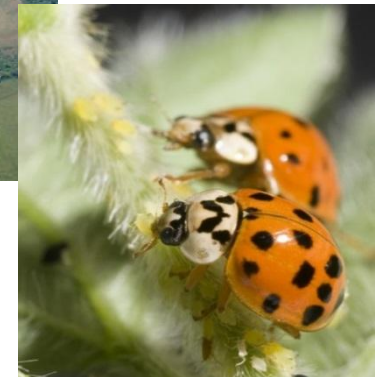
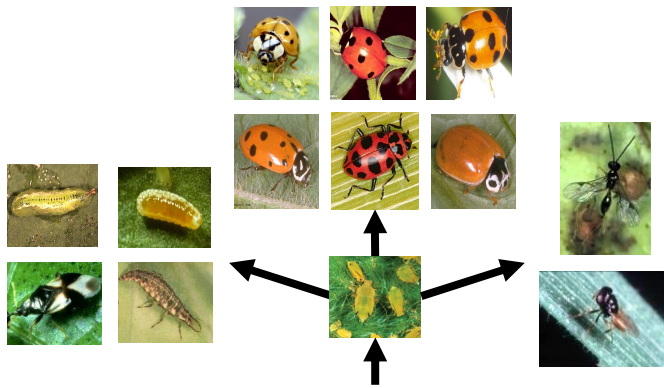
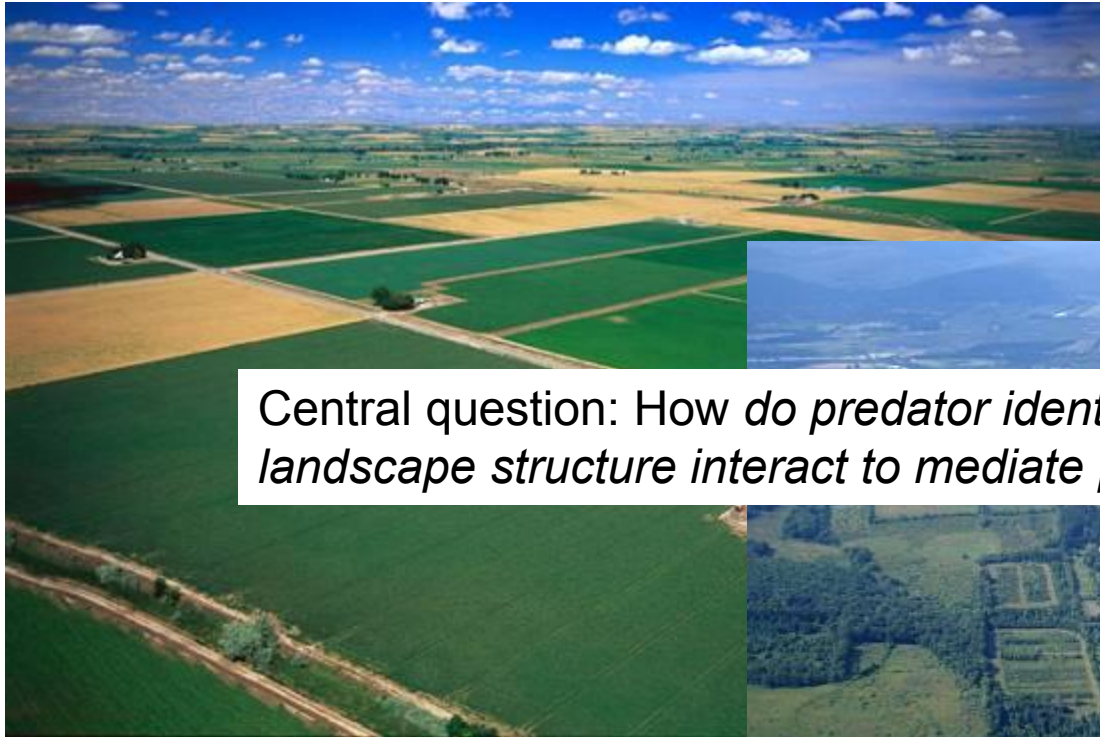


Insect Biodiversity & Ecosystem Services

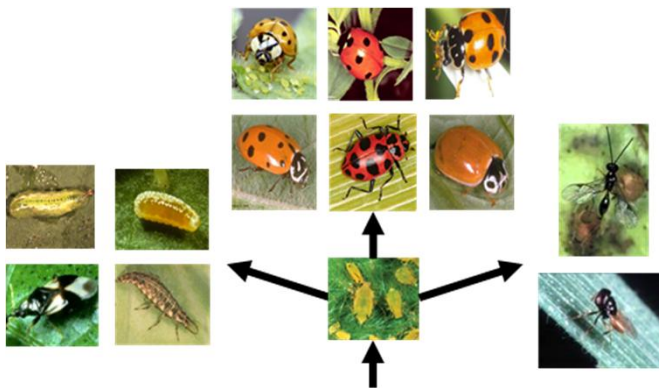
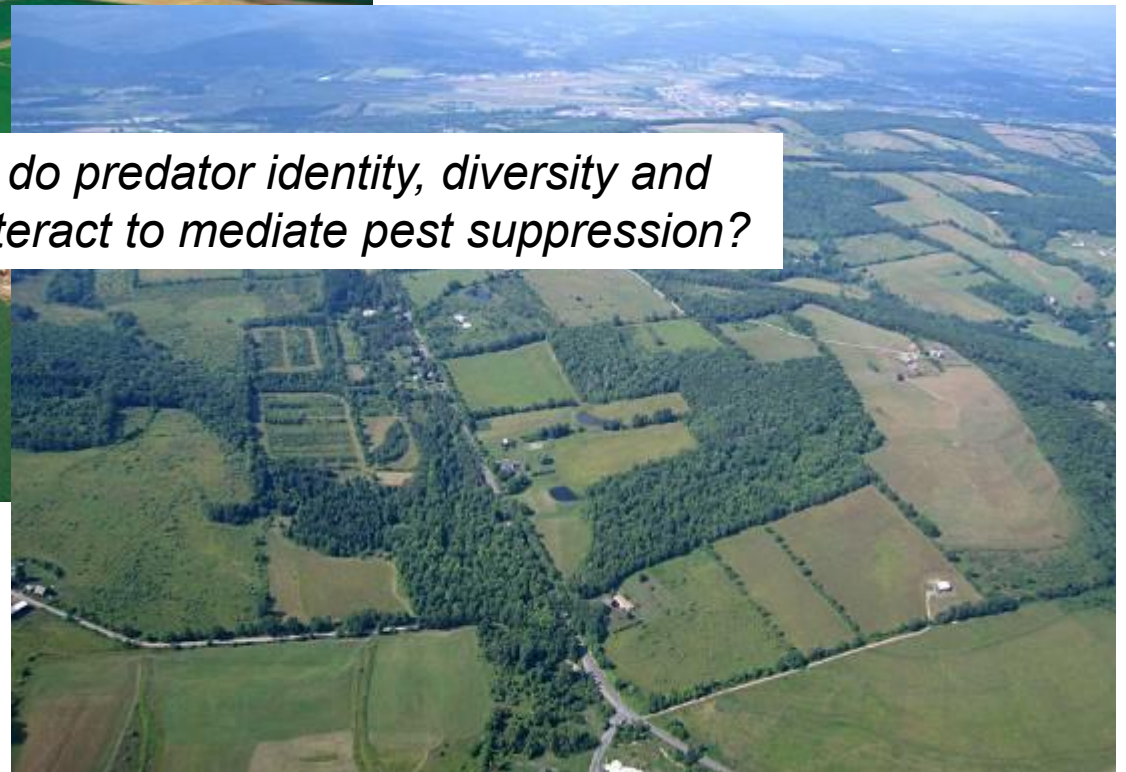


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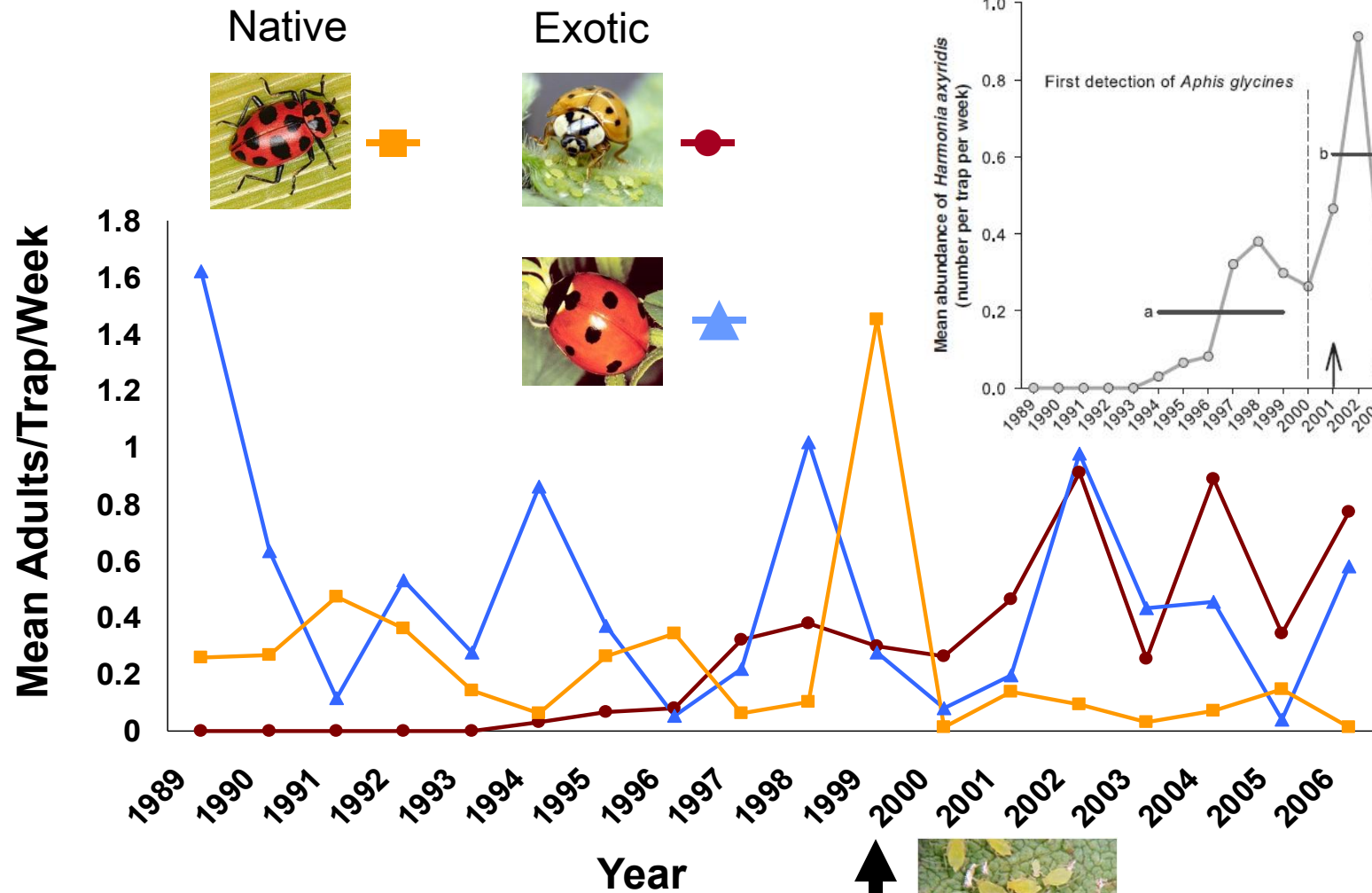
Agricultural Landscapes



Central question: How do *predator identity, diversity and landscape structure interact to mediate pest suppression?*



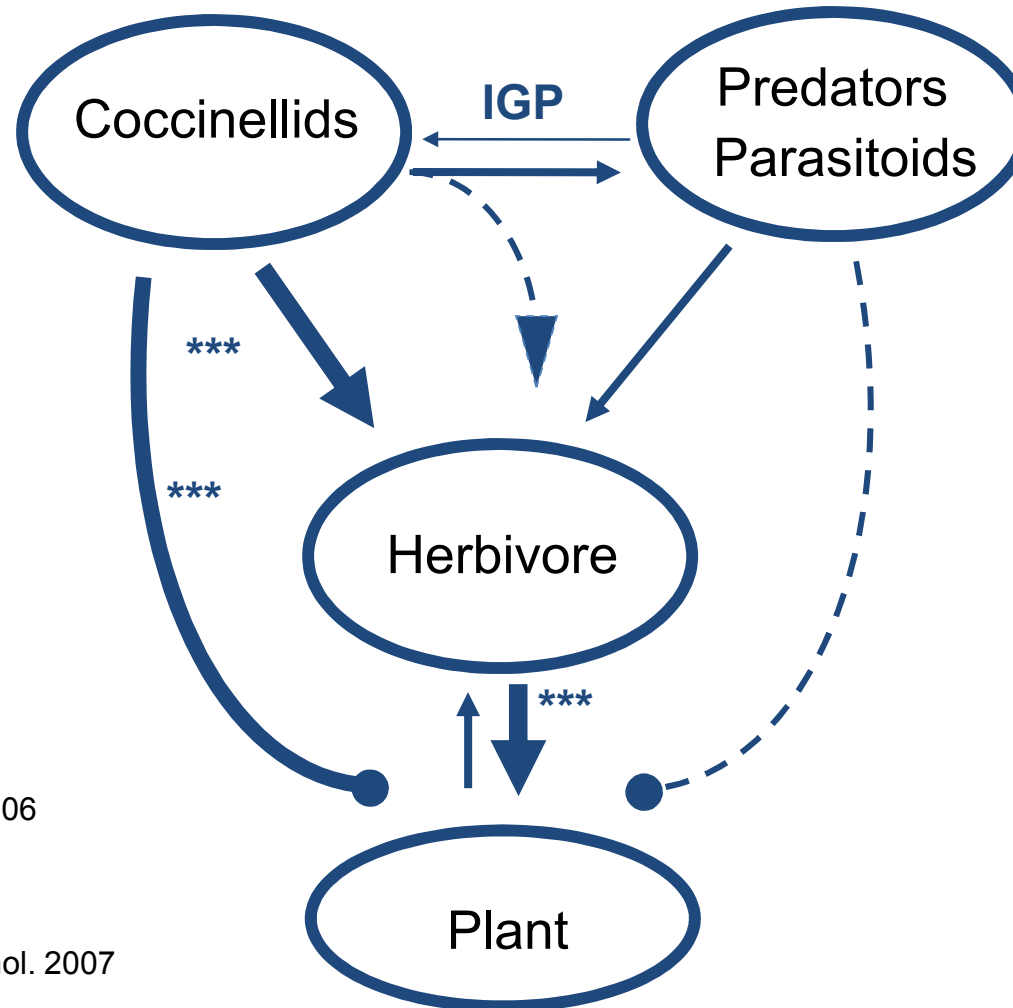
The Value of Long-term Studies



Knapp et. al Bioscience 2012

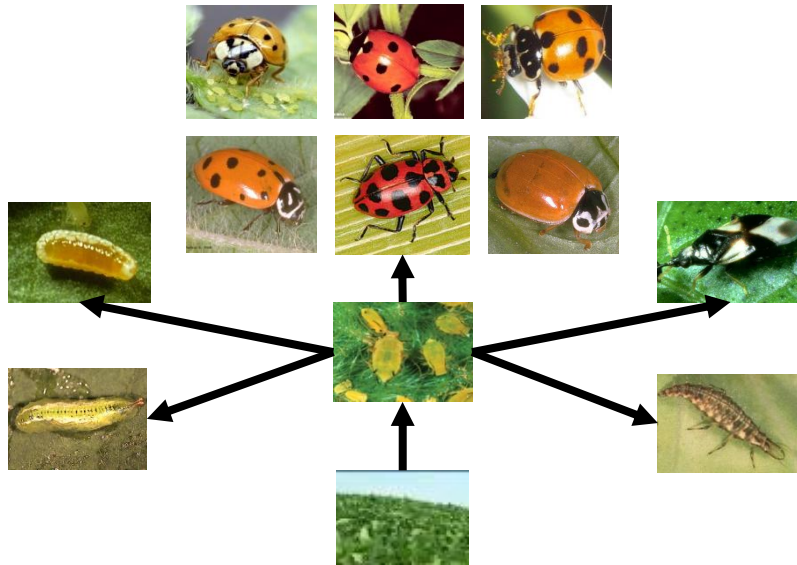
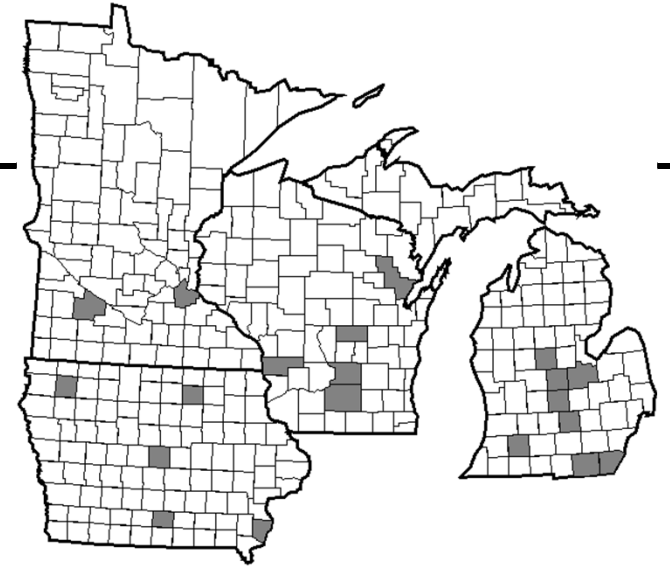


Tri-trophic Interactions

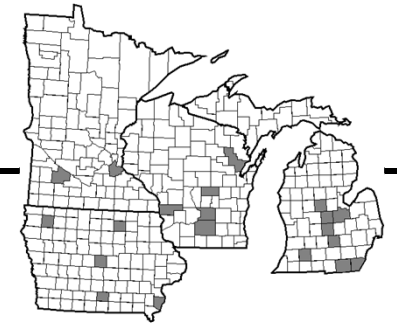
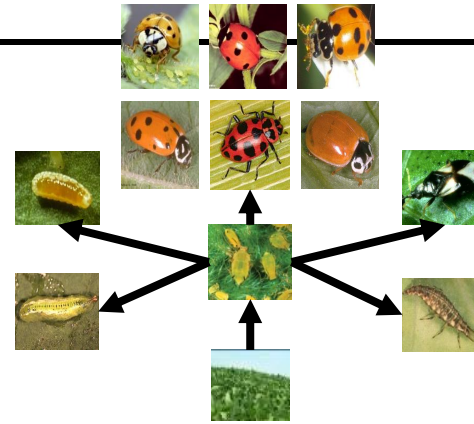
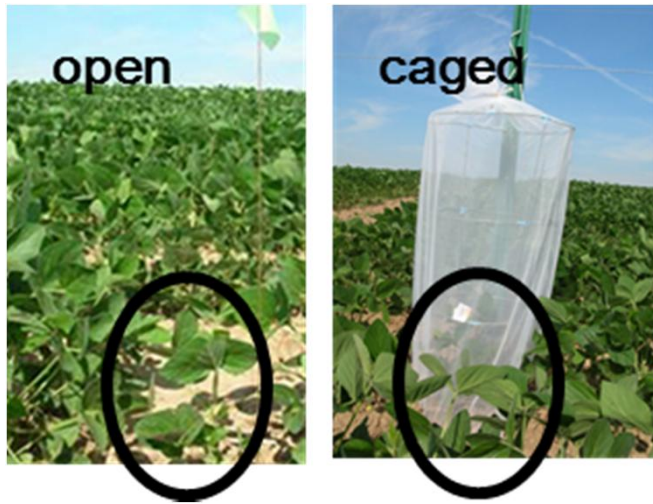


- Costamagna & Landis. Ecol. Applic. 2006
- Costamagna *et al.* Ecol. Applic. 2007
- Gardiner & Landis. Biol. Cont. 2007
- Costamagna *et al.* Biol. Cont. 2007
- Costamagna *et al.* Agr. and For. Entomol. 2007
- Costamagna *et al.* Biol. Cont. 2008
- Costamagna and Landis 2011. Biol. Cont.

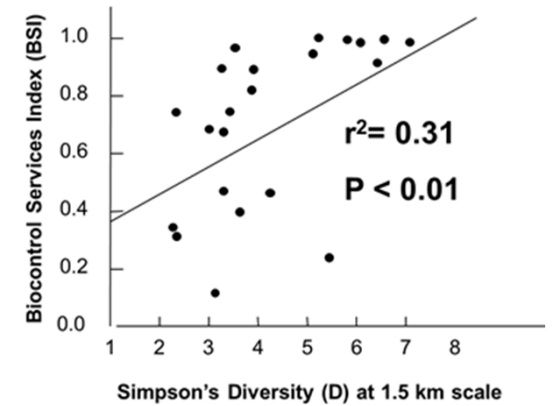
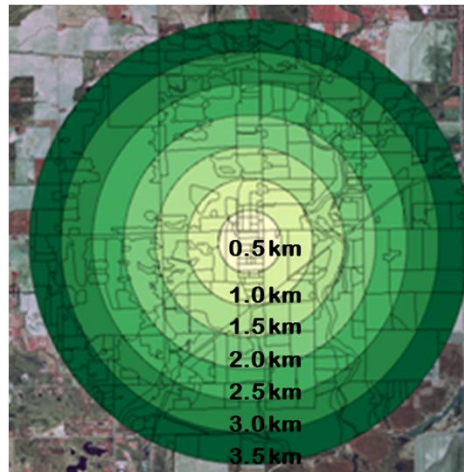
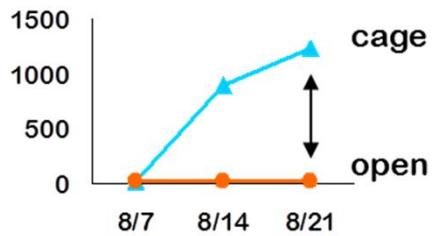
Landscape Interactions



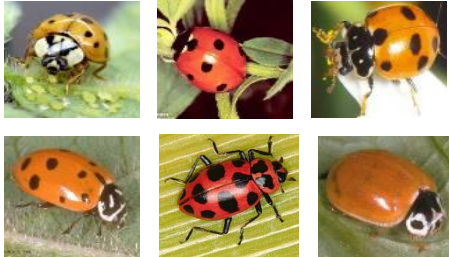
Landscape Interactions



Biocontrol Services Index (BSI)

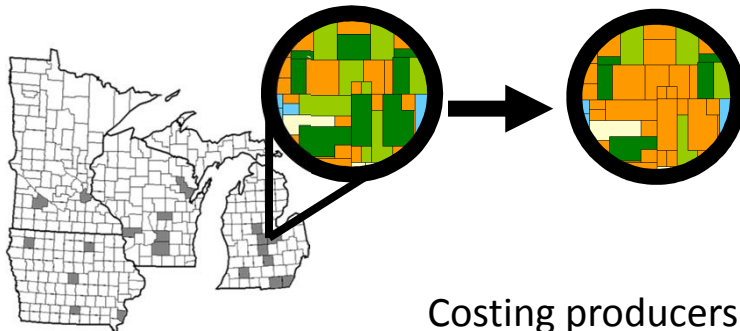


Valuing Aphid Biocontrol at Landscape-scales

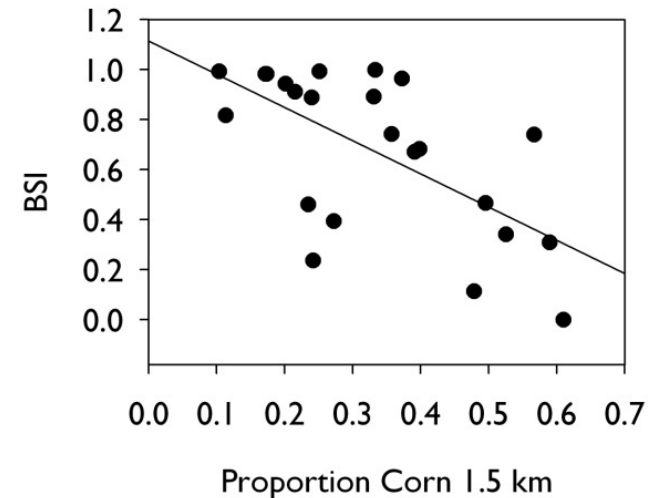


Predators save soybean farmers $\$13-79 \text{ acre}^{-1} \text{ yr}^{-1}$ in reduced pesticide applications and yield loss

Increased corn in the landscape reduces key predators and biocontrol services in soybean

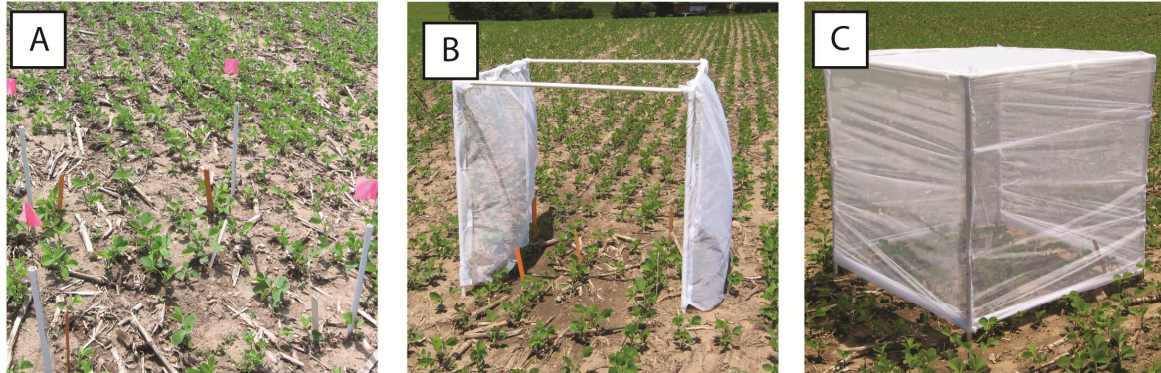


Costing producers $\$58 - 671 \text{ M yr}^{-1}$ in forgone biocontrol services
(based on actual 2006-07 increase in corn in MI, MN, IA, WI)

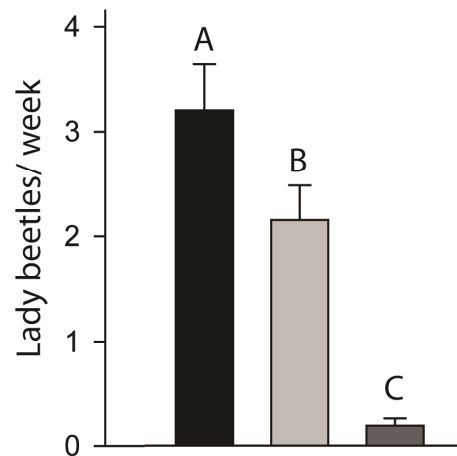


Coccinellid Flux

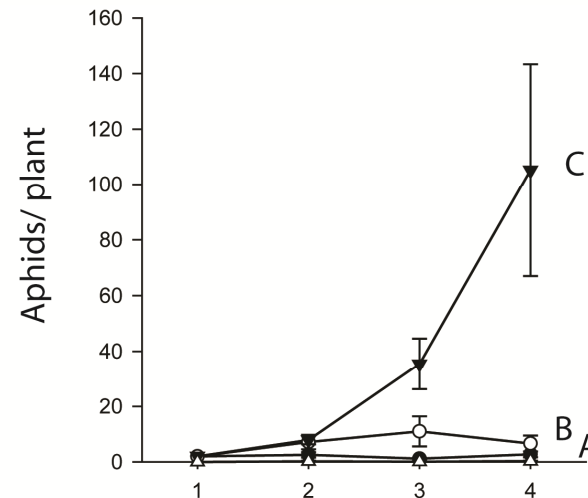
1) Barriers disrupted coccinellid dispersal ...



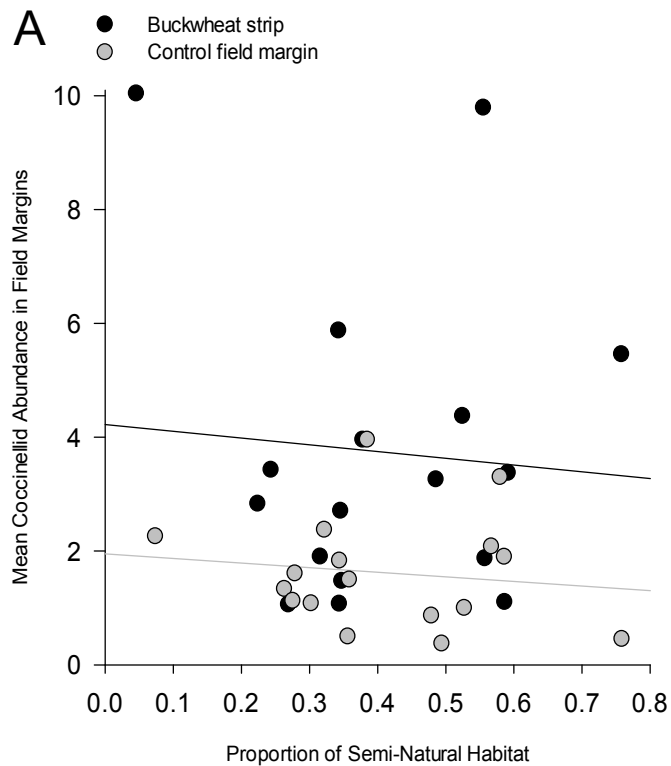
2) ...changing coccinellid immigration rates to plots ...



3) ... resulting in changes in aphid suppression.



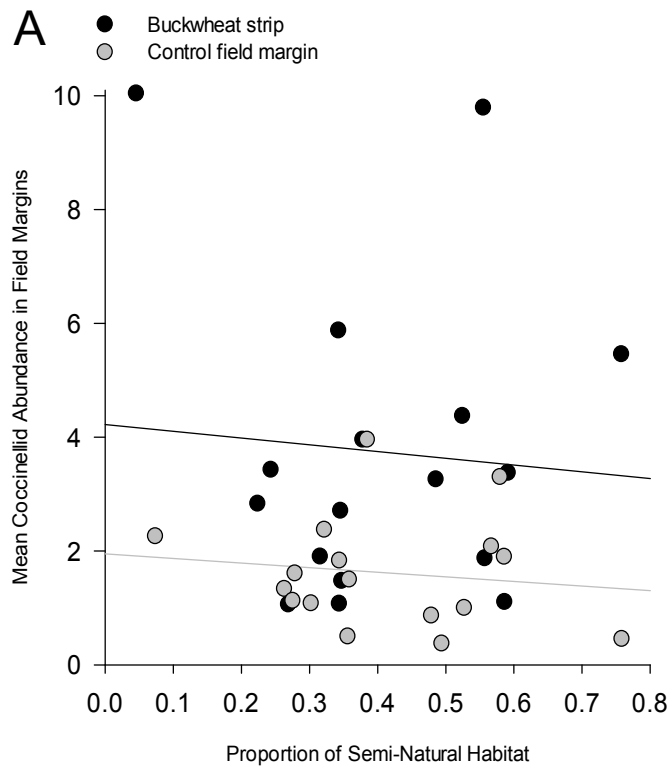
Buckwheat successfully attracts lady beetles to field edges



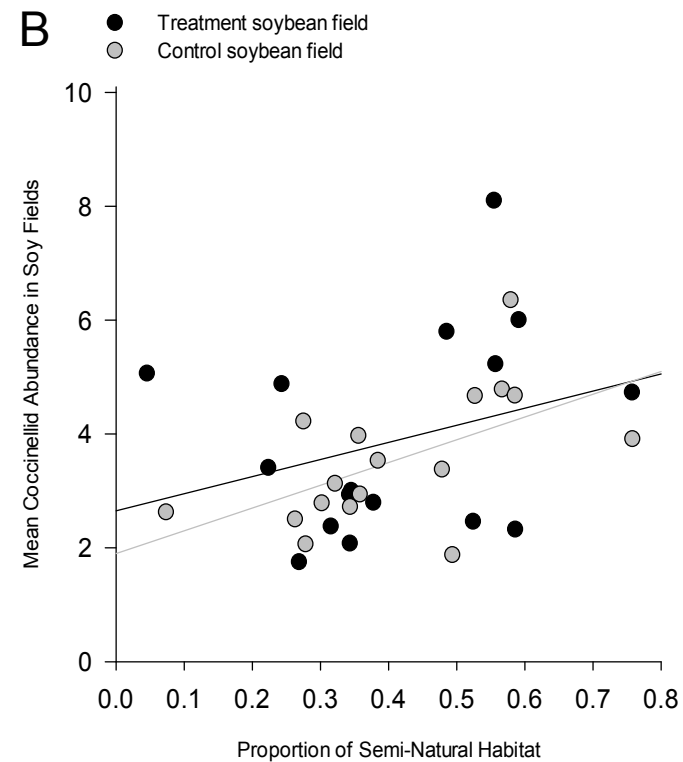
$F_{1,30}=10.78, p=0.003$



But lady beetle abundance in fields is controlled by landscape structure

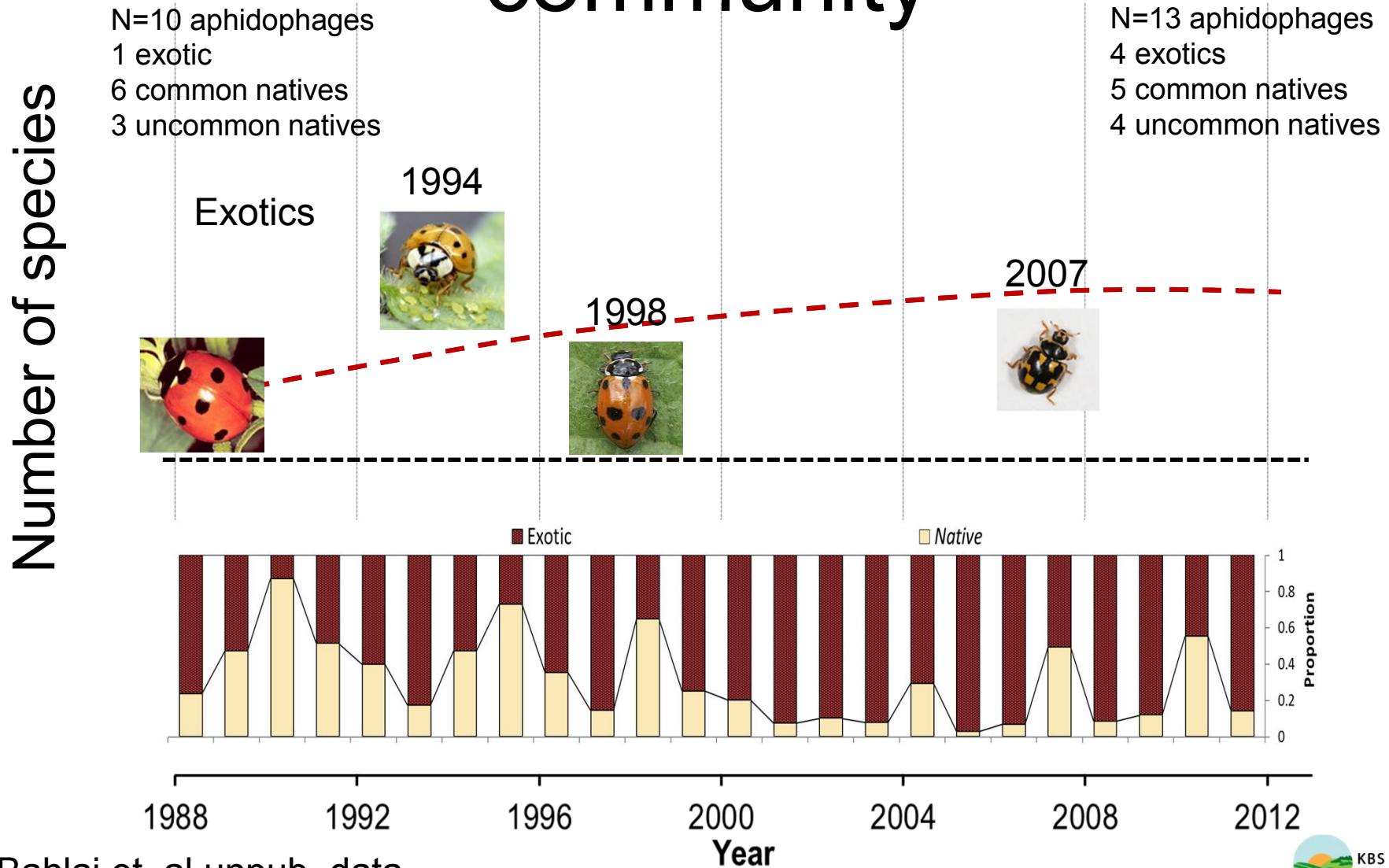


$$F_{1,30}=10.78, p=0.003$$



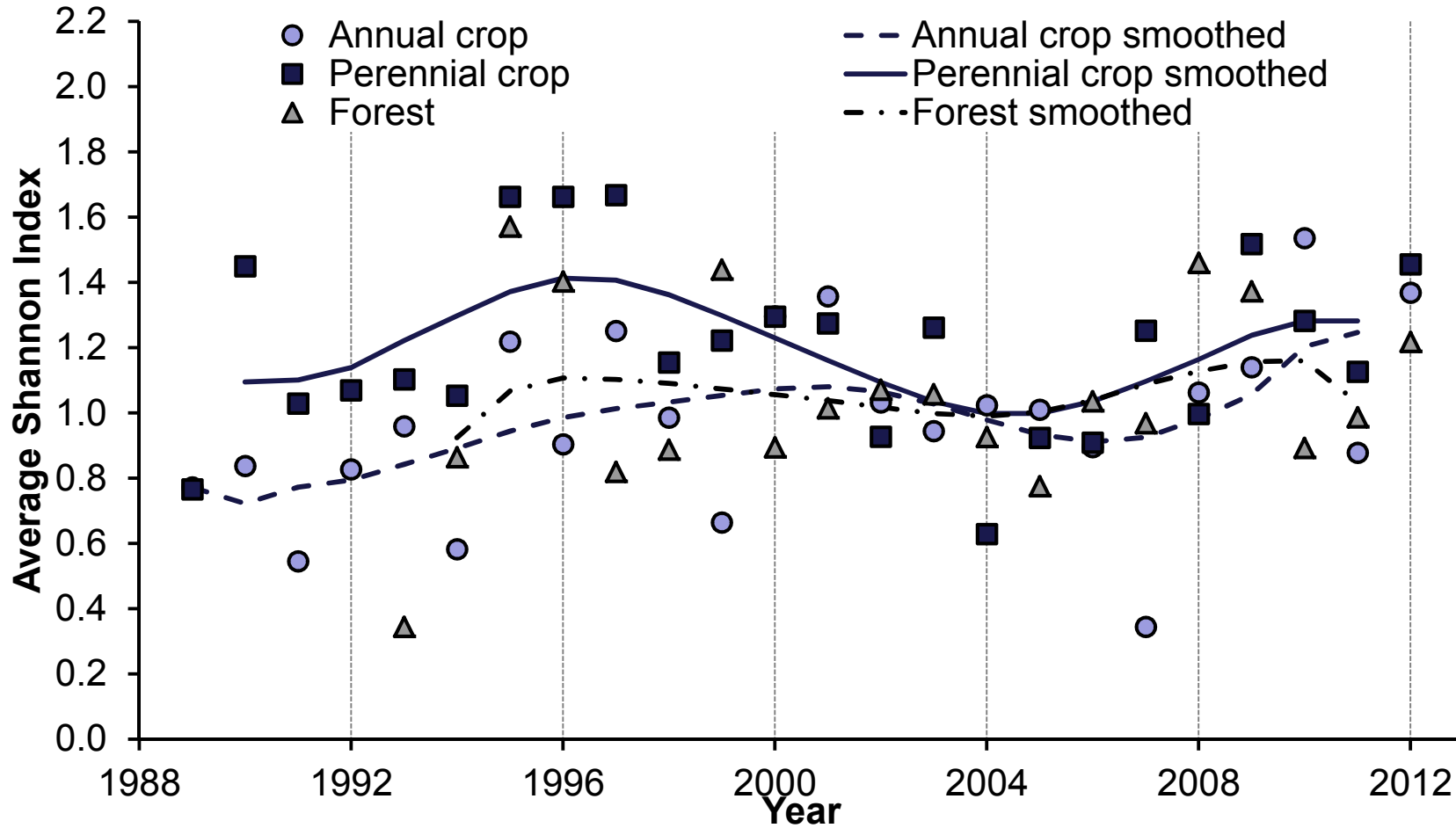
$$F_{1,30}=6.11, p=0.02$$

The changing LTER ladybeetle community



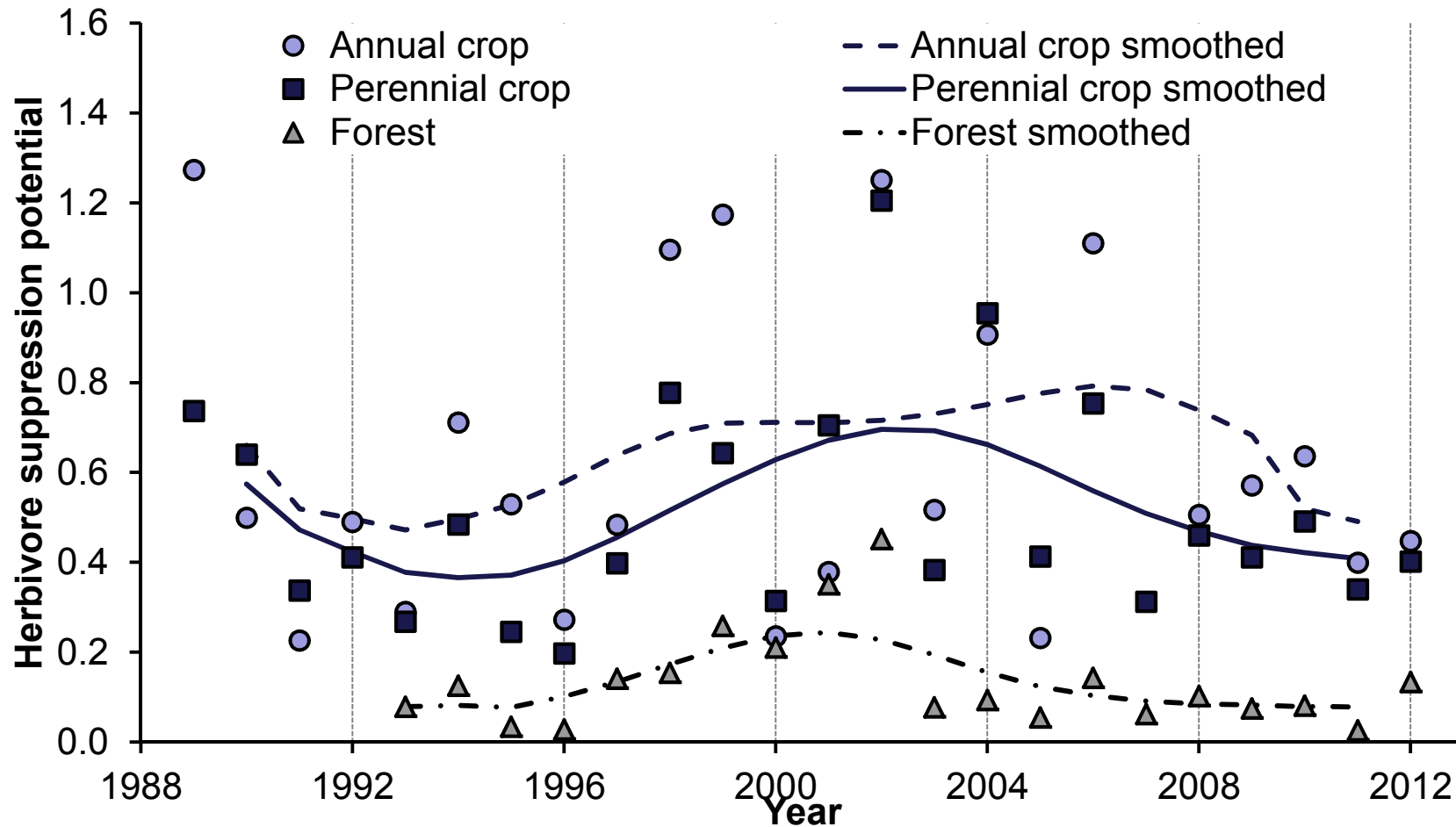
Bahlai et. al unpub. data

Diversity



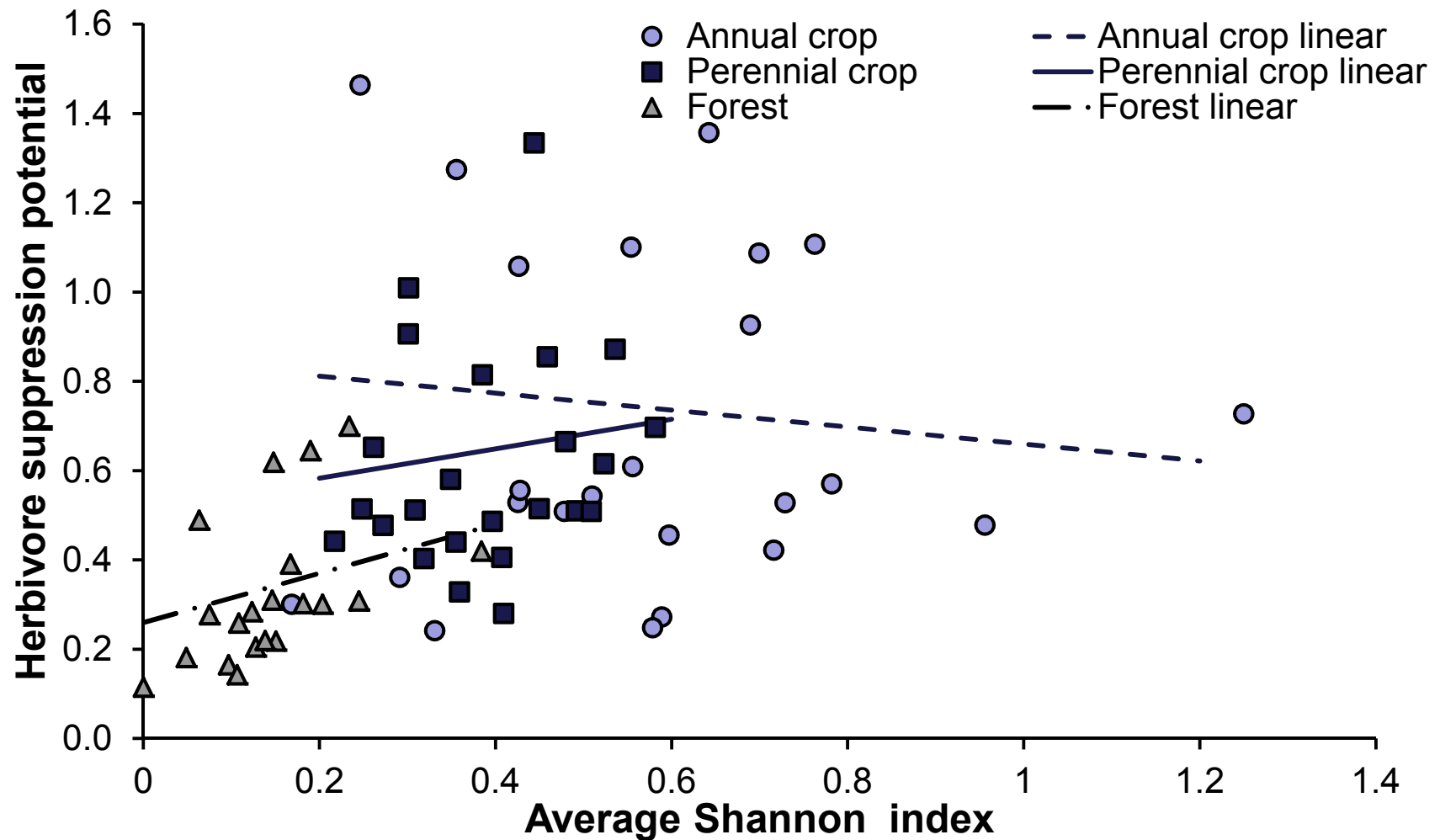
Bahlai et. al unpub. data

Predicted biocontrol service



Bahlai et. al unpub. data

Habitat type impacts the diversity/biocontrol relationship



Bahlai et. al unpub. data

Conclusions

- Predator communities provide valuable pest suppression services in agricultural landscapes
- Pest suppression is controlled by species identity and landscape configuration
- Design agricultural landscapes to maximize ecosystem services and enhance sustainability?



Acknowledgements

ILTER Collaborators

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