

What have we learned from 50-year large scale field study on the biodiversity in an agricultural landscape?



Krzysztof Kujawa, Jerzy Karg

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

Field Station
in Turew

the Dezydery Chłapowski Landscape Park



Small fields



Wooded patches



Shelterbelts



Unique feature of the area: large variety of windbreaks, tree lines, hedgerows and other small wooded patches



Photo K. Kujawa ski

Study on biodiversity carried out by IAFE near Turew

- Effect of habitat and landscape structure
- Long-term changes – 50 years
- Effect of prey-predator relationships (insects, Red Fox vs birds)

Taxa studied:

- | | |
|-----------------------|--------------|
| ■ vascular plants | ■ fish |
| ■ macrofungi | ■ amphibians |
| ■ insects | ■ birds |
| ■ spiders | ■ mammals |
| ■ other invertebrates | |

Methods (main) – insects



For flying insects – motor-net:



For epigeic insects – suction trap:



For migrating insects – tower with passive trap

Methods – other taxa

Plants and macrofungi:

- Sampling plots and long routes across a variety of habitats

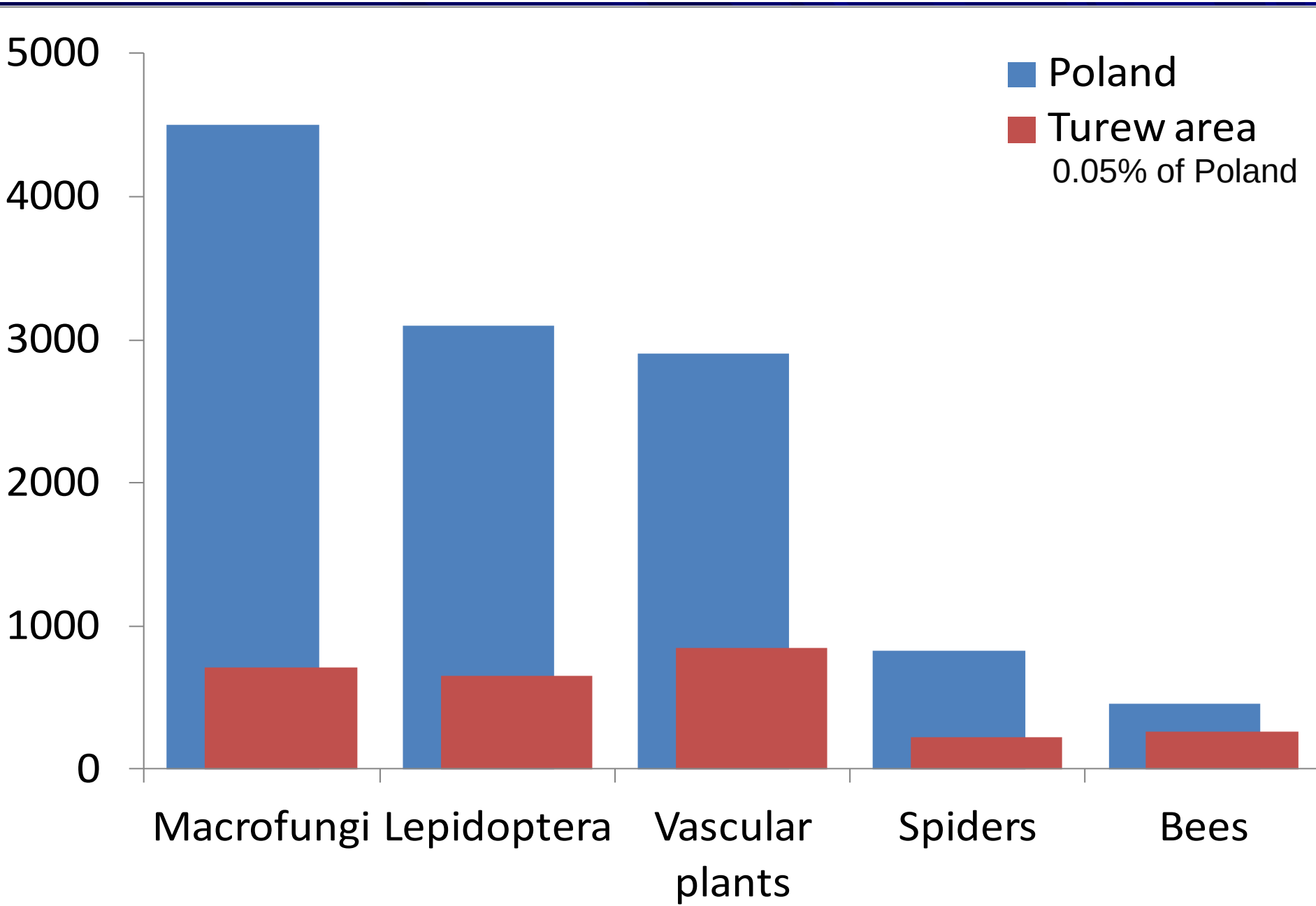
Birds:

- Sampling plots, points and transects

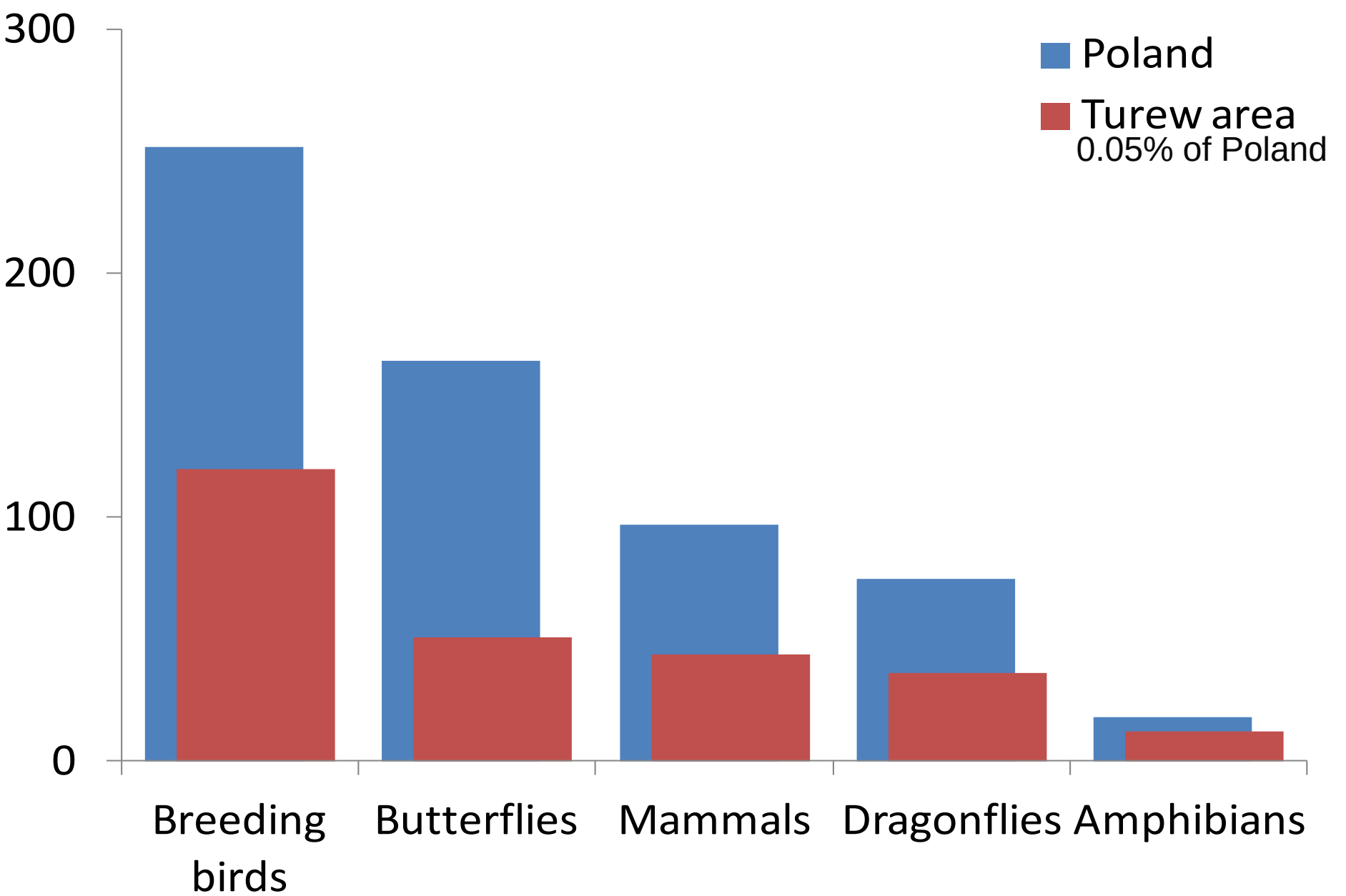
Key results:

1. High biological diversity

Number of species in Turew area and Poland



Number of species in Turew area and Poland



Vascular plants

- No. of species – 828 spp. (54% of regional list)
- 85 spp. of special care,
- 1 sp. from II Annex of HD,
- 2 spp. from Red Data Book,
- 44 spp. protected by law

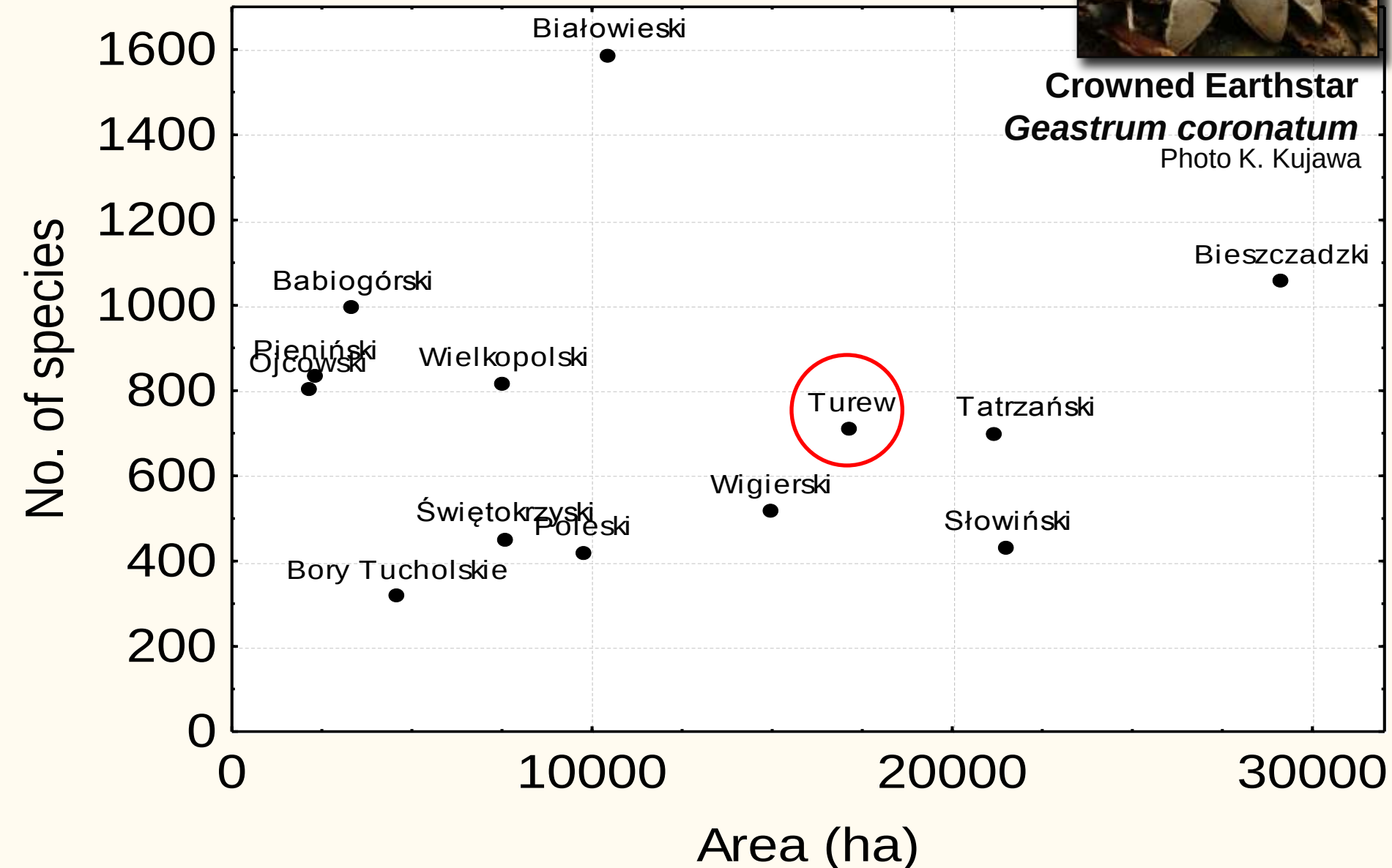


Common Corncockle
Agrostemma githago
Photo K. Kujawa

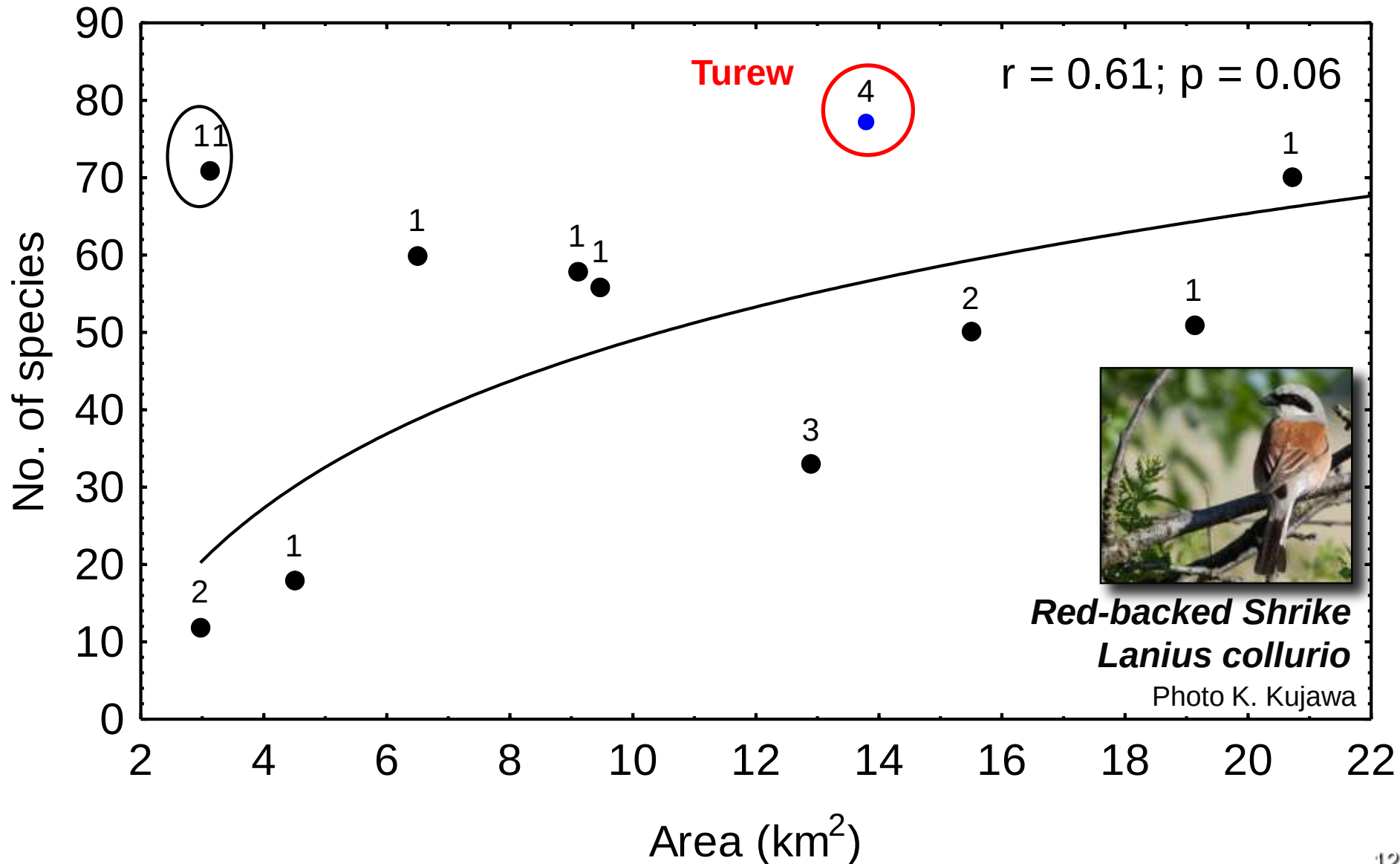
Number of **macrofungi** species in Turew area and in Polish national parks in relation to their area



Crowned Earthstar
Geastrum coronatum
Photo K. Kujawa

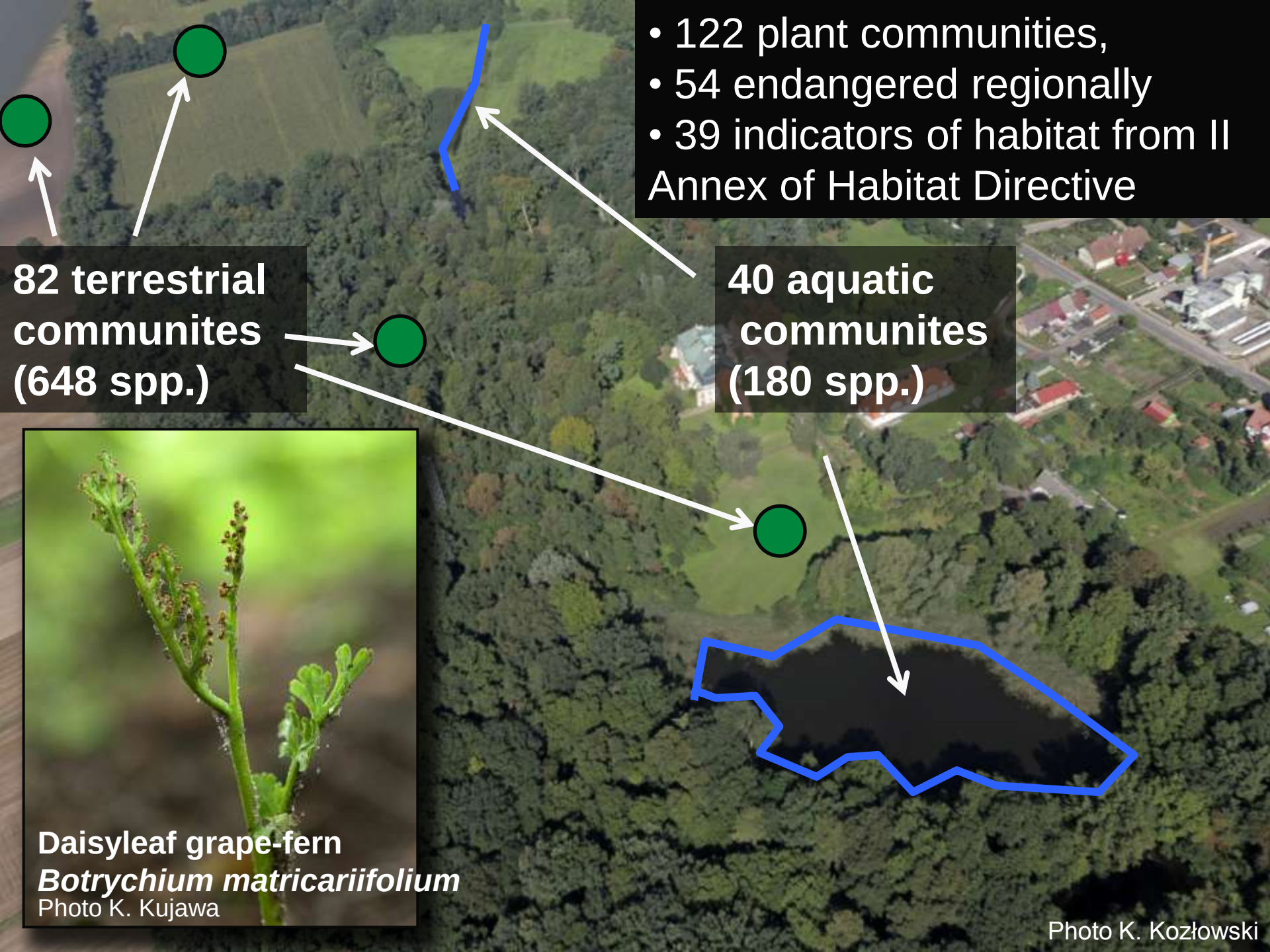


Number of **breeding bird species** in Polish farmlands in relation to study area size (no. of years is given)



Key results:

2. Key factor for preserving biodiversity:
habitat and landscape diversity



- 122 plant communities,
- 54 endangered regionally
- 39 indicators of habitat from II Annex of Habitat Directive

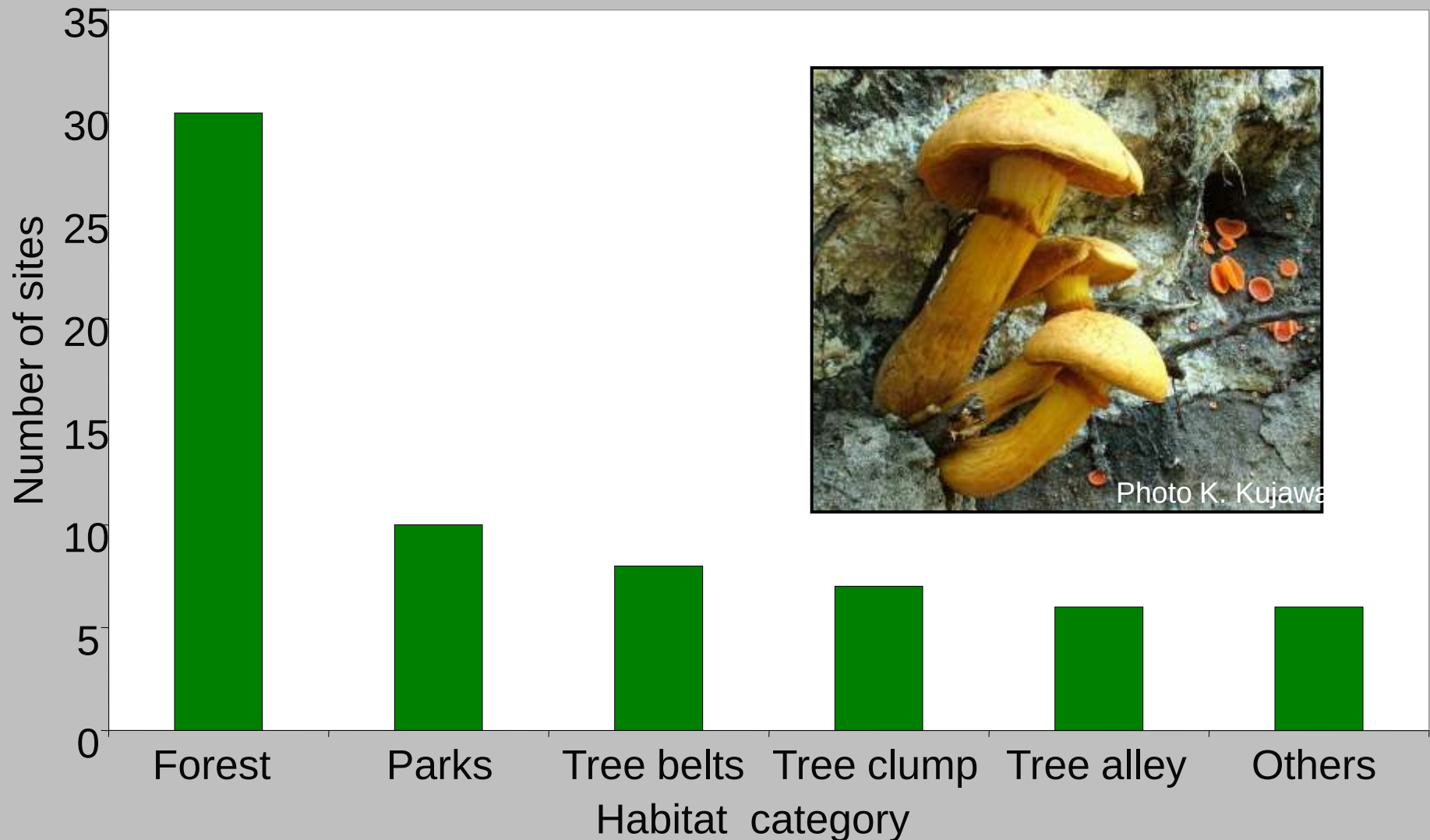
82 terrestrial
communities
(648 spp.)

40 aquatic
communities
(180 spp.)

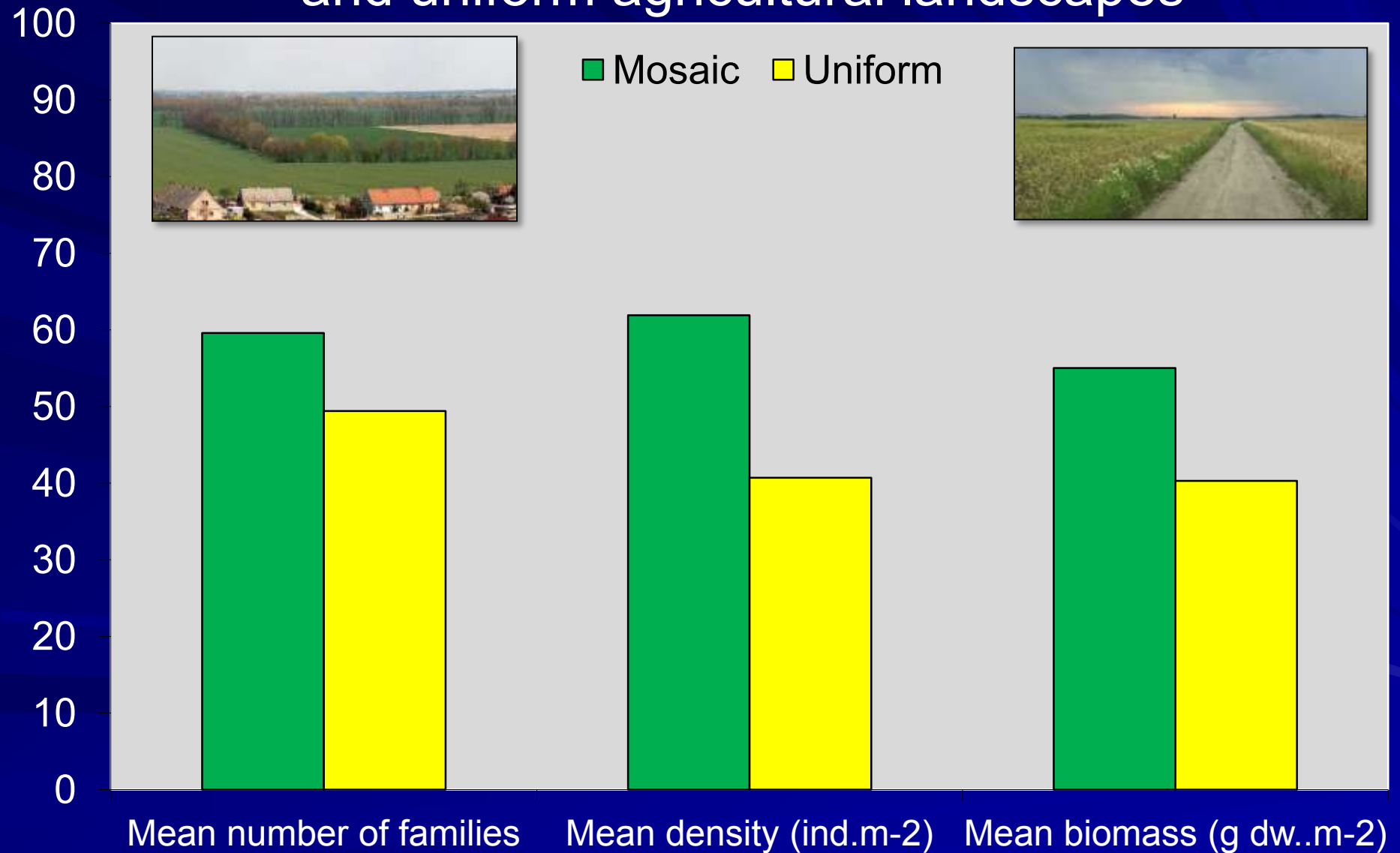


Daisyleaf grape-fern
Botrychium matricariifolium
Photo K. Kujawa

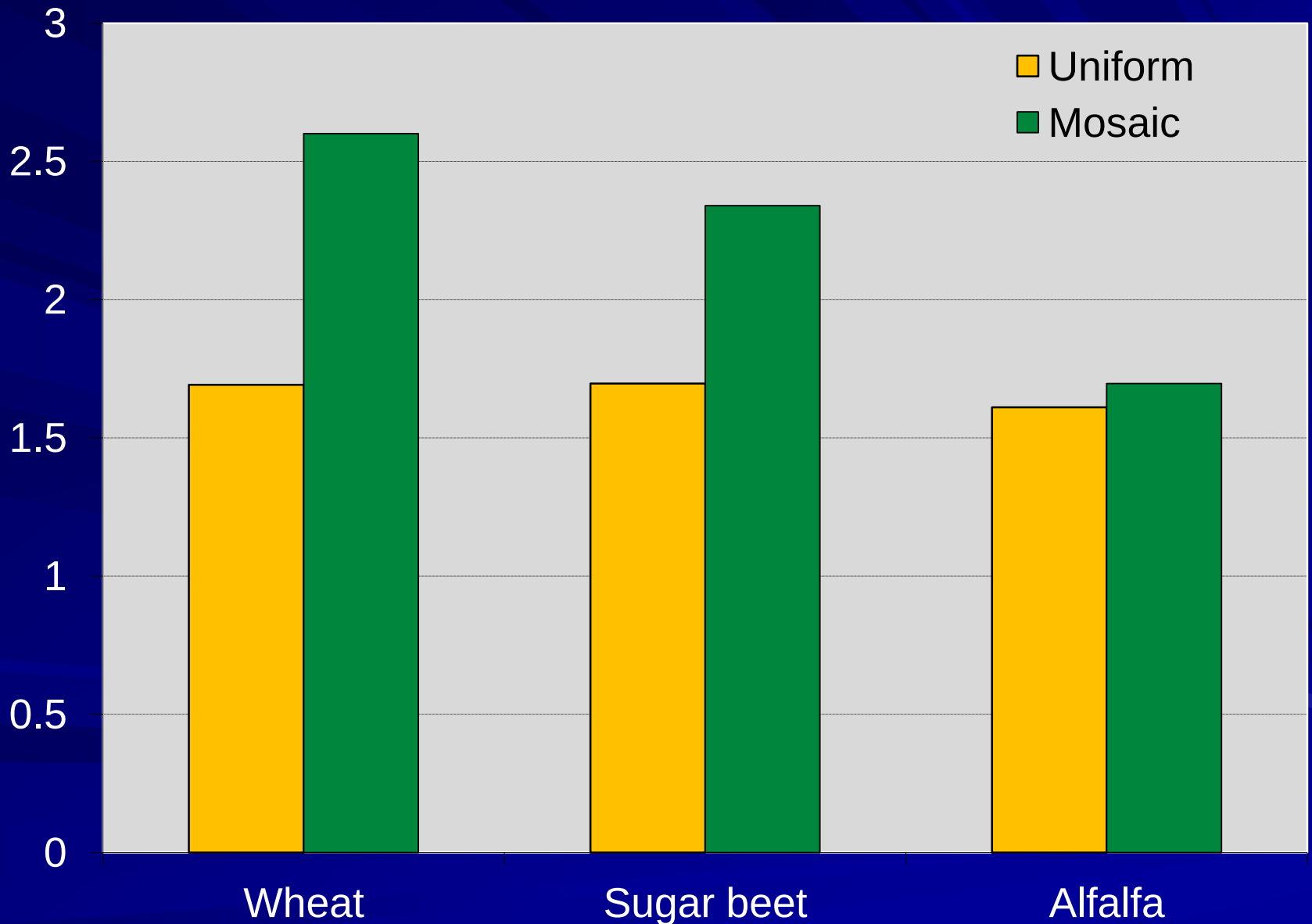
Number of sites of 16 species protected by law (Poland – ca. 100 spp.) in various habitats of agricultural landscape near Turew



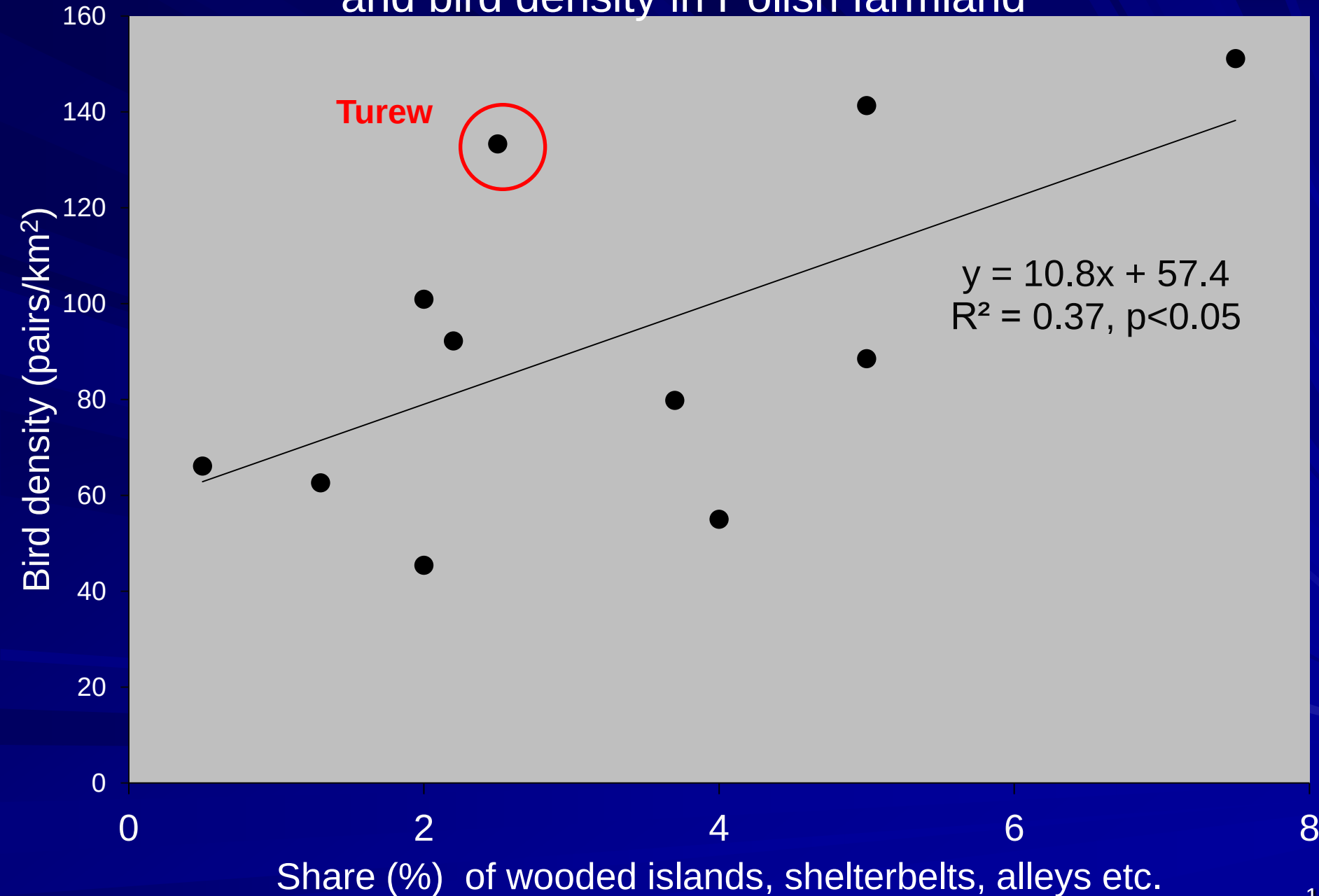
Long-term comparison of epigeic insect communities in crop fields between mosaic and uniform agricultural landscapes



Diversity (H') of spider assemblages in various crop fields and two landscape types



Relationships between share of small wooded islands and bird density in Polish farmland



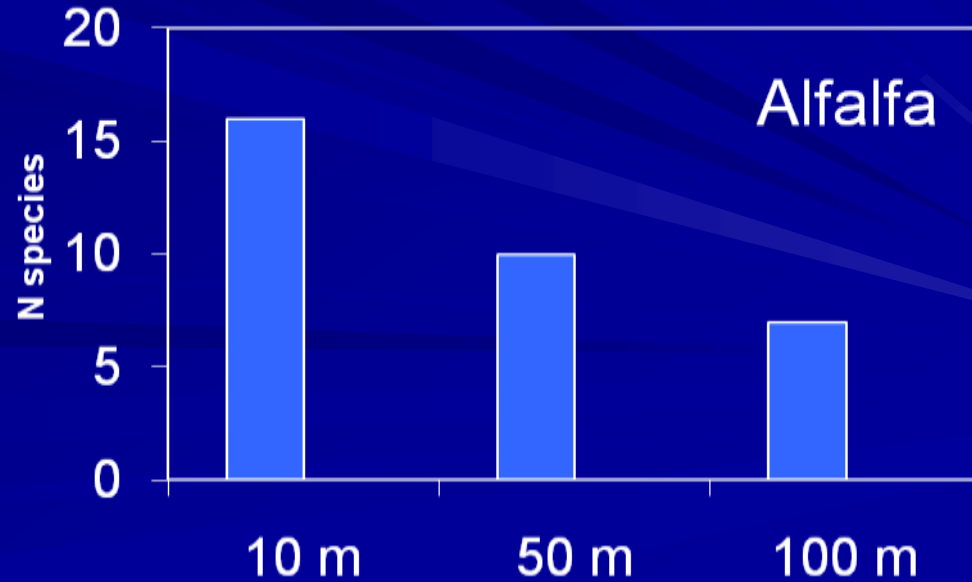
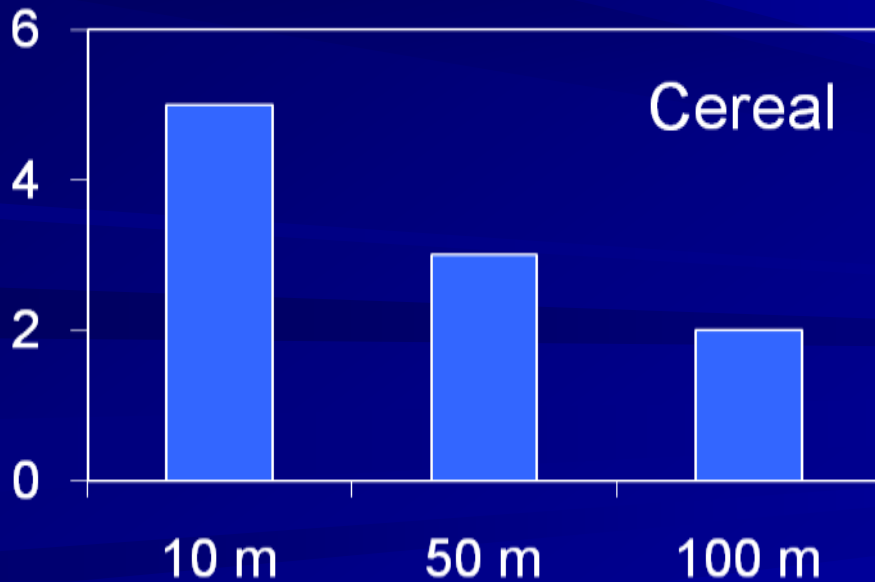
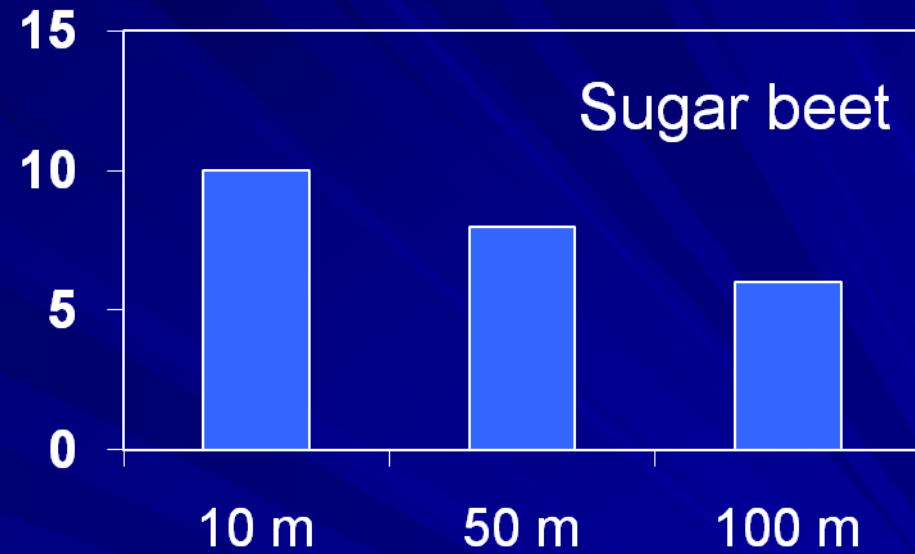
Key results:

3. Potential for biological control related to habitat and landscape diversity

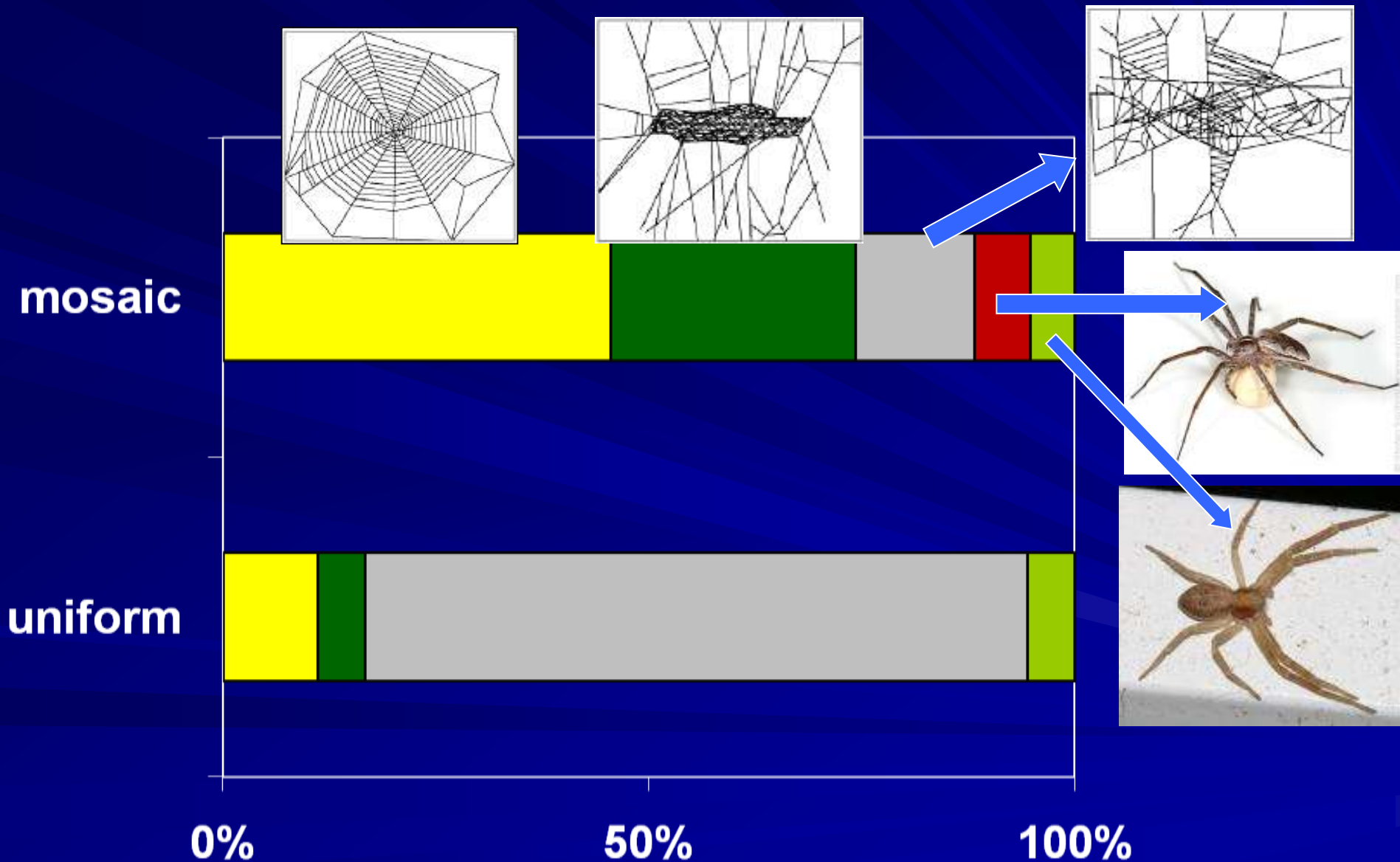
Spiders



Effect of distance from shelterbelt on species numbers of plant-dwelling spiders in crop fields (3-years study)



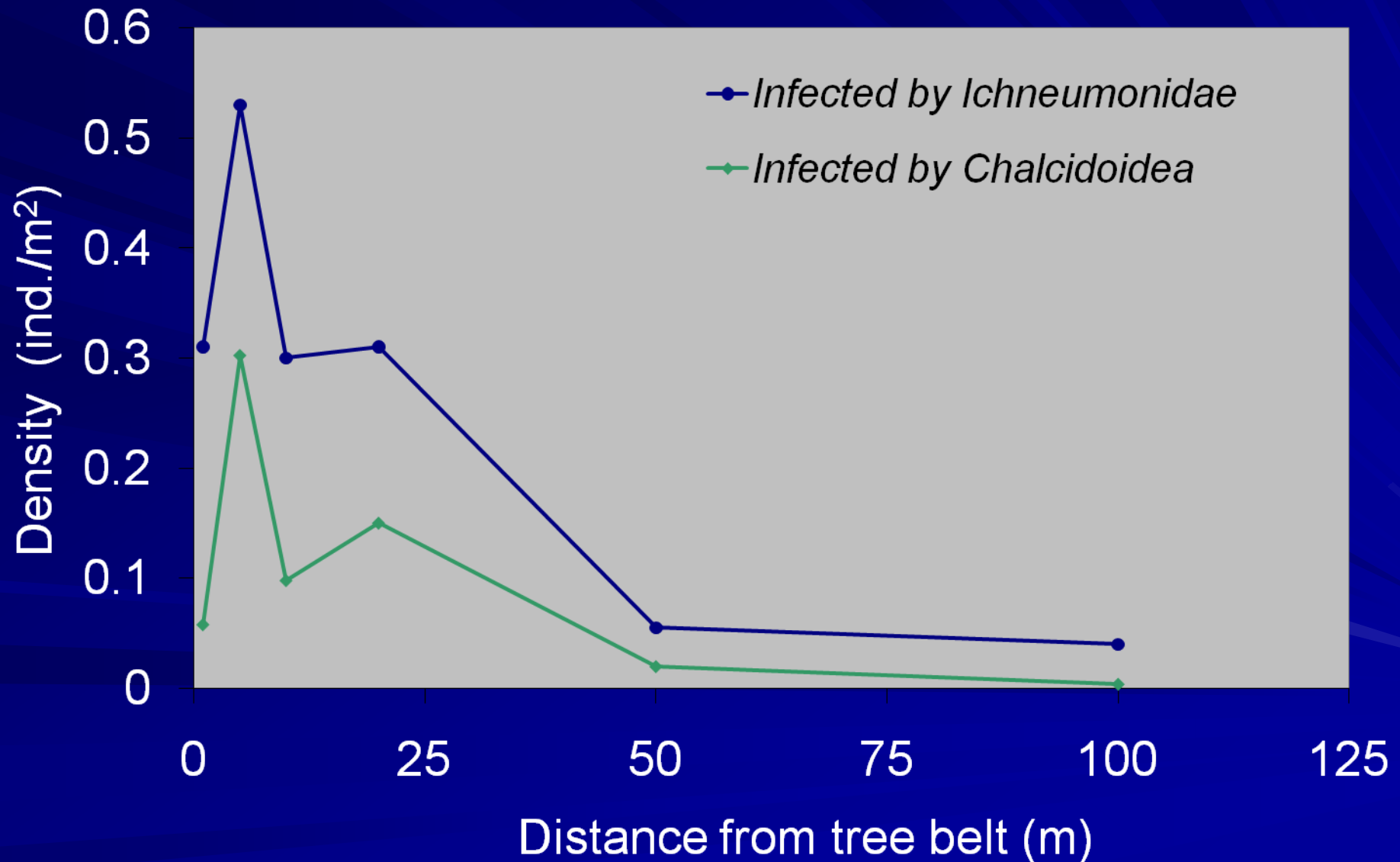
Effect of landscape type on share of types of spiders webs in sugar beet plantations (3-years studies)



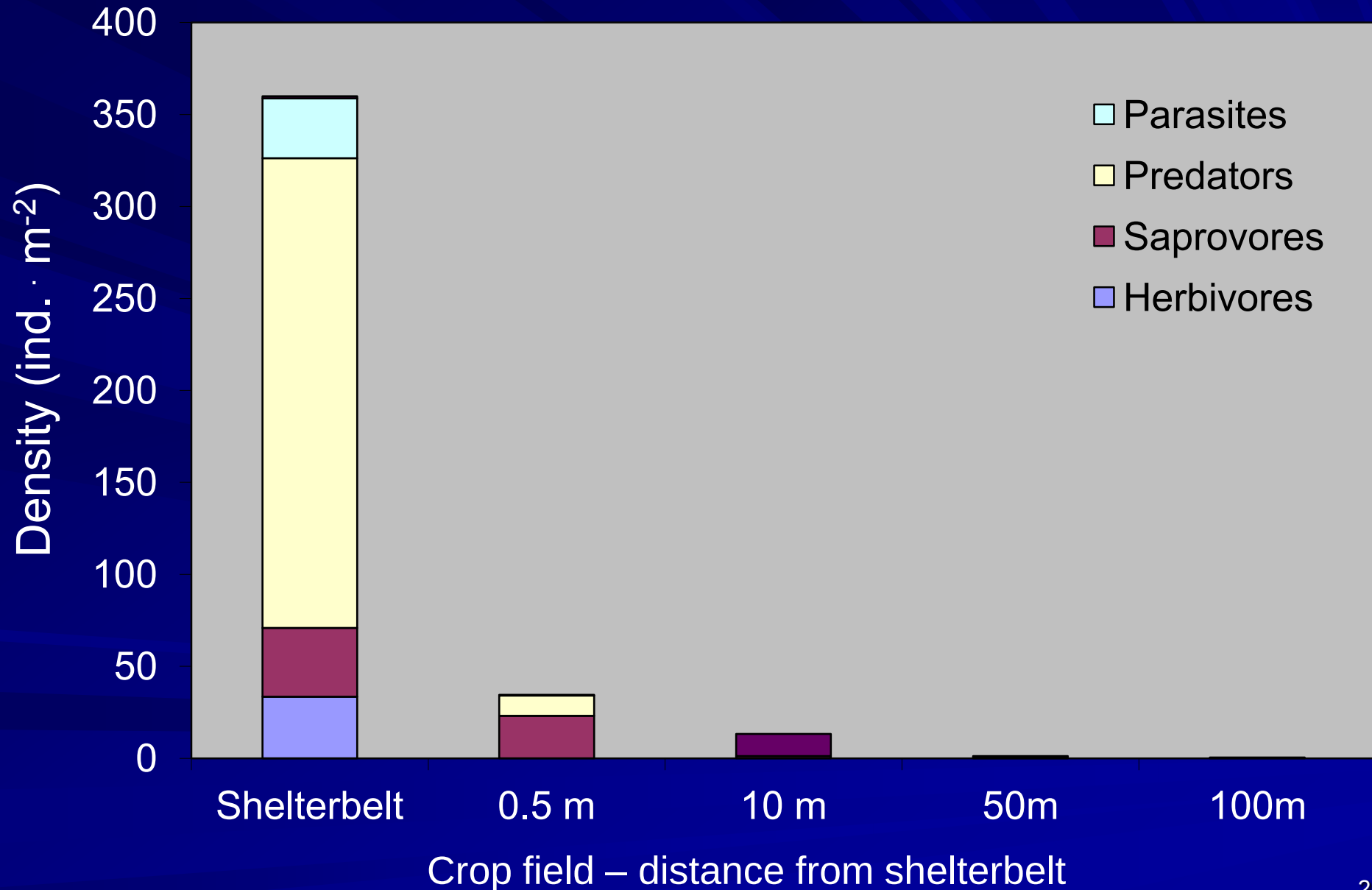
Insects



Effect of tree belt on density of insect larvae infected by parasitic insects (*Ichneumonidae* and *Chalcidoidea*)



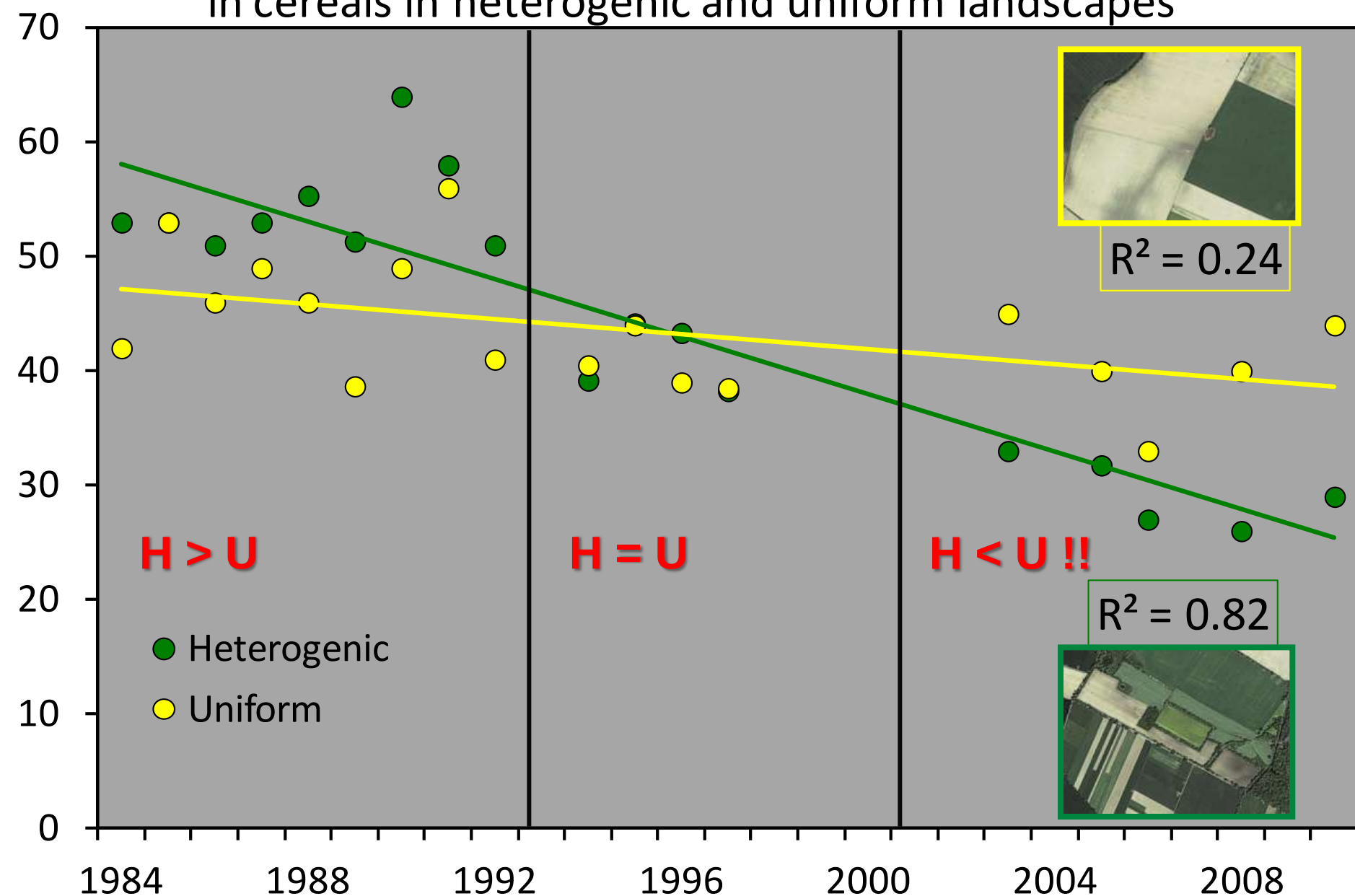
Trophic structure of insect assemblages wintering in crop fields and shelterbelts



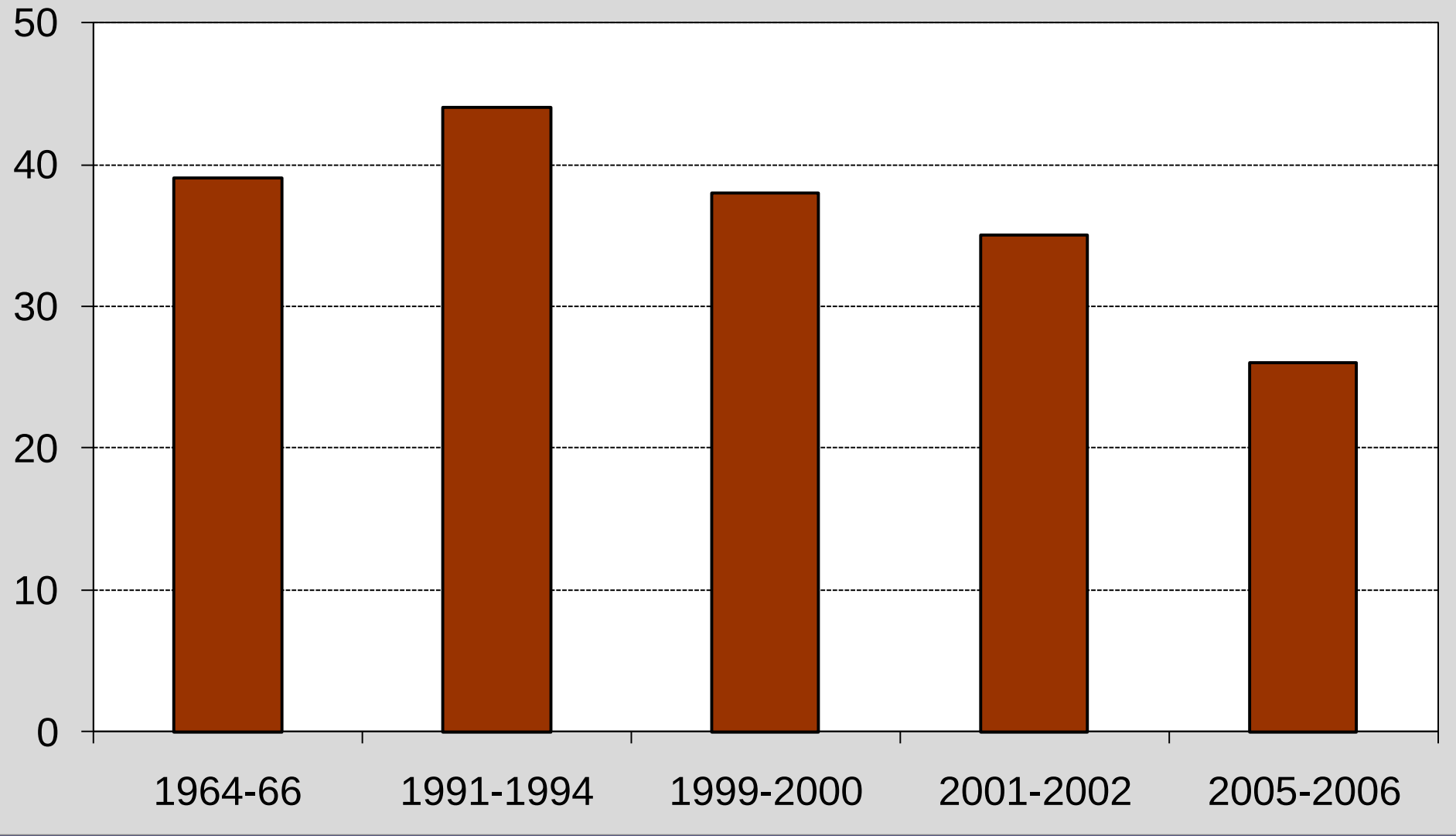
Key results (unexpected!):

4. In contrary to our previous conclusions, high and constant landscape diversity seems to be not sufficient for preserving biodiversity when intensity of farming practices is above some threshold

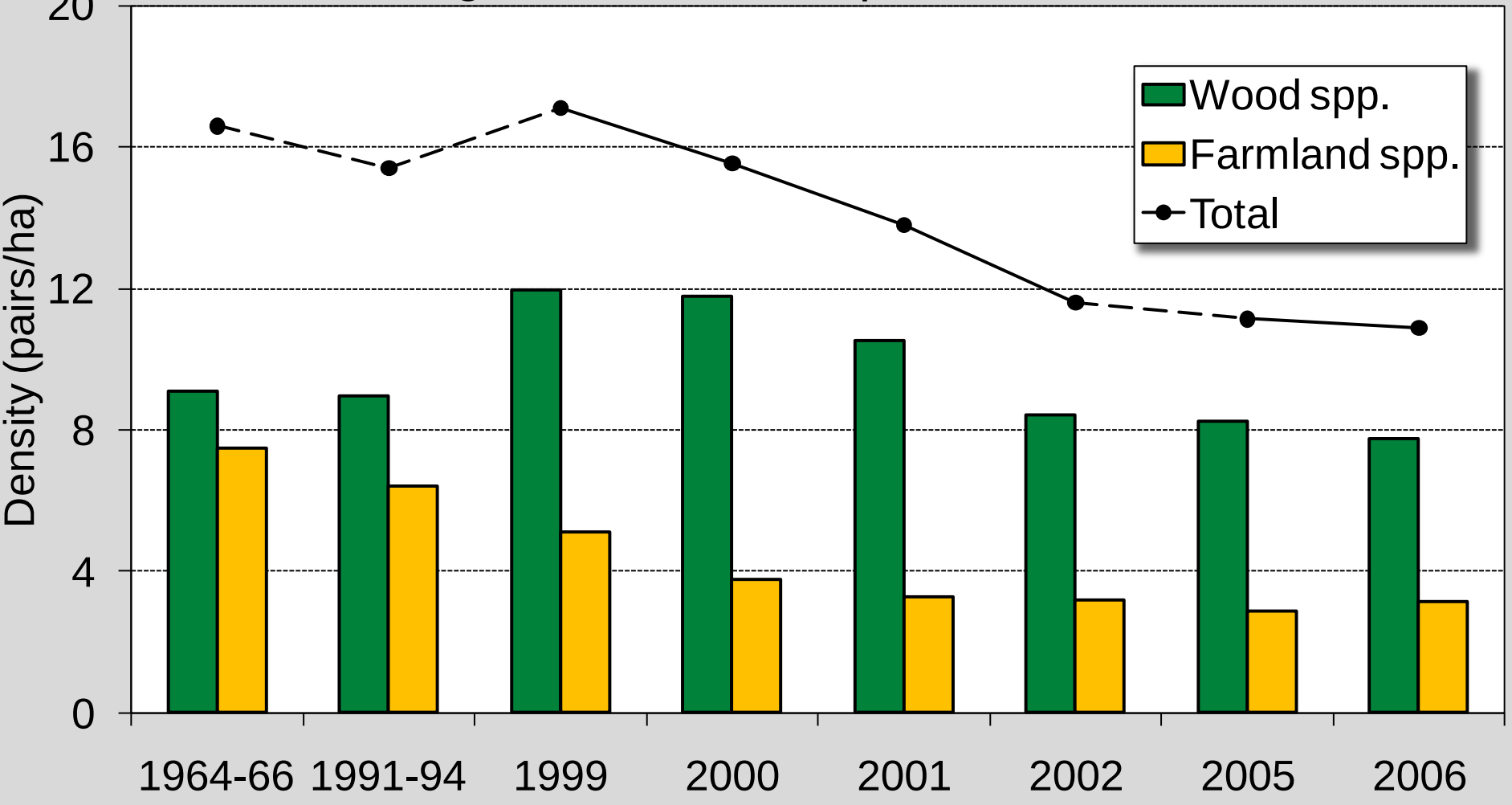
Long term trends in diversity (number of families) of epigeic insects in cereals in heterogenic and uniform landscapes



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



Long-term changes in bird density in wooded patches
in agricultural landscape near Turew



Key results:
(by the way ...)

5. A conservation paradox?

One of most abundant tree species in the Turew area is Black Locust, listed in 100 worst invasive species in Europe

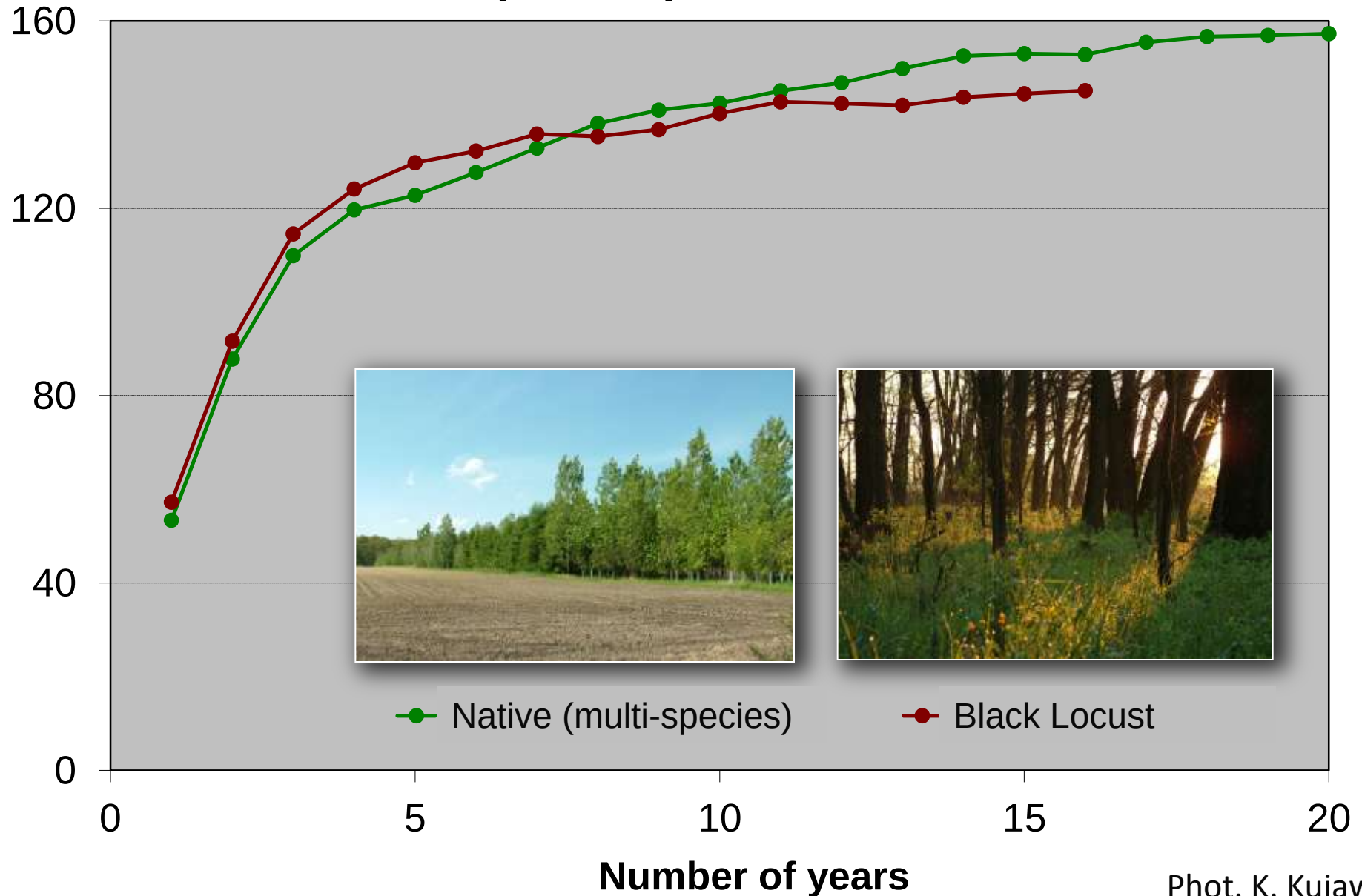
Black Locust in Turew area



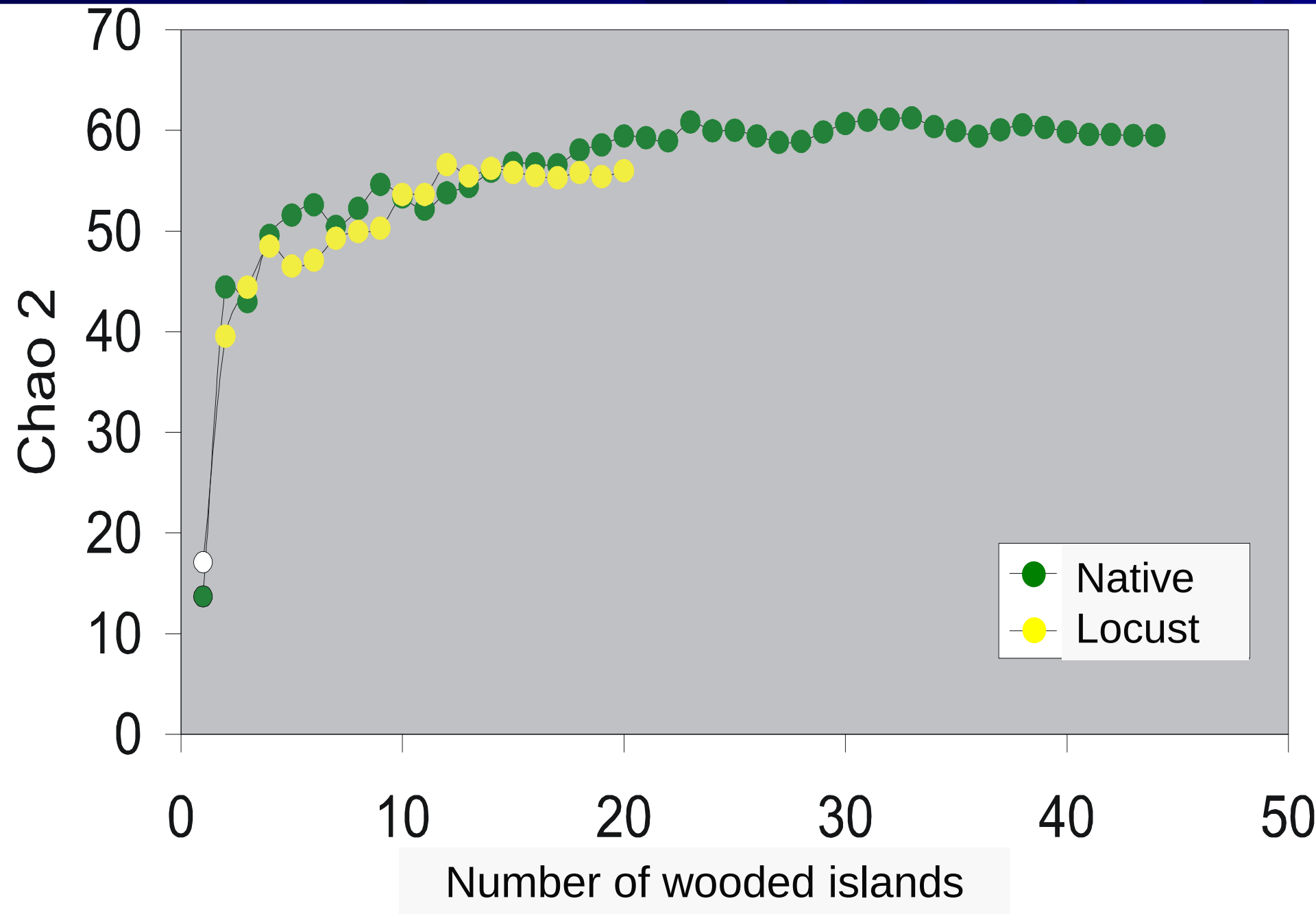
Zadrzewienia robinowe

Insect taxonomical richness in „native” and Black Locust tree belts

No. of families (Chao 2)

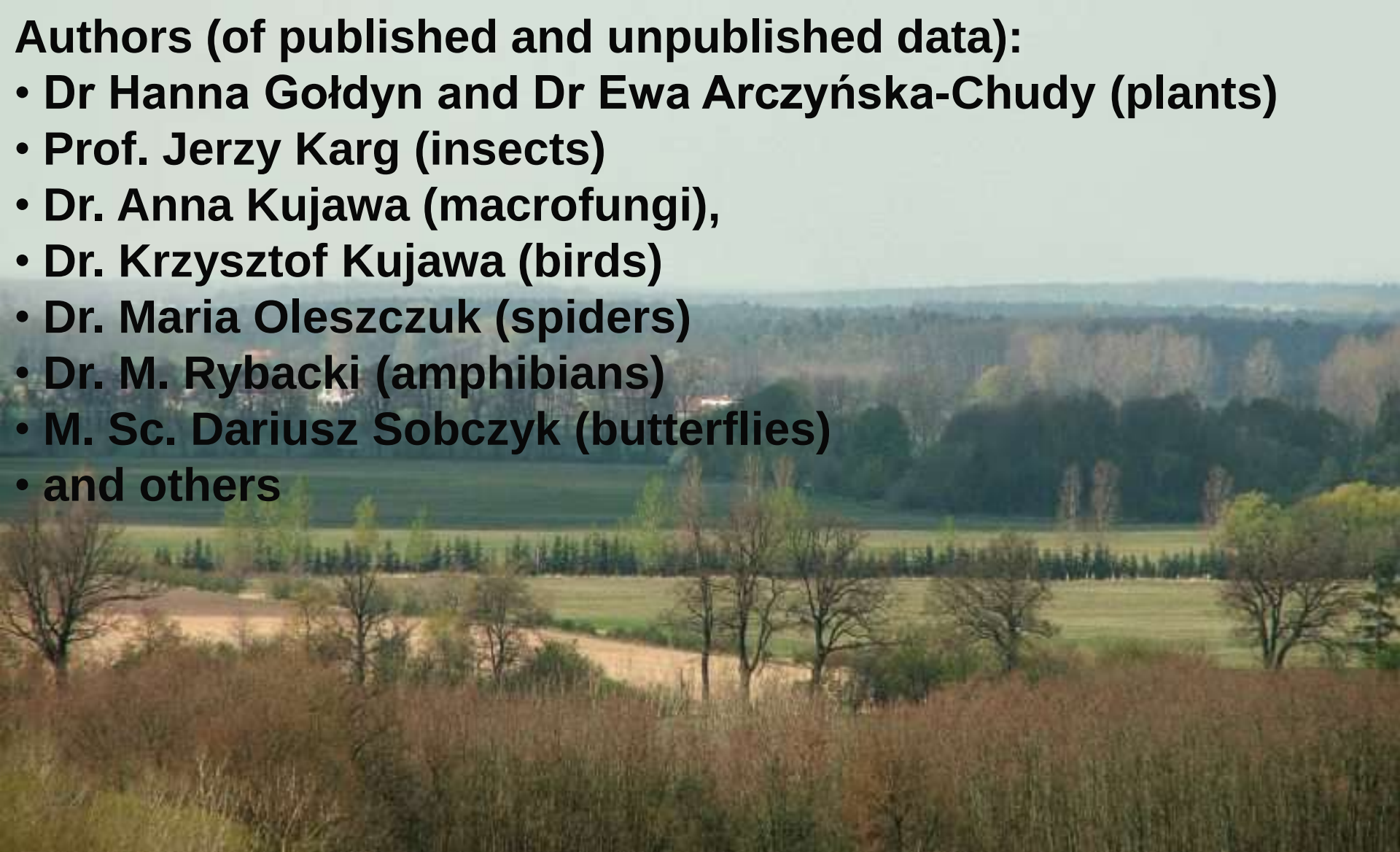


Birds – species richness in „native” and Black Locust wood islands



SUMMARY & CONCLUSIONS:

- Agricultural landscape near Turew is inhabited by **a variety of species-rich communities**, that among others include **species of high conservation priority**
- **High diversity and abundance of predatory and parasitic species** create favorable condition for application of biological control
- **High and stable landscape heterogeneity supports high biodiversity level**, however long term analysis indicates that it is not able to counteract intensification of agriculture when it is above some threshold that seems to be crossed . Thus, also **potential for biological control may be strongly impoverished**



Authors (of published and unpublished data):

- **Dr Hanna Gołdyn and Dr Ewa Arczyńska-Chudy (plants)**
- **Prof. Jerzy Karg (insects)**
- **Dr. Anna Kujawa (macrofungi),**
- **Dr. Krzysztof Kujawa (birds)**
- **Dr. Maria Oleszczuk (spiders)**
- **Dr. M. Rybacki (amphibians)**
- **M. Sc. Dariusz Sobczyk (butterflies)**
- **and others**

Thank you for attention