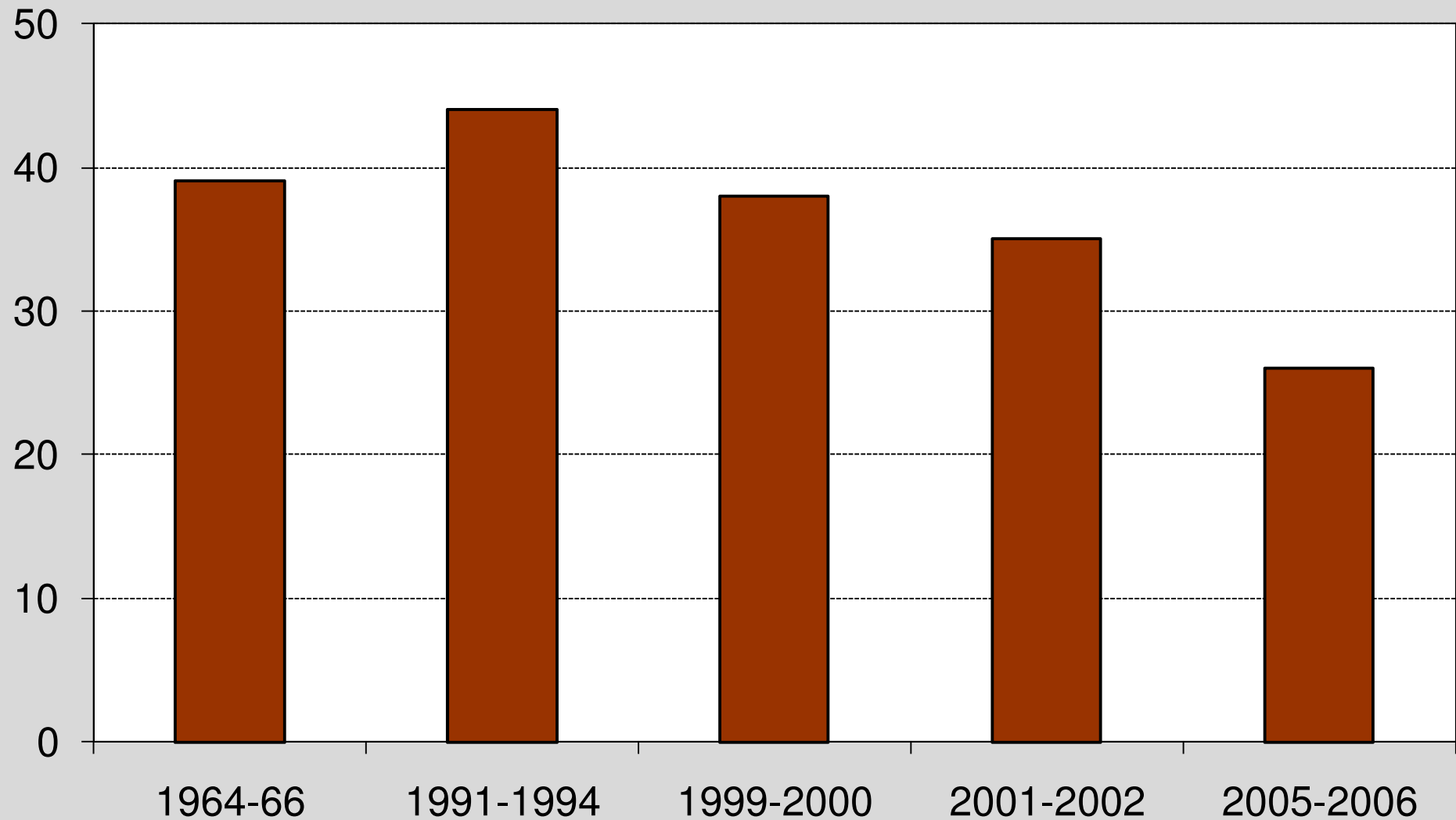
Study on long-term changes in biodiversity

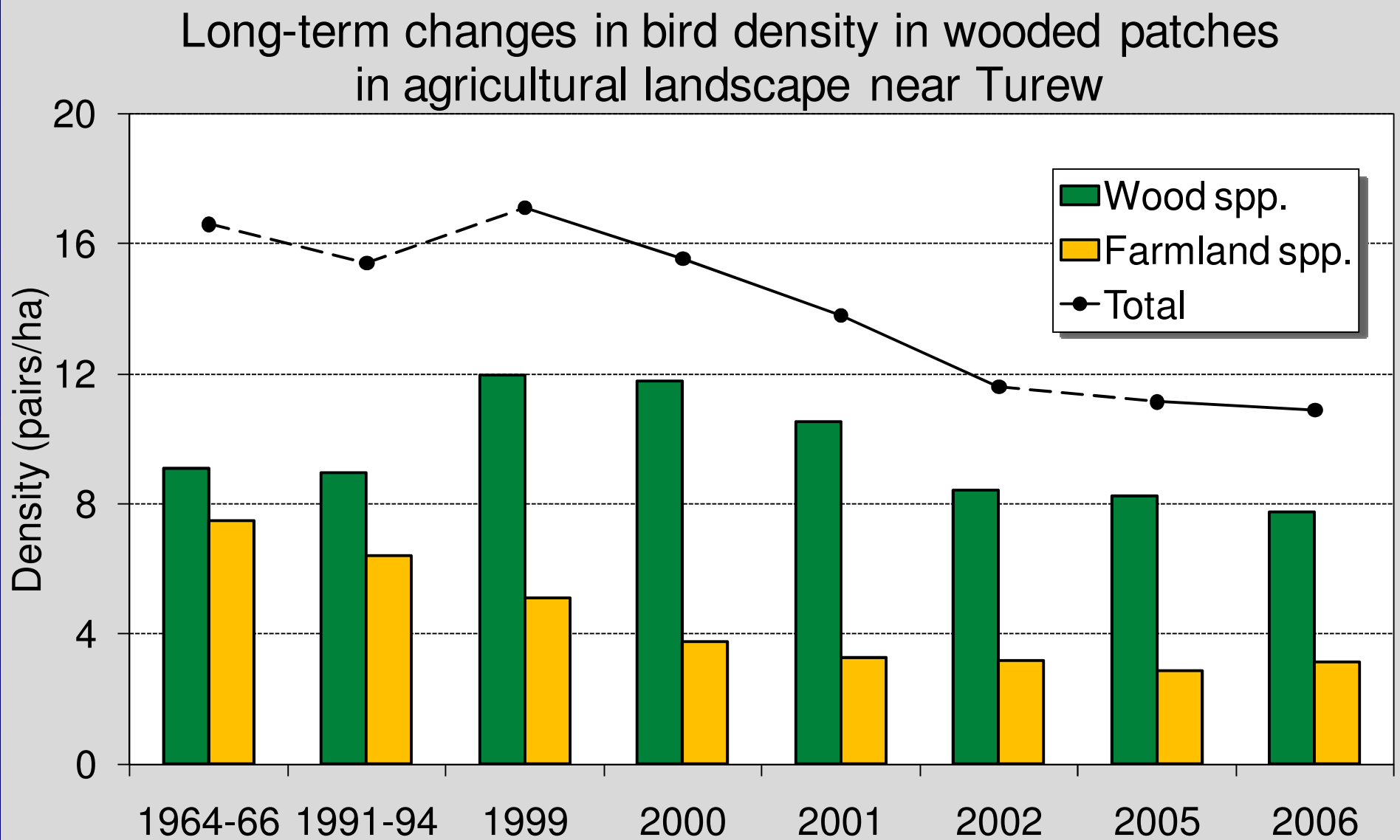
- Detection of changes
 - Looking for patterns of changes
 - Understanding the reasons for the changes
-
- Examples (insects and birds):

Long term trends in diversity (number of families) of epigeic insects in cereals in relation to landscape structure



Long-term changes in number of breeding bird species in wooded patches in agricultural landscape near Turew in 1964-2006

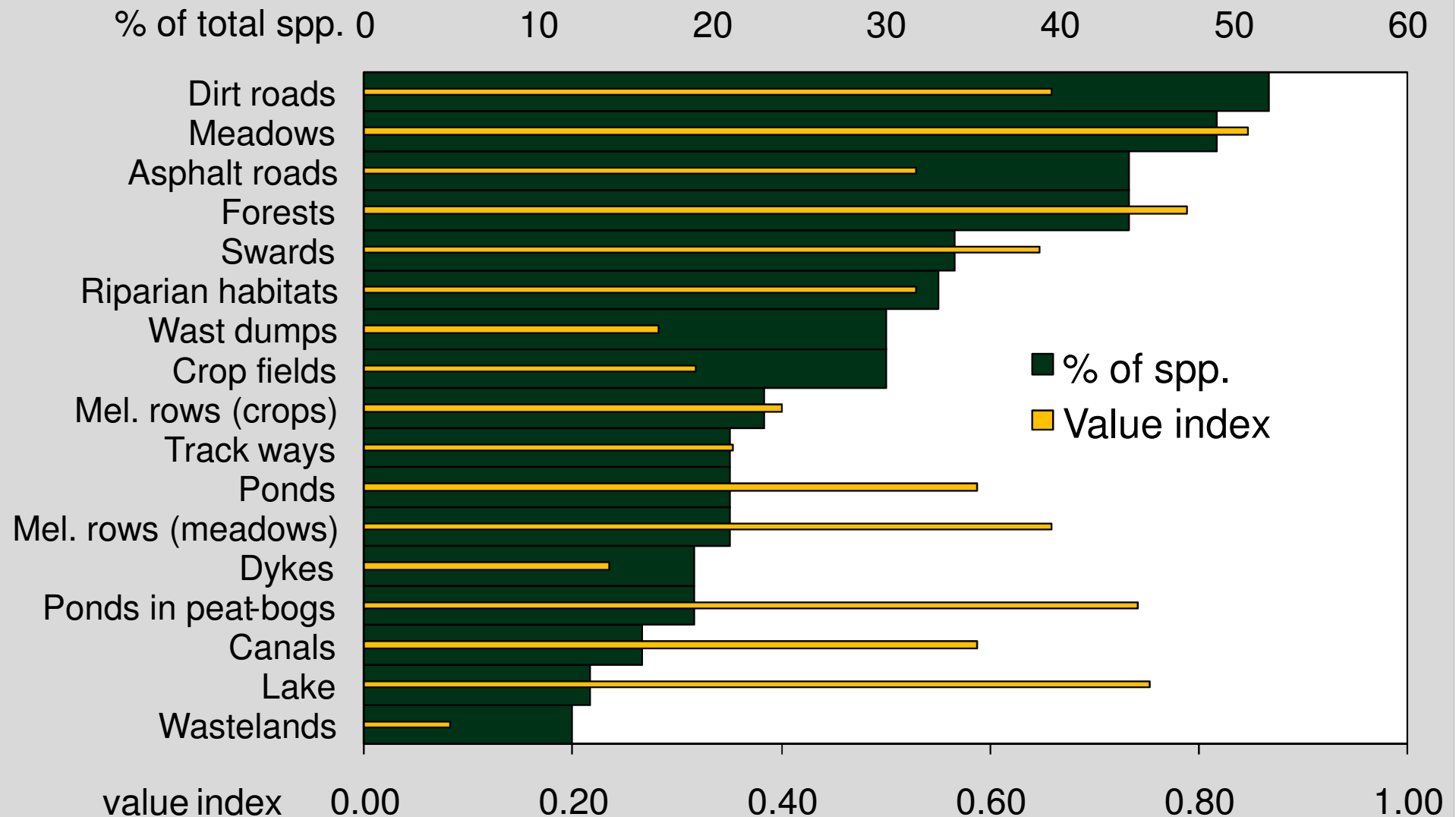




Study on effect of habitat and landscape structure on biodiversity

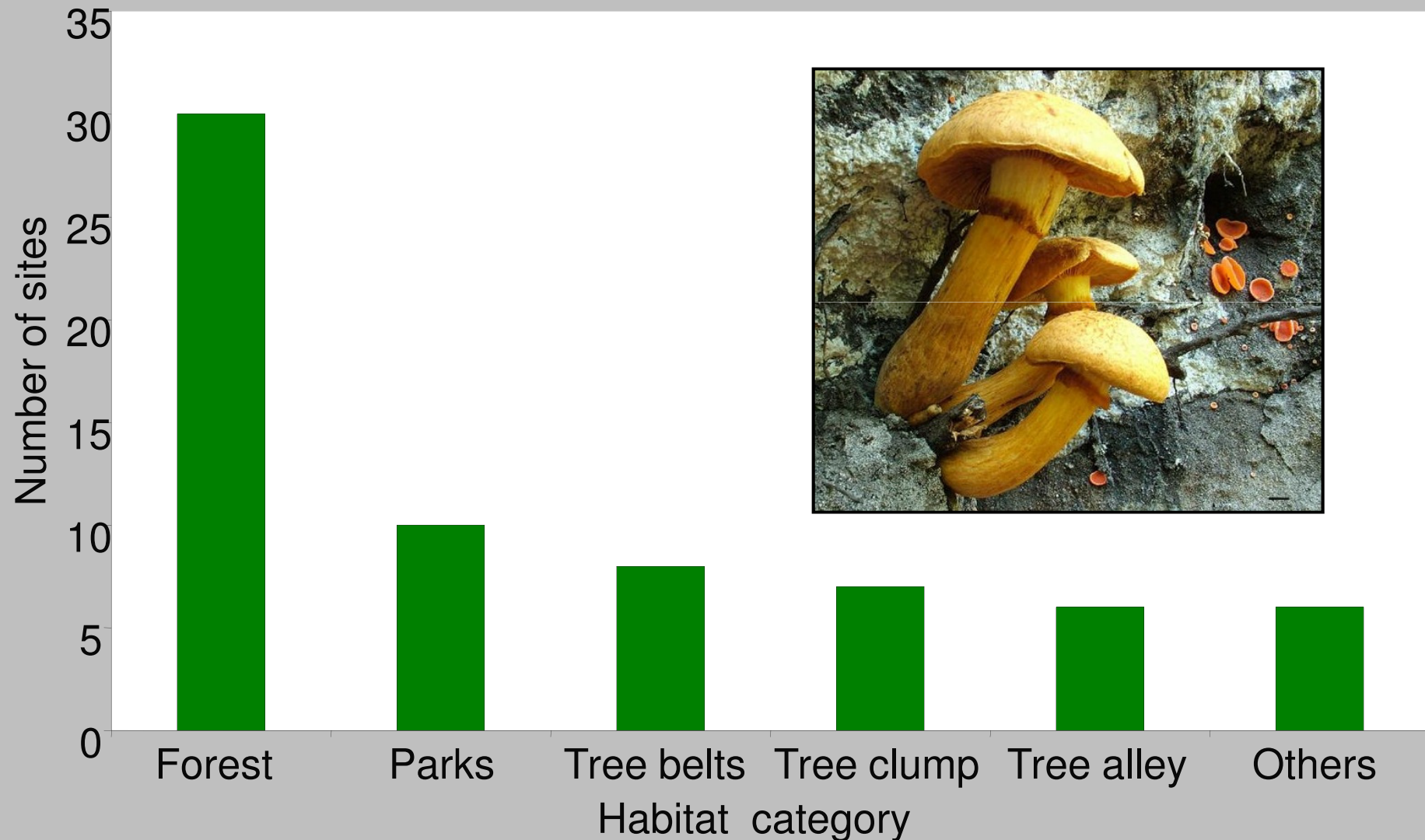
- Looking for patterns of spatial differences
- Understanding the functions of landscape structure for biodiversity protection
- Examples (plants, fungi, insects, birds):

Contribution of habitats to overall plant species diversity in agricultural landscape near Turew

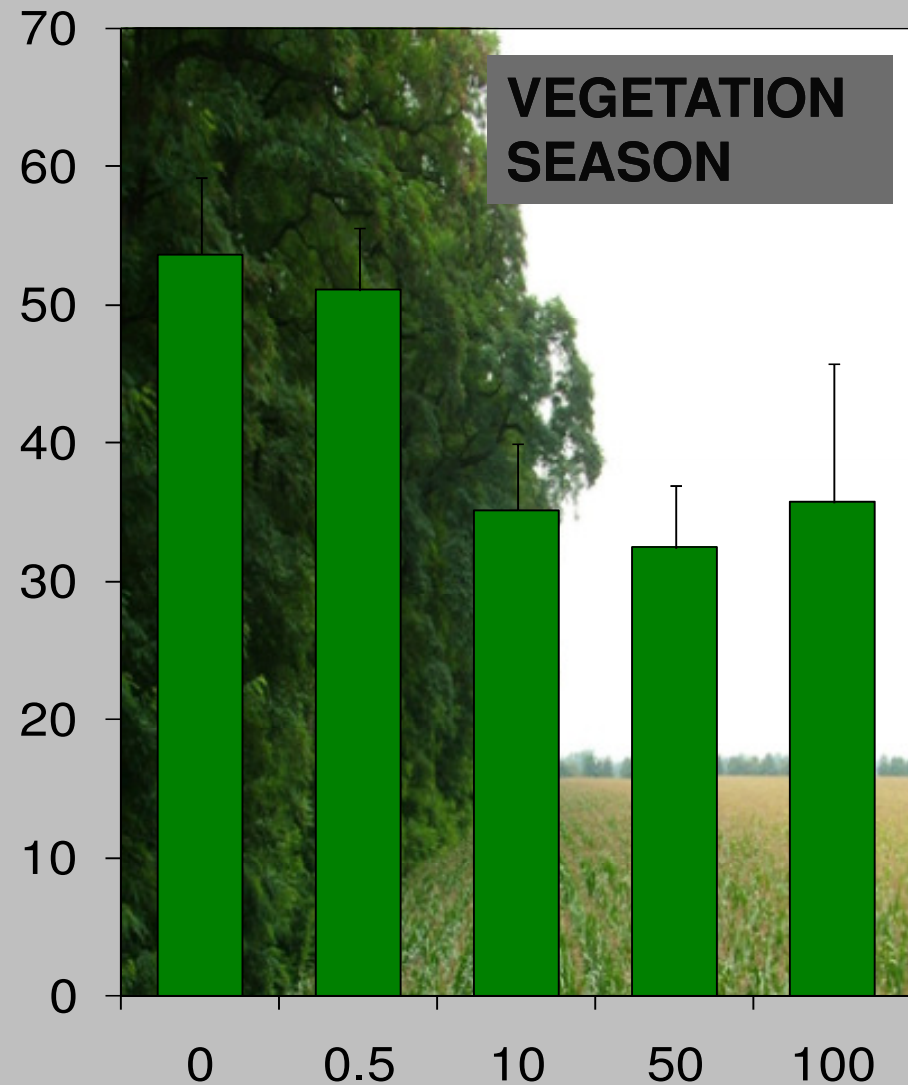
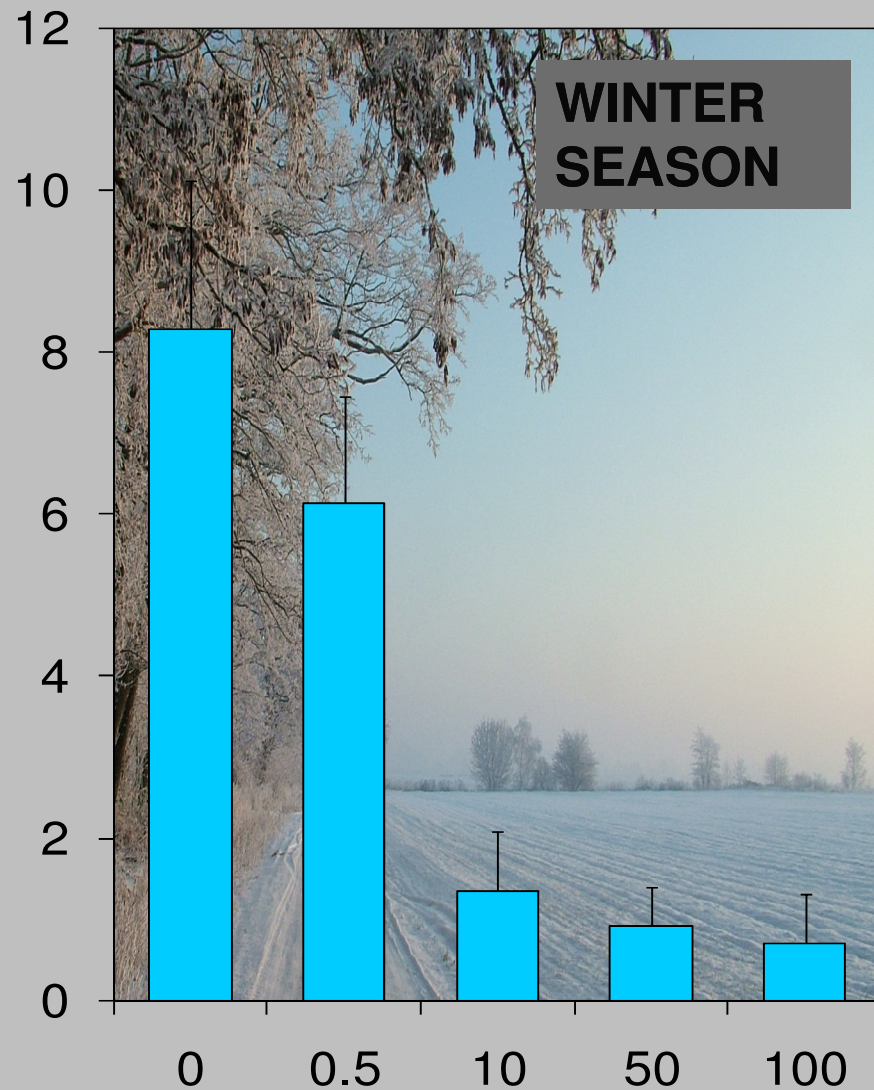


Effects of landscape structure – fungi

Number of sites of 16 species protected by law (Poland – ca. 100 spp.) in different habitats of agricultural landscape near Turew



Mean number (1995-2008) of insect families in shelterbelts and in adjacent crop fields in relation to distance from the shelterbelts



Distance from the shelterbelts (m)

Scheme of study on effect of habitat and landscape structure on birds



Breeding bird communities

Habitat structure of wood

Nearest neighborhood
(to 50m from plot)

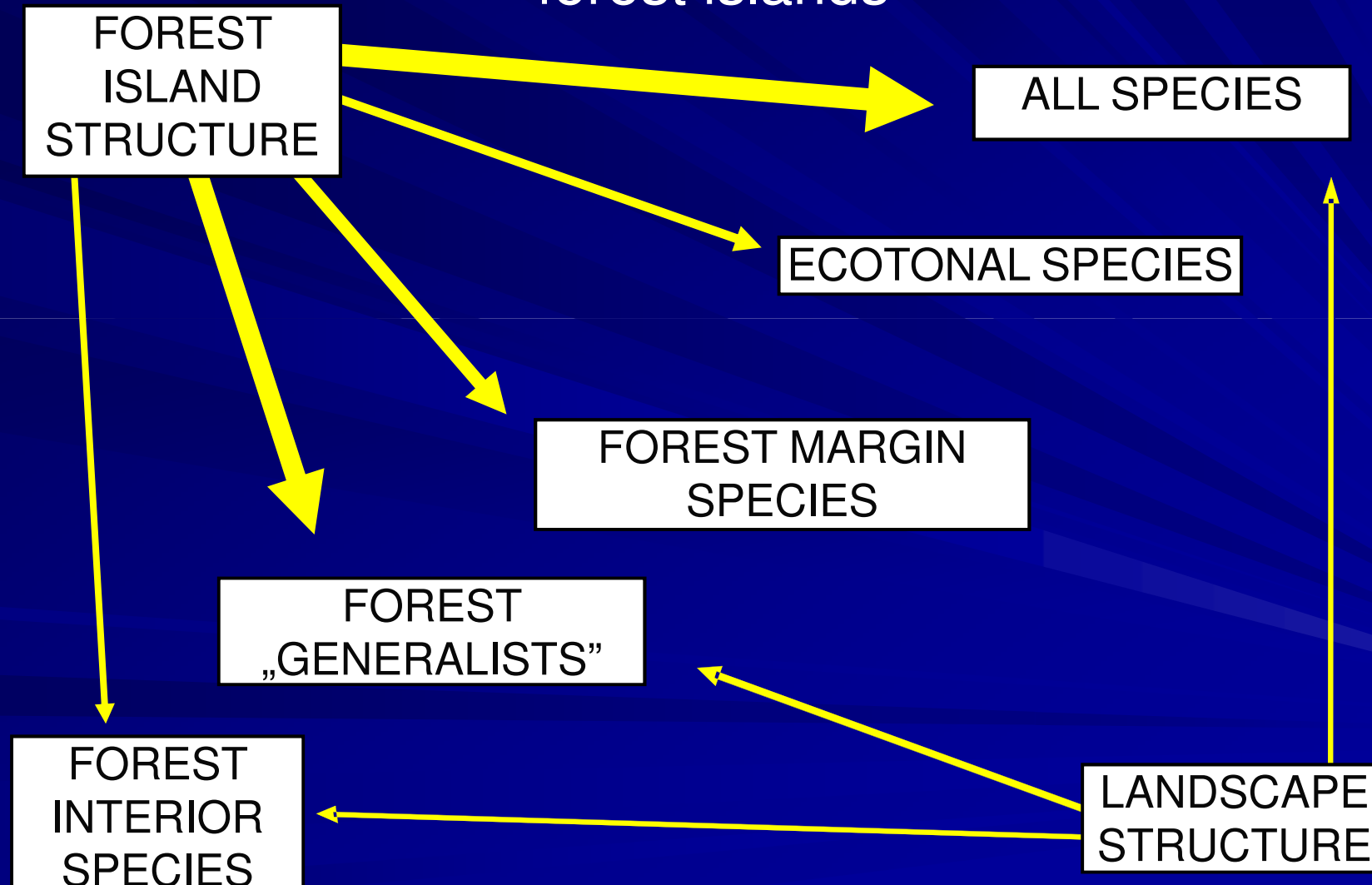
Landscape structure
(1.5 km around plot)

?

?

?

Relative influence (arrows width) of habitat (forest islands) and landscape structure on number of bird species in forest islands

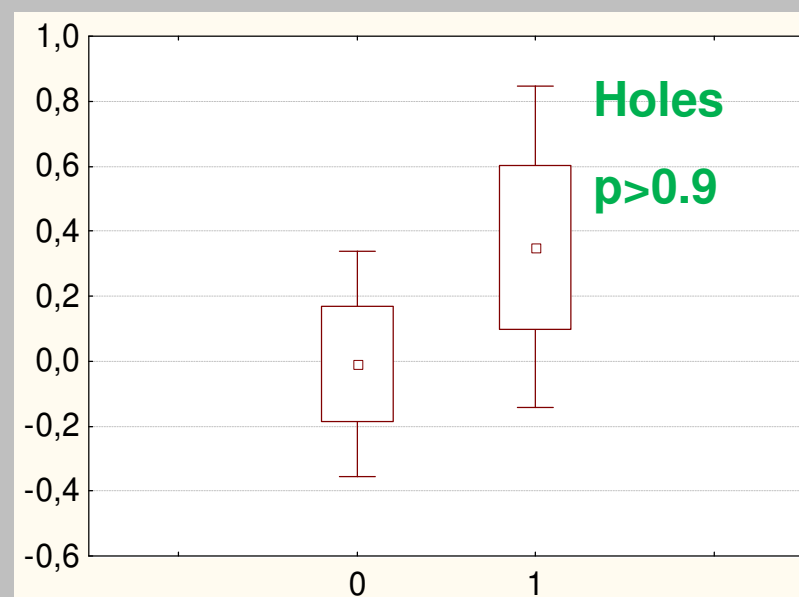
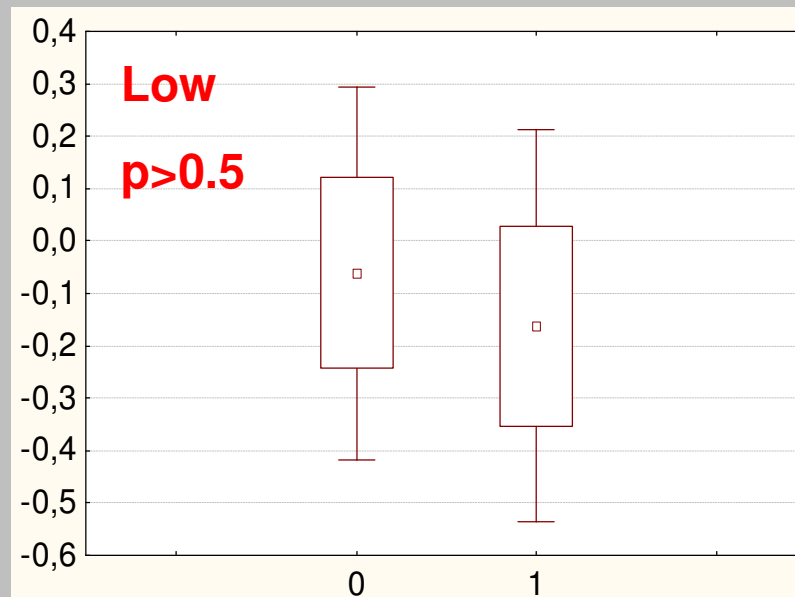
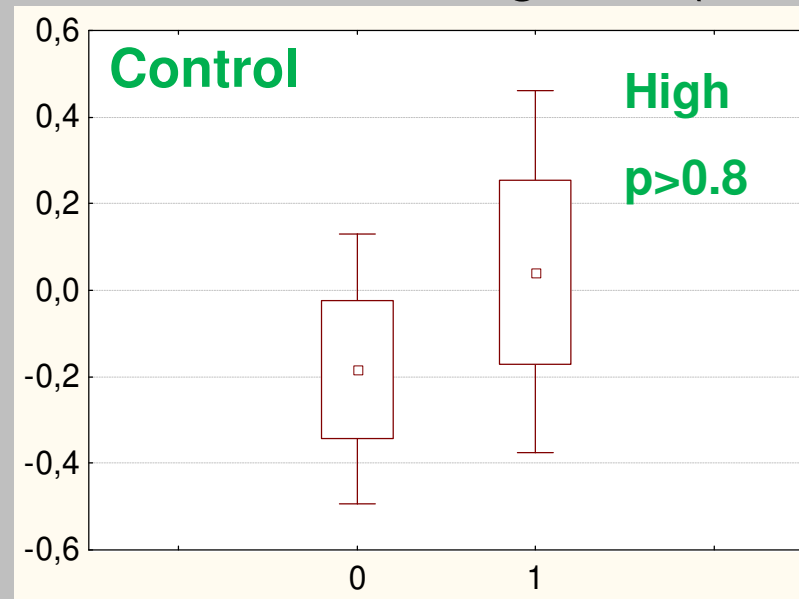
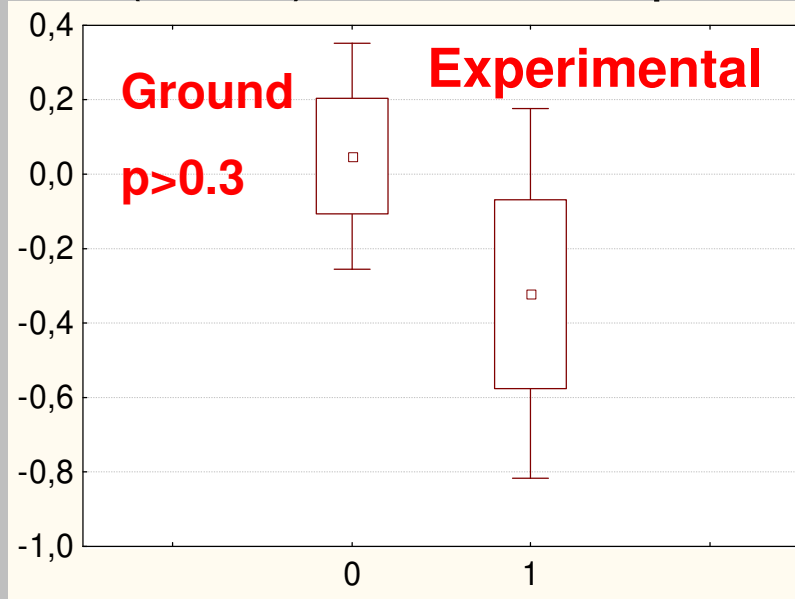


Red fox impact on bird communities occurring in farmland

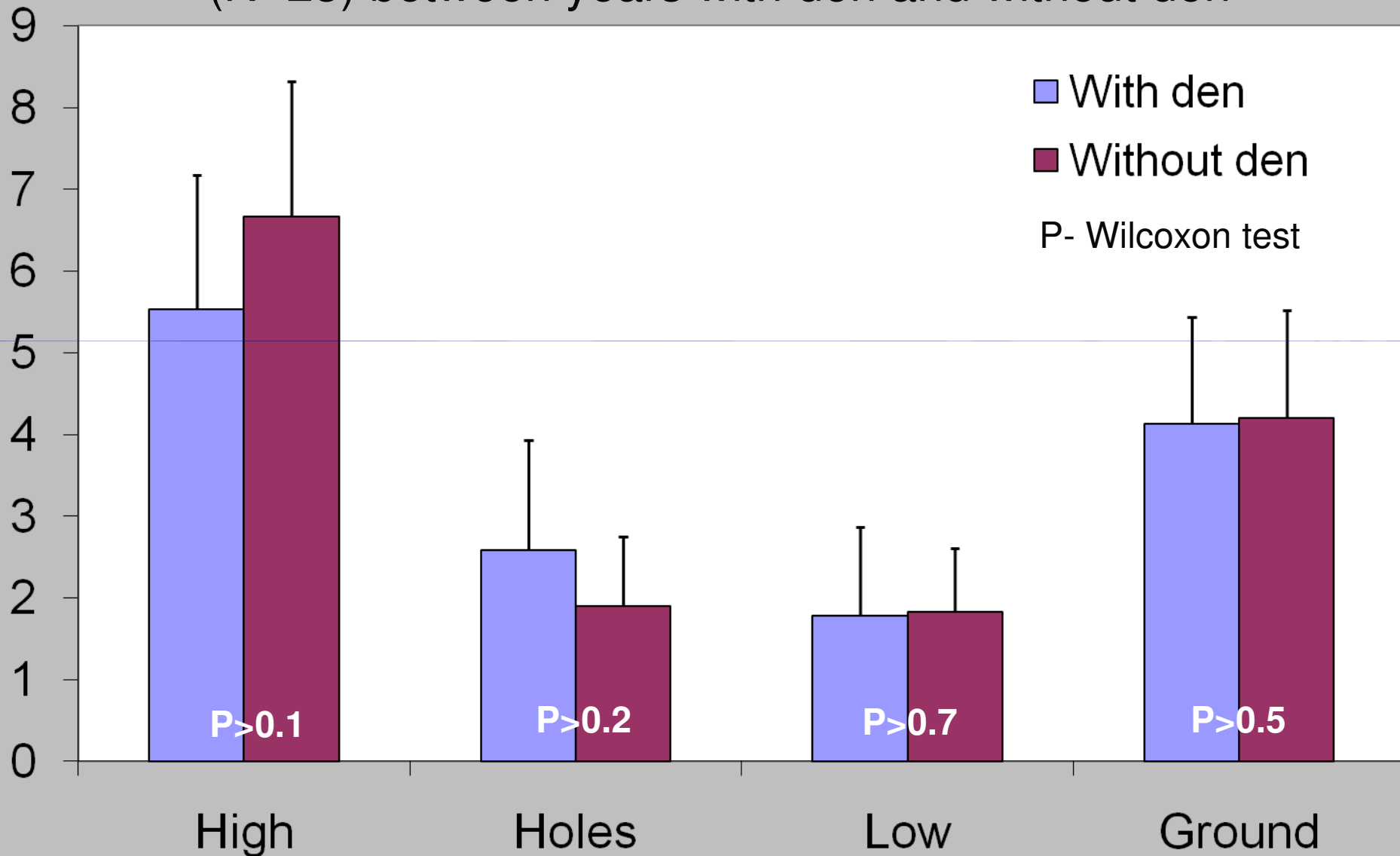


Prey-predator relationships – Red Fox & birds

Bird species number (residuals) in wood islands without (N=42) and with (N=22) dens for „experimental” and „control” guilds (2005)



Comparison of bird density (with 95% conf. level) in wood islands (N=23) between years with den and without den



SUMMARY & CONCLUSIONS:

- A variety of non-farmed habitats in an agricultural landscape indisputably constitutes basic conditions for maintaining relatively high biodiversity
- Landscape context has to be taken into account for optimization of strategy for biodiversity protection in given patchily distributed habitats
- In spite of maintaining differentiated structure of landscape, overall diversity level in farmland near Turew seems to be going down. It strongly suggests that efficiency of managing landscape structure as a tool for biodiversity protection in farmland is limited and should be complemented with applying appropriate, biodiversity-friendly farming practices (e.g. agri-environmental schemes ?).

Due to collecting of long-term data for a variety of organisms and persistence of stable and mosaic structure of landscape, farmland near Turew provides unique opportunities for testing hypotheses dealing with impact of agriculture intensification on biodiversity



Thank you for attention

Name and surname: Krzysztof Kujawa.

Born: 16.06.1964, Wrocław.

M.Sc: 1983-1988, University of Wrocław, Faculty of Natural Sciences, biology.

PhD: University of Wrocław, 1996, zoology

Habilitation: University of Life Sciences in Poznań, 2007, ecology of agricultural landscape.

- since 1987 till now at Institute for Agricultural and Forest Environment PAS in Poznań, presently as head of the Field Station in Turew;
- since 1996 till now at Grammar School in Krzywiń as a teacher of biology.

My first research (during studying biology at Wrocław University) dealt with classical population ecology of the dipper (*Cinclus cinclus*) and white stork (*Ciconia ciconia*). When I started to work at IAFE PAS, I continued study on ecology of white stork and begun research on relationships between the structure of agricultural landscape and the communities of birds and other organisms with special attention paid to biodiversity issues. The last topic is my main research area till now. Other current studies cover long-term changes in breeding bird communities and the impact of red fox on breeding bird communities in an agricultural landscape

The results of my work have been published in 41 scientific papers (including chapters in books) and presented in 24 lectures on international (e.g. EUROMAB and INTECOL seminar; International Congress of Ecology, Meetings of the European Ornithologists Union, International Ornithological Congress) or numerous Polish conferences and seminars.

I took a part in different international research, among other I cooperated with Wurzburg University, ZALF (Germany) and within the Alter-NET.

I was involved in different measures dealing with nature protection: preparing of expert's report on protected areas, preparing Polish scheme of common bird monitoring (MPPL) and improvement of Polish agri-environmental measures (cooperation with Ministry of Agriculture and Rural Development).

For more information please visit my website: www.krzysztof.kujawa.org.pl