

# Research Highlights



Multicolored Asian lady beetles prey on soybean aphids at the Kellogg Biological Station LTER site.  
Credit: K. Stepnitz

## Landscape Diversity

**DIVERSE LANDSCAPES CURTAIL CROP PESTS —** Agricultural researchers traditionally focus their studies at the field level. By casting a wider net, KBS scientists have discovered how plant diversity in surrounding landscapes enhances habitat for predators of agricultural pests. Those predators can reduce pesticide use and avert yield loss worth millions of dollars annually.

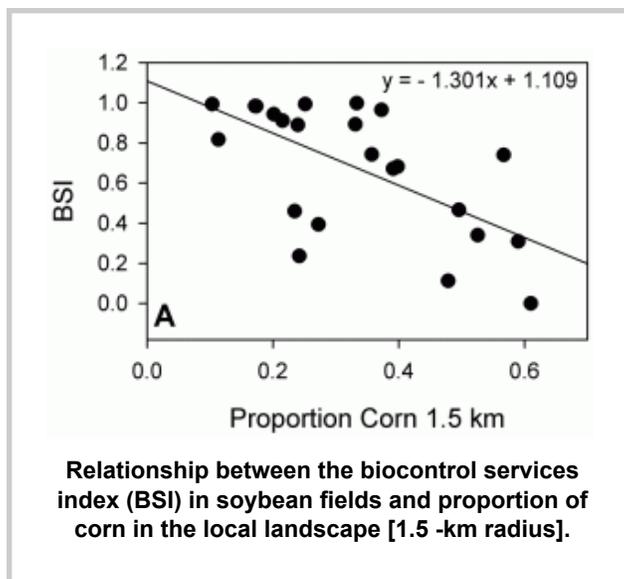
The soybean aphid *Aphis glycines*, an invasive insect pest, is the greatest threat to soybean production in the United States. First detected in the United States in 2000, this East Asian pest has spread rapidly through the Midwest and costs growers about \$30 million to \$50 million per year in reduced yield. By 2005, farmers had responded with a 20-fold increase in insecticide use, spraying

millions of acres of soybeans that formerly went untreated — at increased costs of \$10 per acre.

Long-term study of ladybird beetles at KBS had documented their importance as predators of other aphids in wheat, poplar, and other crops. In 2002, KBS researchers detected the arrival of *Harmonia axyridis*, an Asian species of ladybird beetle new to the United States. Using experiments in which fine-mesh cages were used to keep predators away from soybean plants, they showed that ladybird beetles could keep aphids below economic thresholds: inside the cages aphid populations quickly built to levels that would otherwise justify spraying. Outside the cages ladybird beetles, and especially the new arrival, kept aphid populations low late into the growing season — but only where there was sufficient natural habitat in the landscape to provide food and shelter for the predators throughout the year.

Economic analysis showed that in 2008 ladybird predation provided biocontrol equivalent to \$13-\$79 per acre in reduced pesticide use and averted yield loss. The value of this natural biological control of the aphid in four states (Iowa, Michigan, Minnesota, and Wisconsin) was estimated to be at least \$239 million per year.

KBS researchers also found that biological control is greater where the surrounding landscape is diverse with many different types of crop and non-crop habitats, animals, and insects. For example, they found that the increased presence of corn within one mile of



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a soybean field tended to reduce biological control because corn is a less favorable habitat for ladybird beetles and other insect predators. Thus, due to a 19% increase in corn acreage from 2006 to 2007 in response to grain ethanol demand, which reduced landscape diversity, the supply of beneficial predators to control pests in soybeans was reduced. For 2008 this loss was valued at about \$58 million for the four states studied.

Achieving the biofuel production levels mandated by Congress will take millions of acres of biofuel crops, with potential to alter the diversity of agricultural landscapes. Reliance on monocultures of a few crops will reduce landscape diversity resulting in lost biocontrol services. In contrast, using mixtures of many biofuel crops could diversify agricultural landscapes, providing greater biological control and pollination services, more wildlife habitat, and other ecosystem services.

## For Further Reading

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