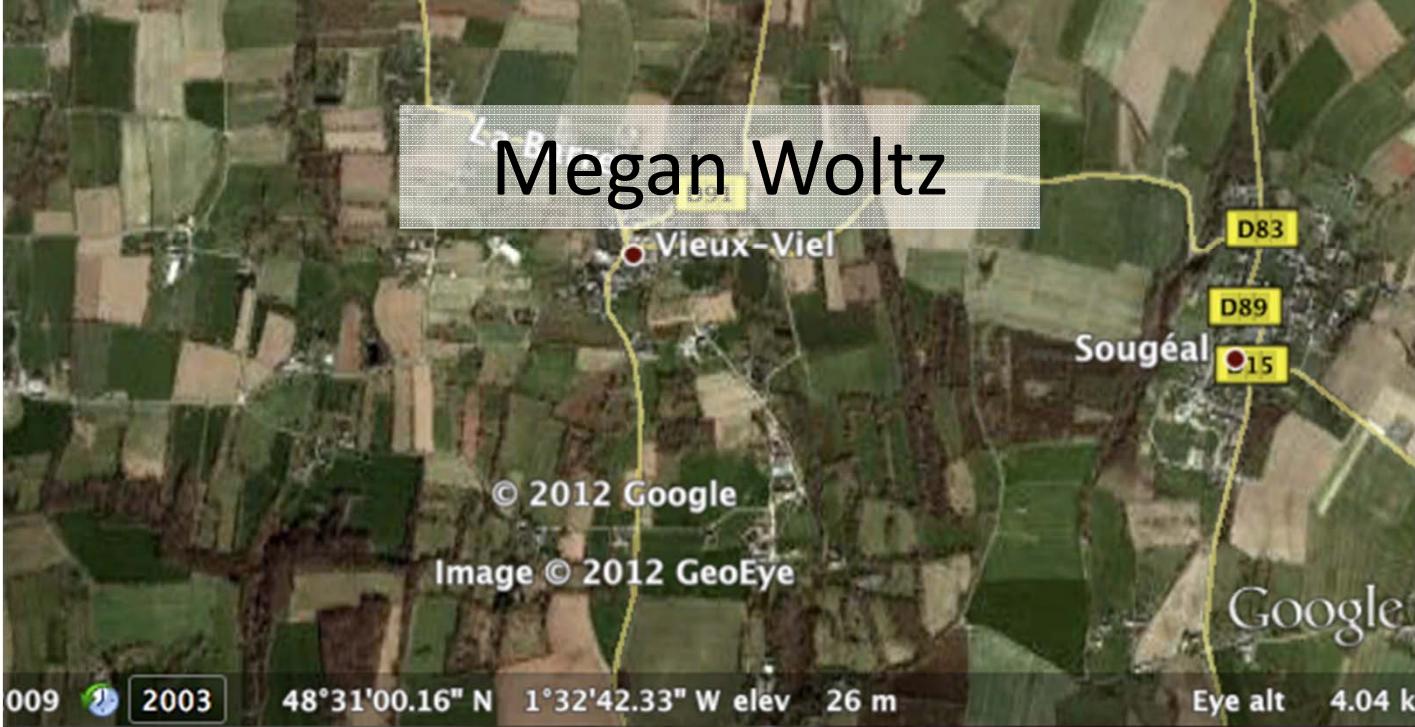




Expanding dimensions in landscape-agroecological research: an iLTER Cross-site Collaboration



Megan Woltz





Diane McKnight

LTER



HarvardForest.fas.Harvard.edu



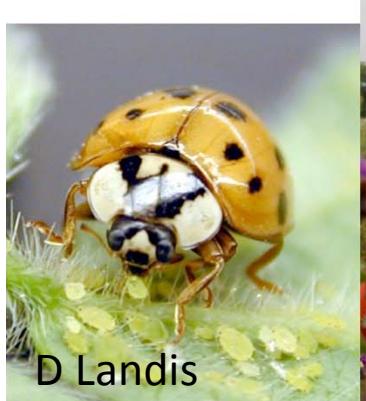


Diane McKnight

LTER



HarvardForest.fas.Harvard.edu



D Landis



AgBioResearch.MSU.edu



KBS LTER
Kellogg Biological Station
Long-term Ecological Research

Ecosystem Services



Ecological functions that support human existence

Daily et al. 2000, MEA 2005

Ecosystem Services from Insects

Pollination



Decomposition



Biological Control



“Beneficial Insects”

“Natural Enemies”

72% of the world's 1330 cultivated crops are insect-pollinated
Which translates into 35% of human food requiring pollination by insects

Klein et al. 2006



Jeffrey Lotz



Alex Wild
cc by-nd



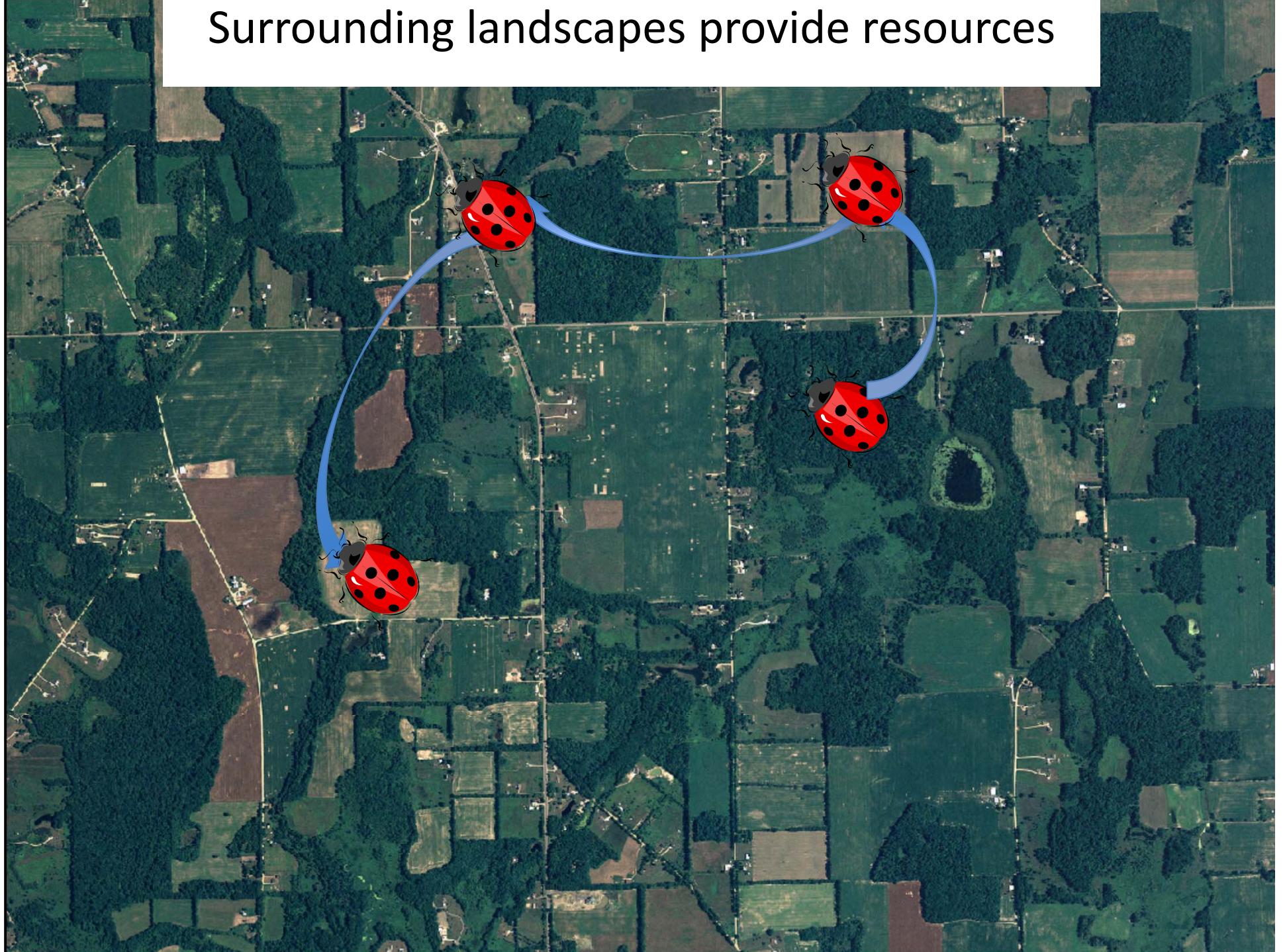
Scott Bauer ARS



Biocontrol worth \$4.5 billion/yr to US Agriculture

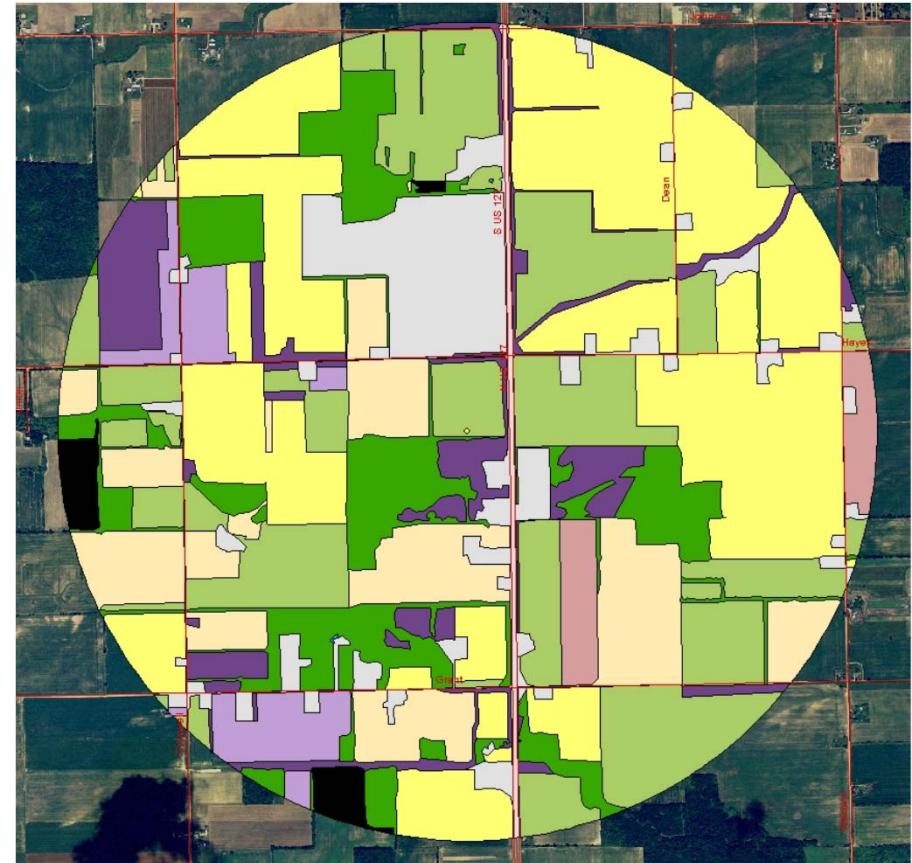
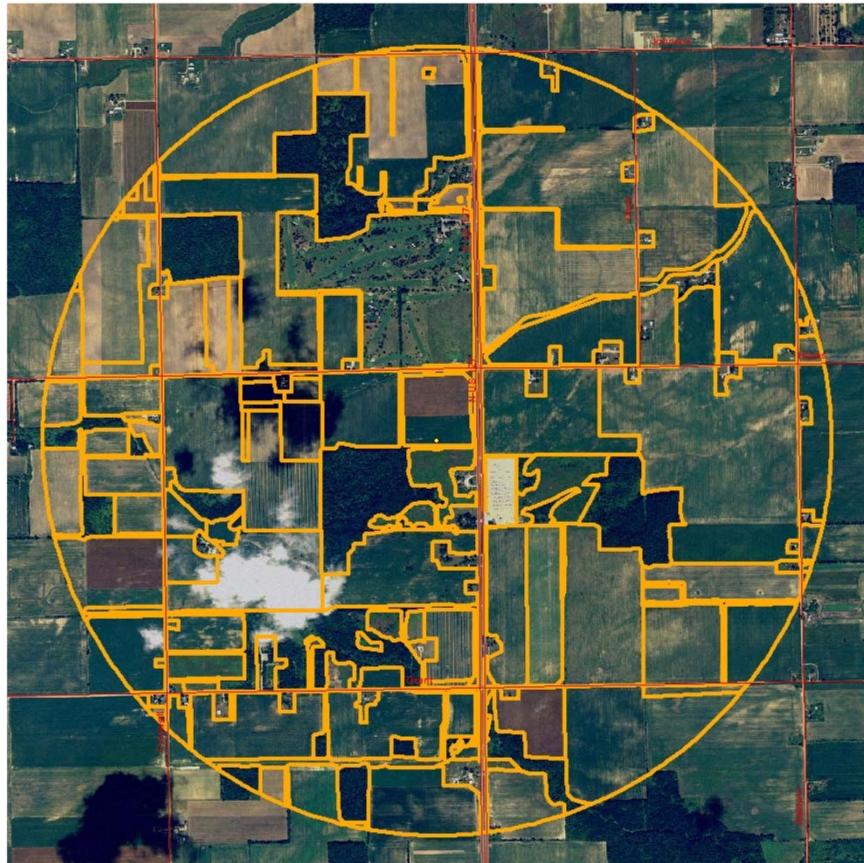
Losey & Vaughn 2006

Surrounding landscapes provide resources

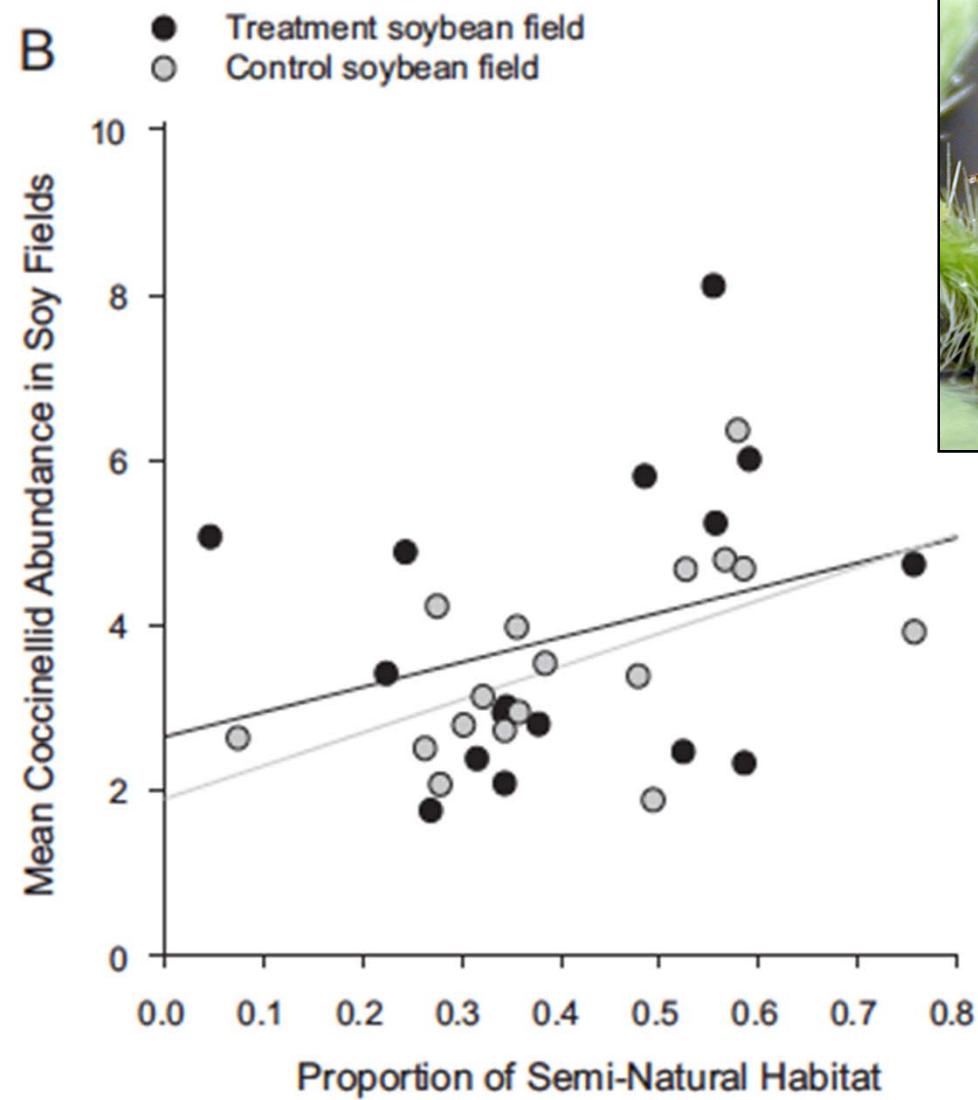




What do we know about landscape effects on ecosystem services?

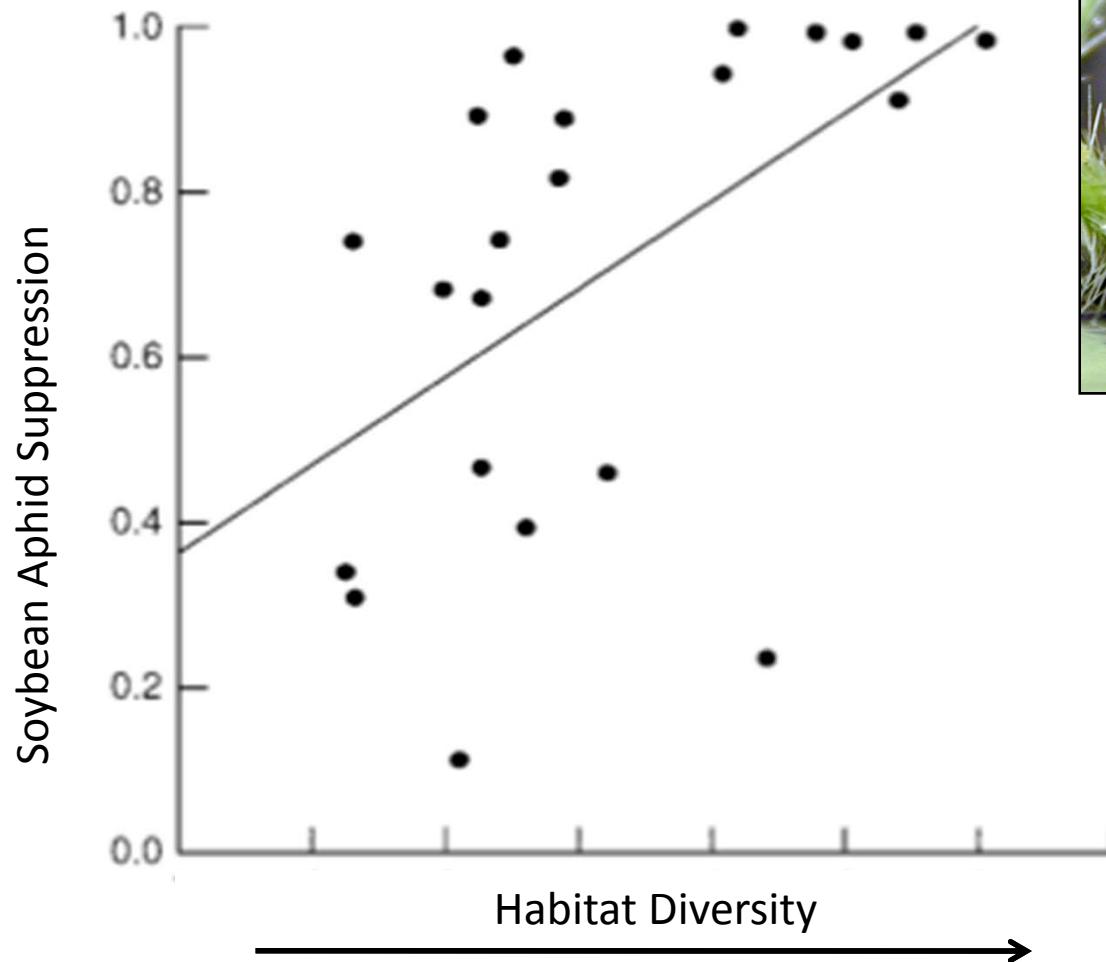


Lady Beetles Increase with Natural Habitat

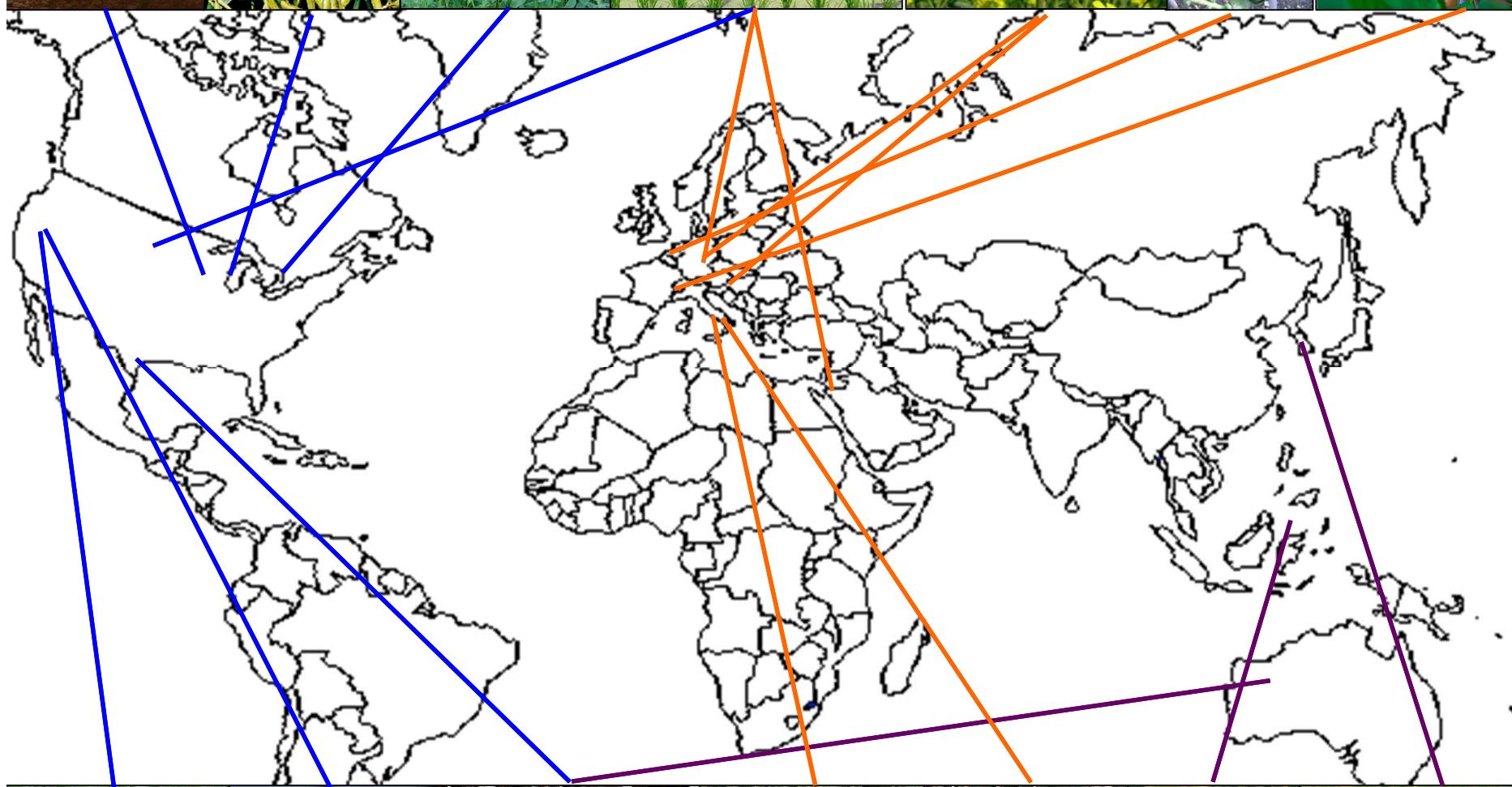


Woltz et al. 2012

Biocontrol Increases with Landscape Diversity



Gardiner et al. 2009



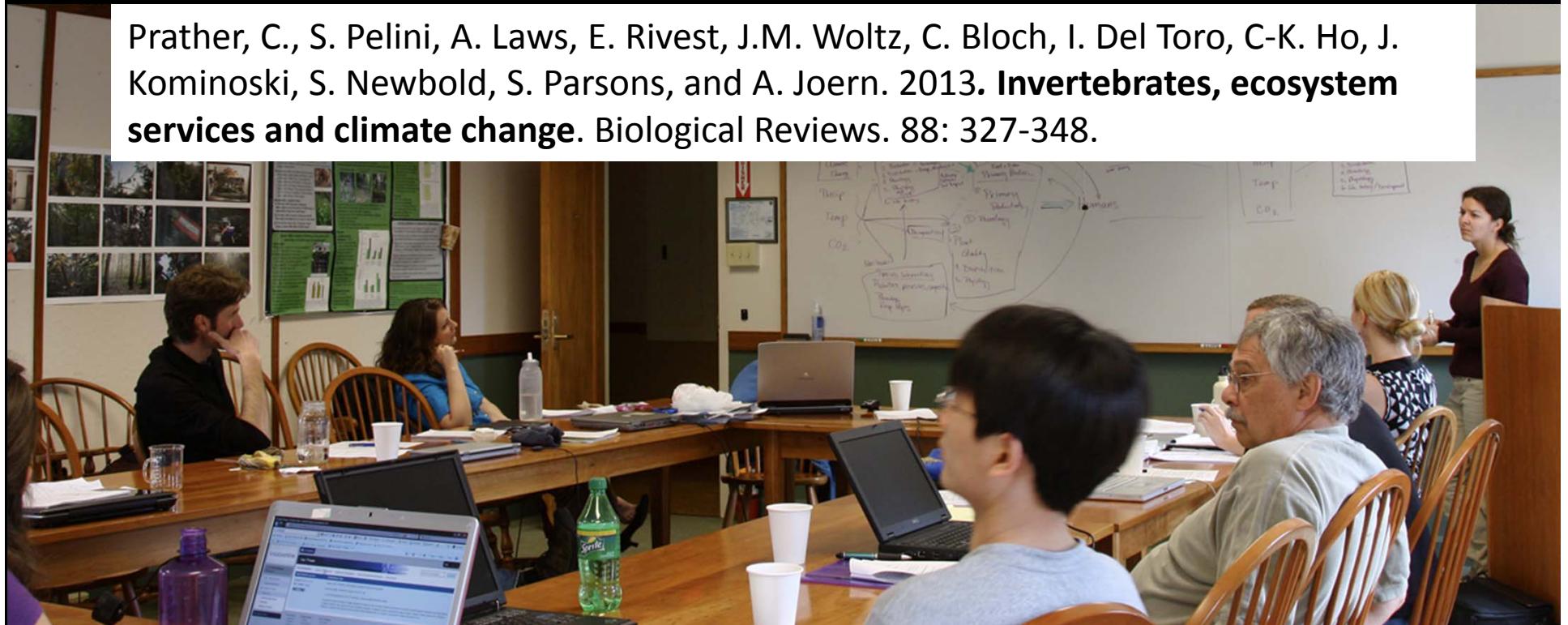




LTER ASM 2009



Prather, C., S. Pelini, A. Laws, E. Rivest, J.M. Woltz, C. Bloch, I. Del Toro, C-K. Ho, J. Kominoski, S. Newbold, S. Parsons, and A. Joern. 2013. **Invertebrates, ecosystem services and climate change**. Biological Reviews. 88: 327-348.





Long Term Ecological
Research site (LTER),
Brittany, France

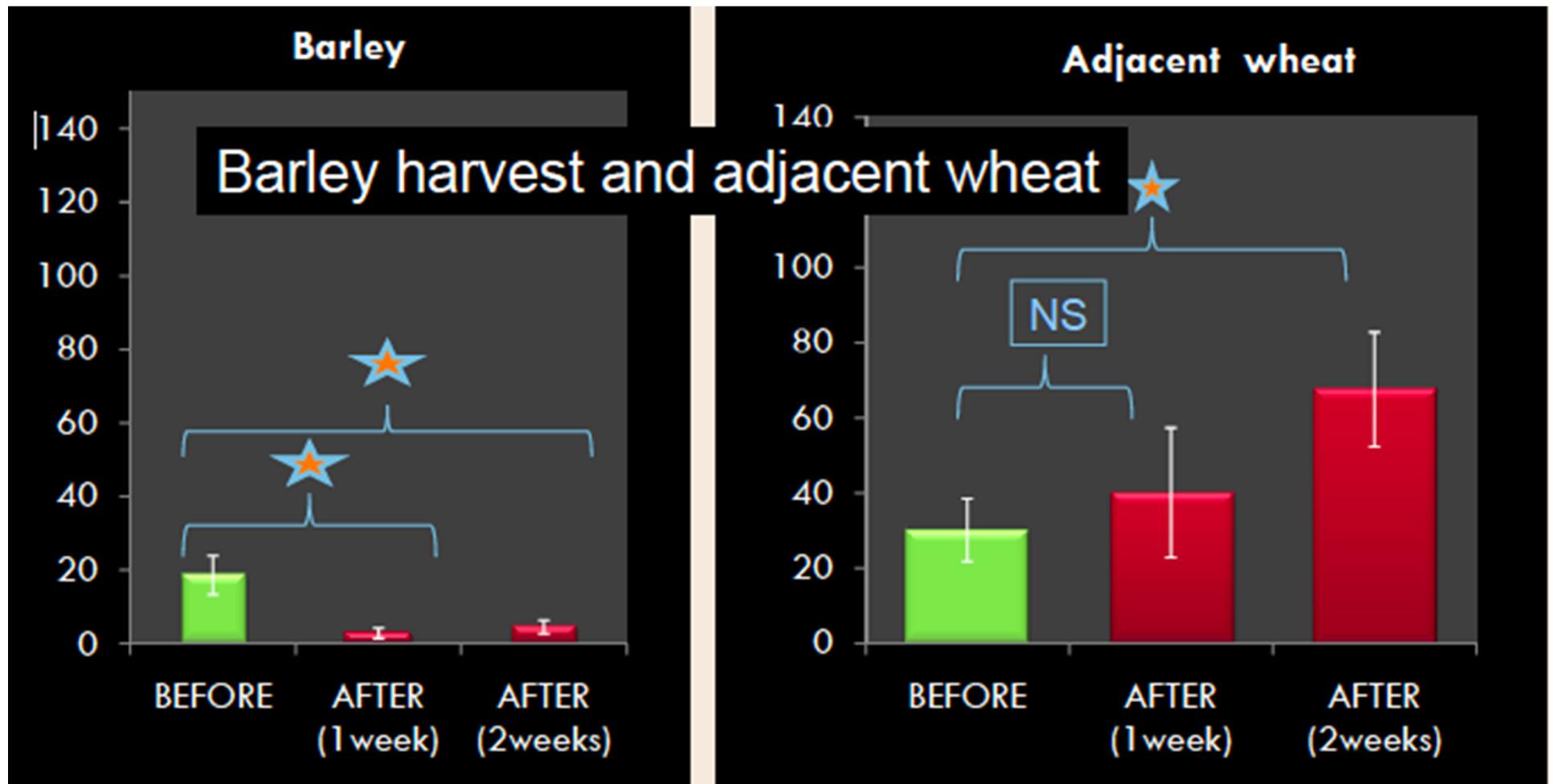


Study area:



~20 ha in openfield landscape:
- Hedgerow network (~ 40m/ha)
-Wide fields (sometimes > 10 ha)
-Mixed crop-livestock farming





Data from Jacques Baudry and Chloé Vasseur

Temporal Heterogeneity





Support: KBS LTER Summer Graduate Research Fellowship
Pioneer Hi-bred International Graduate Student Fellowship



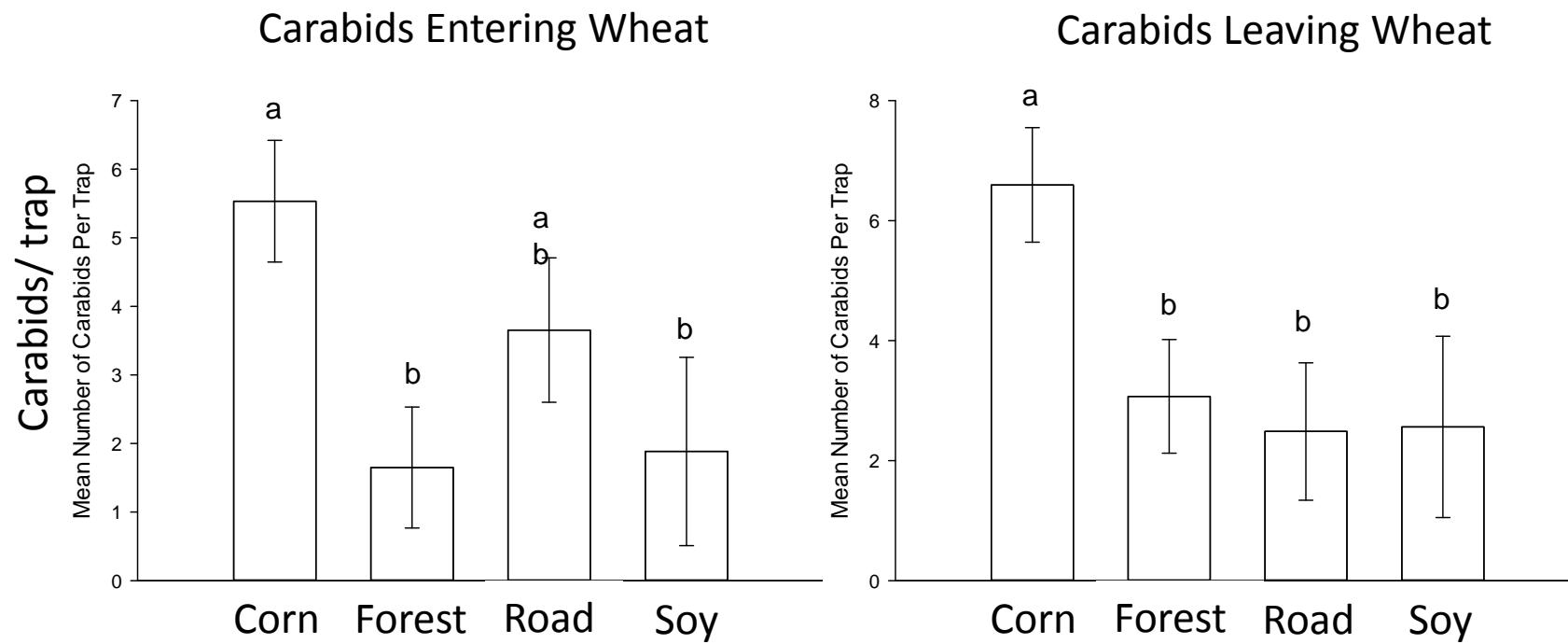


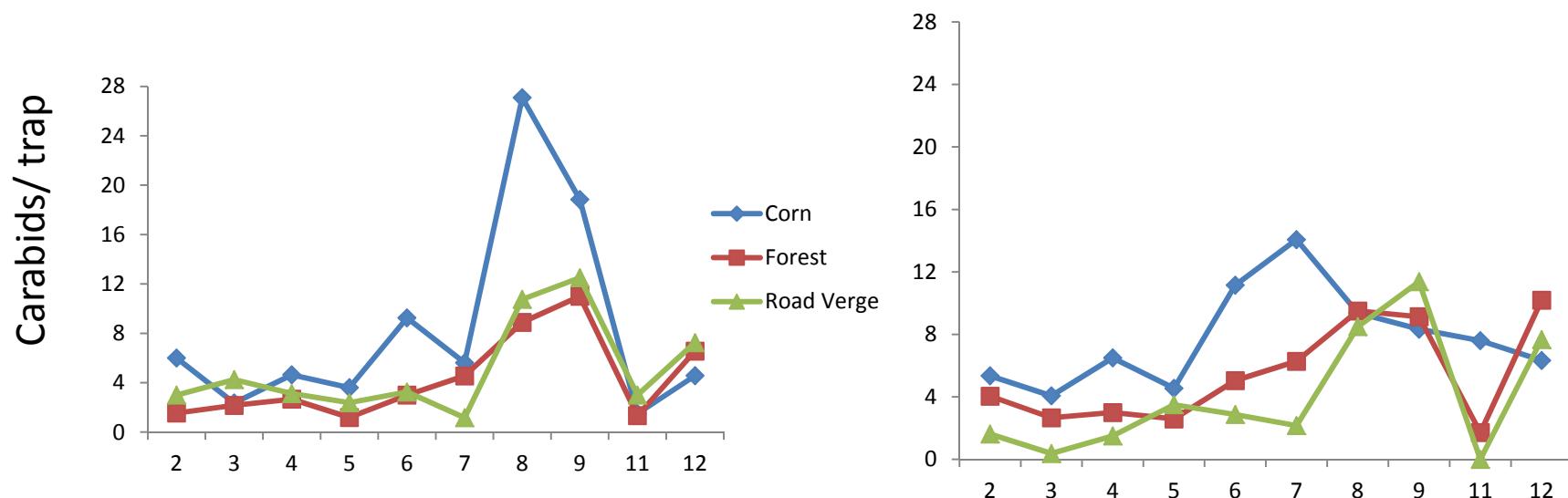
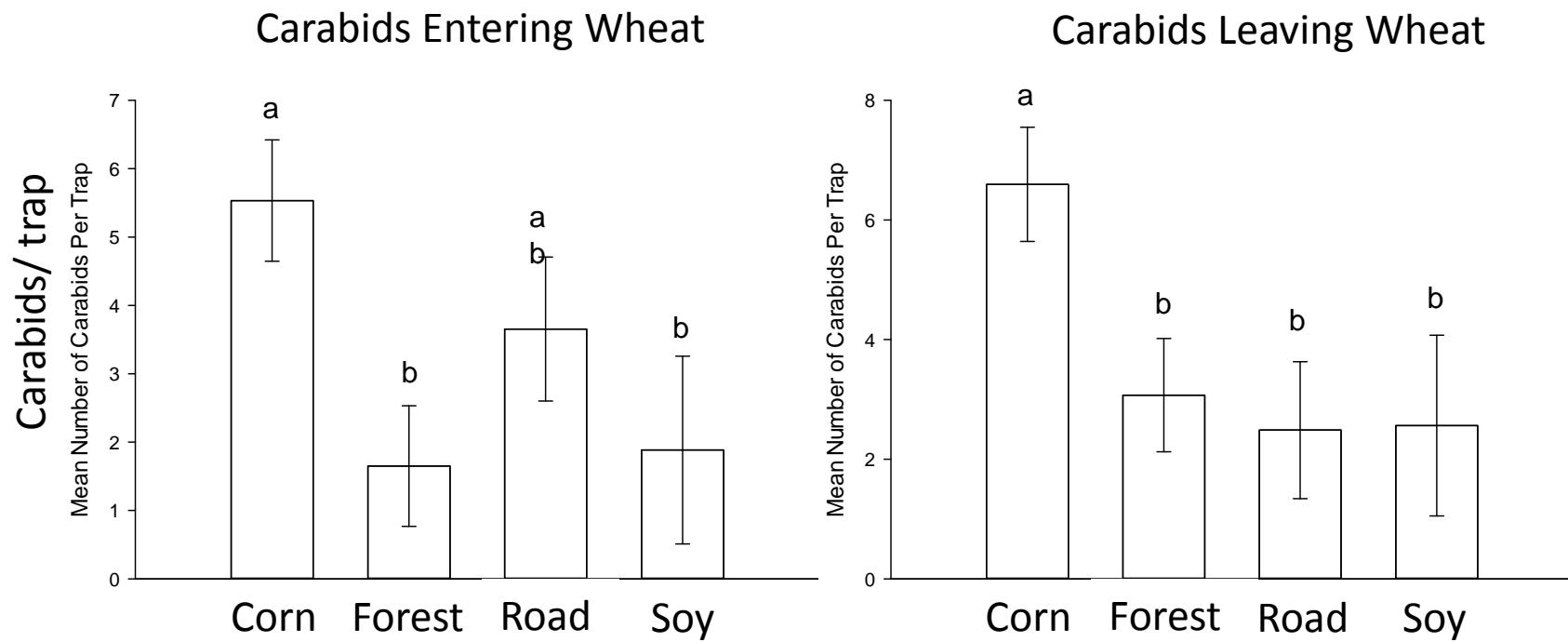
© 2012 Google
Image: USDA Farm Service Agency

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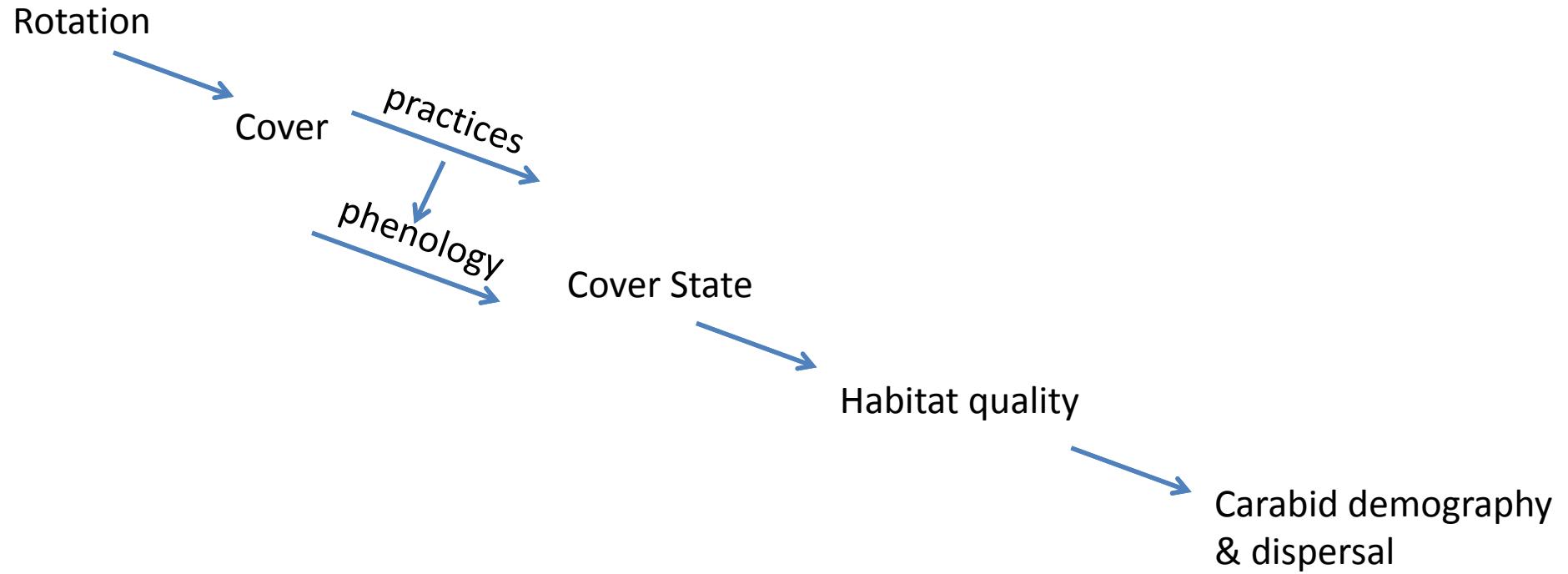


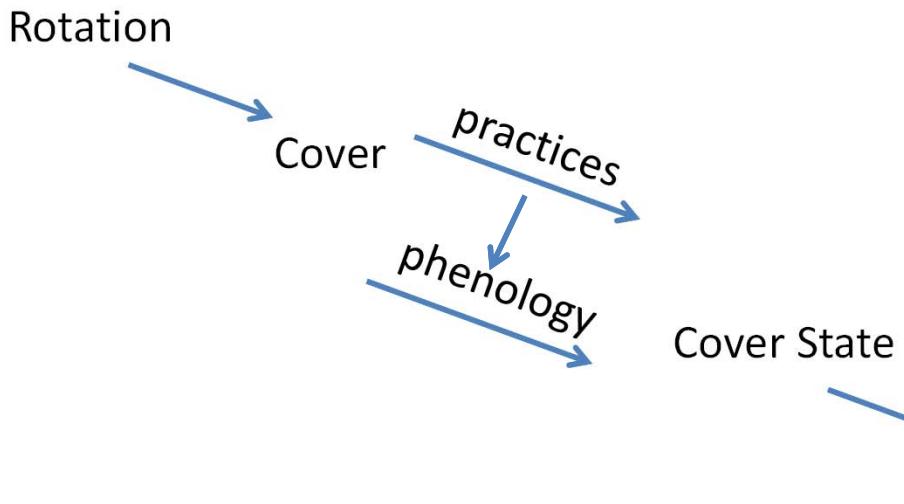
Landscape Modeling

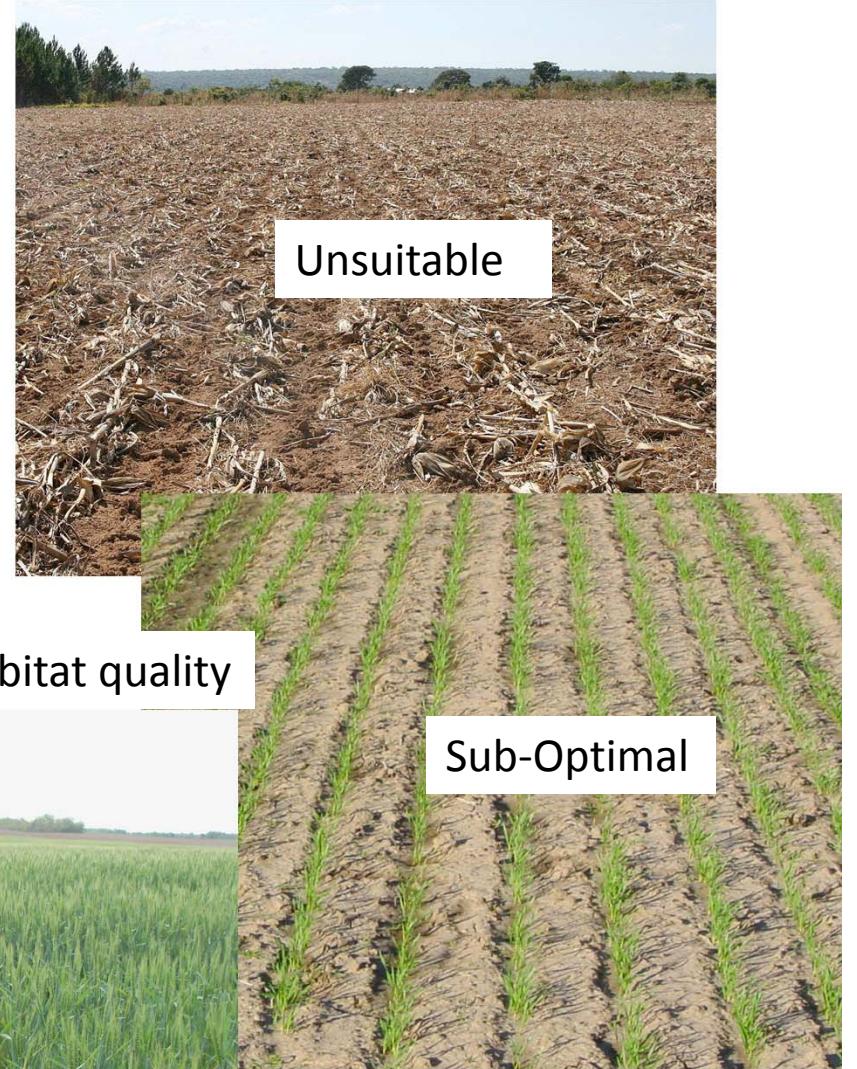
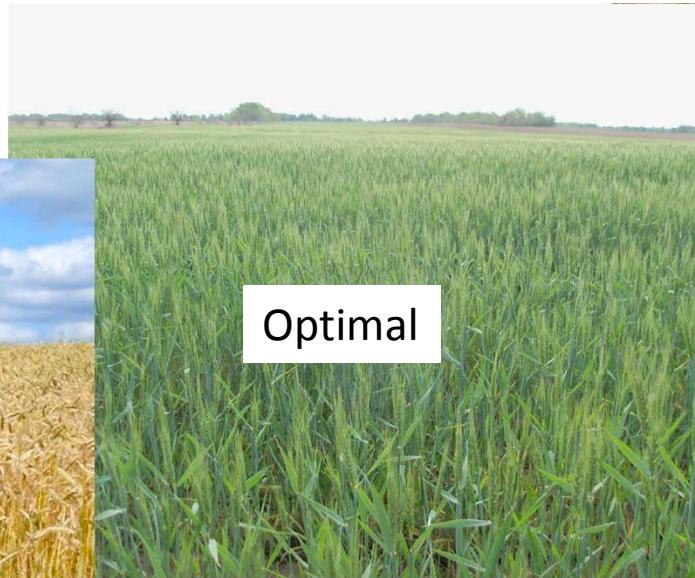
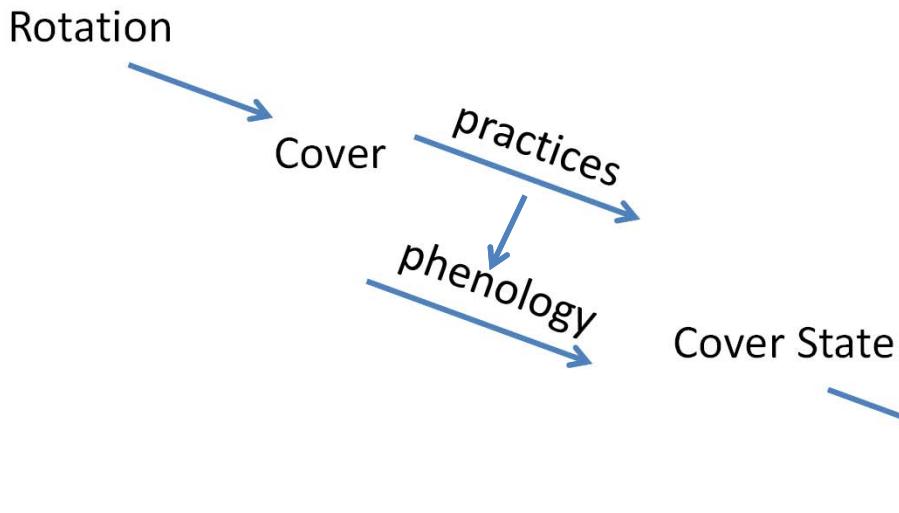
NSF Office of International
Science and Engineering
supplemental funding

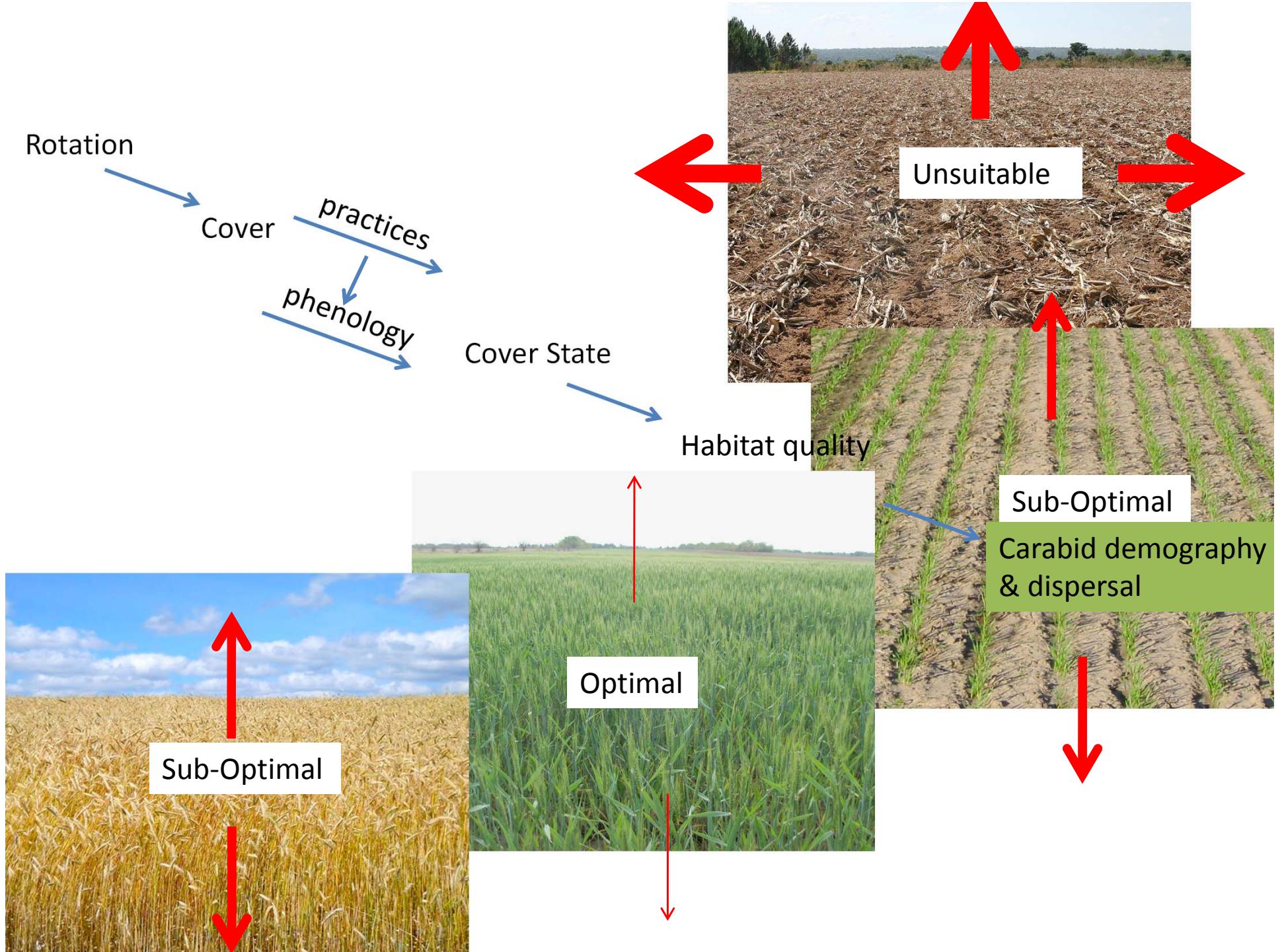
Institut National de la Recherche
Agronomique

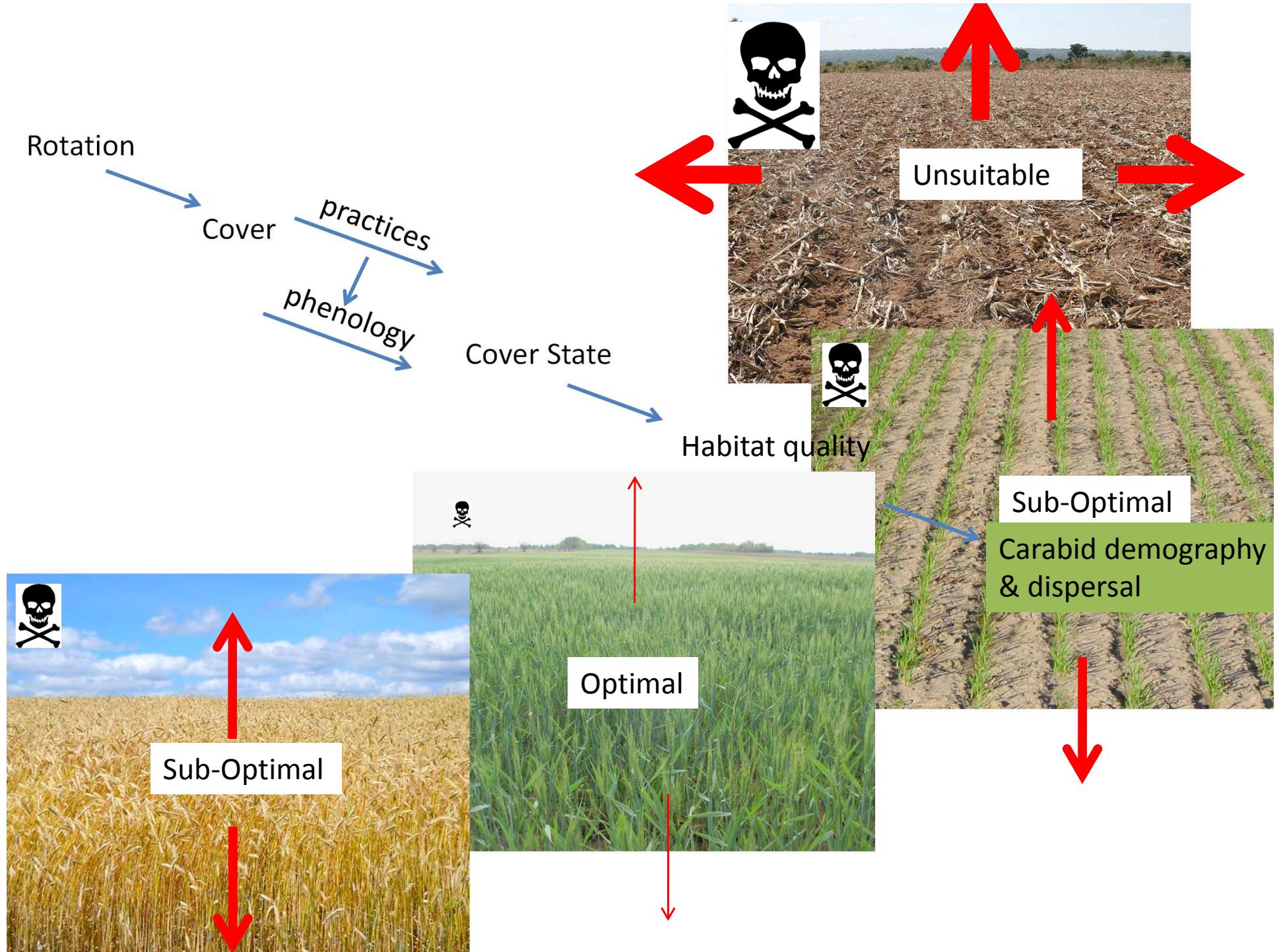












Adapting Model to Michigan

Alter rotation

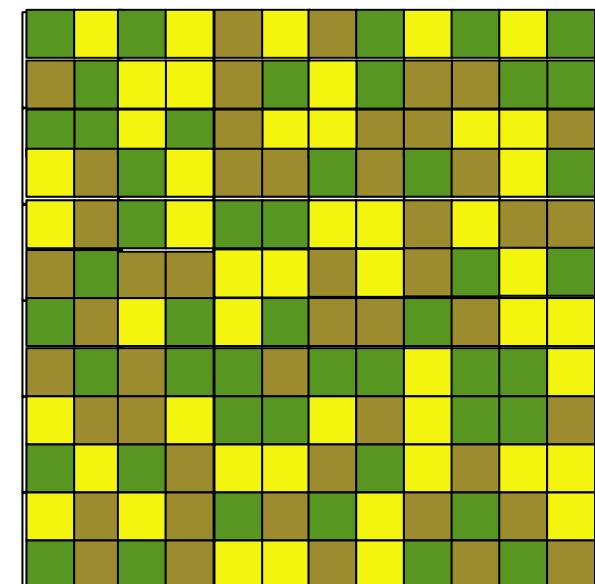
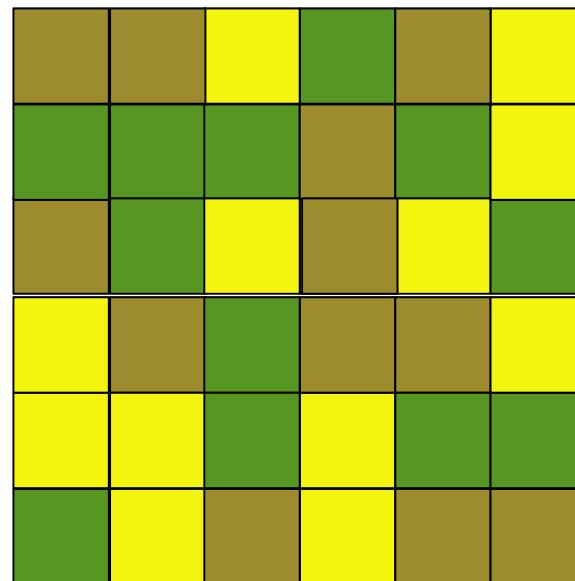
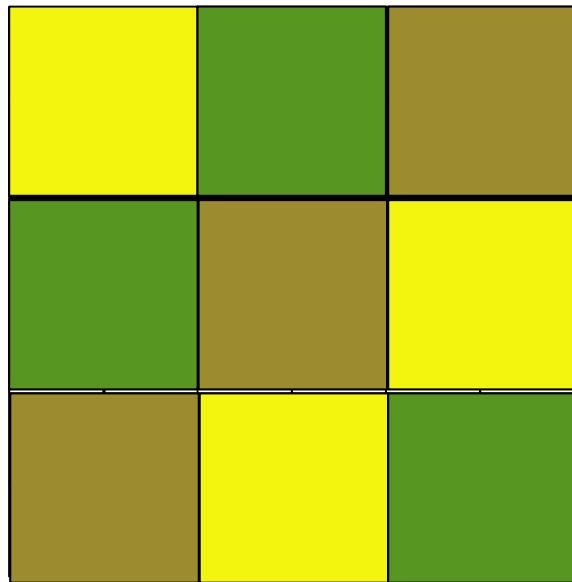
corn, wheat, barley → corn, soy, wheat

Crop phenology

shorter growing season

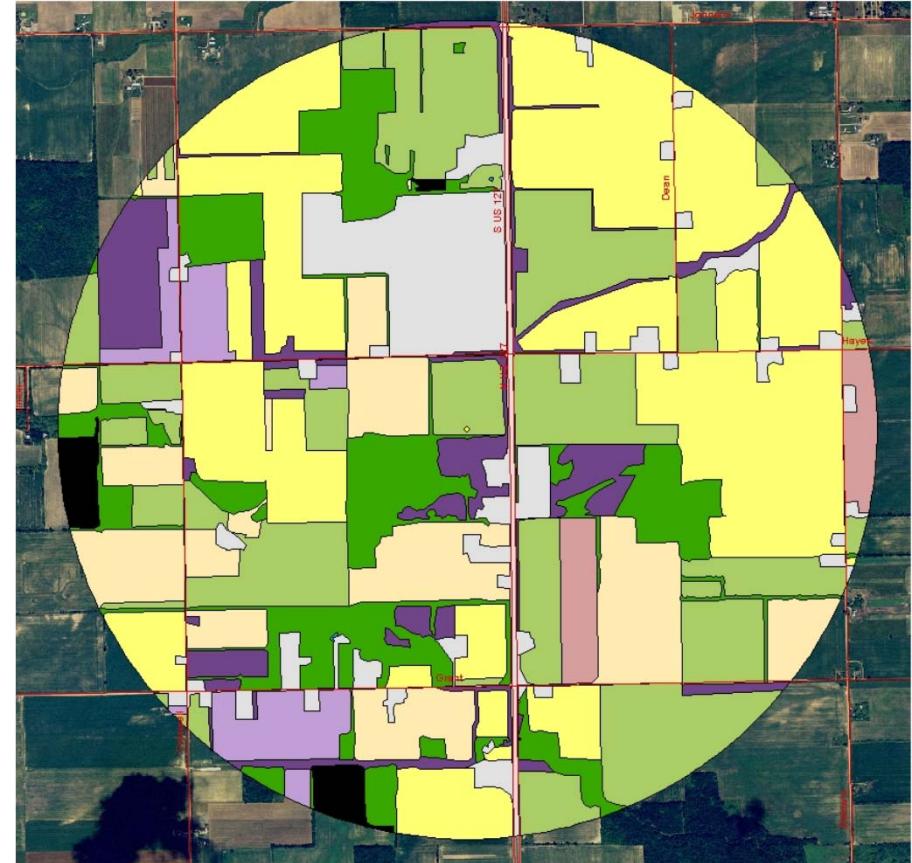
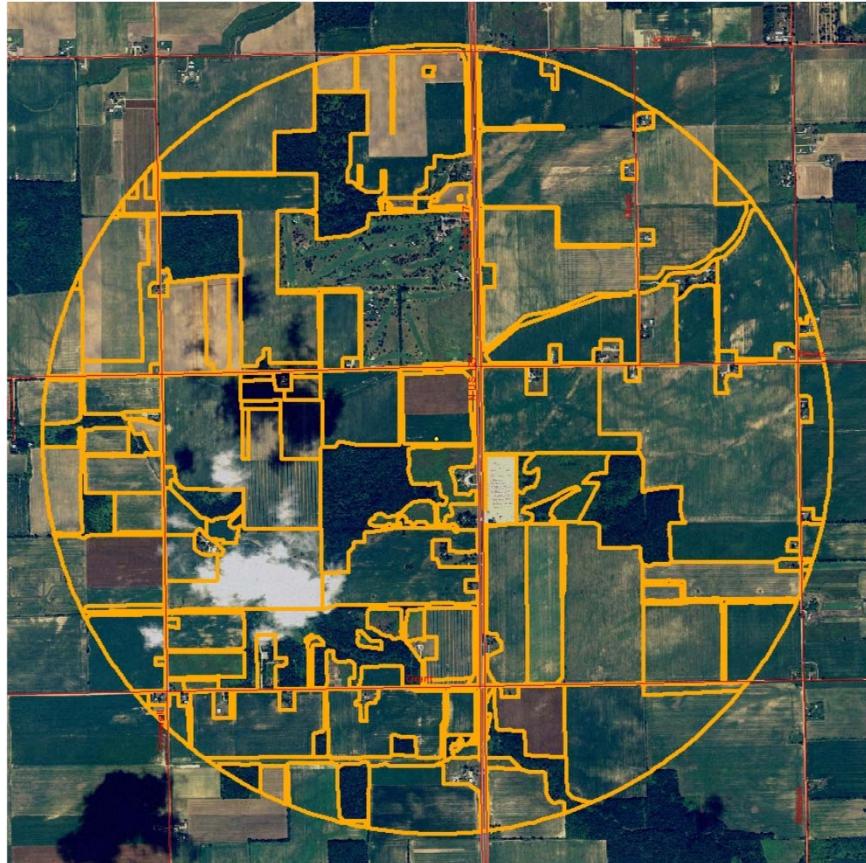
timing of practices

Incorporate snow – period of no growth



Question: Effects of crop field size and
interspersion on carabid population
persistence

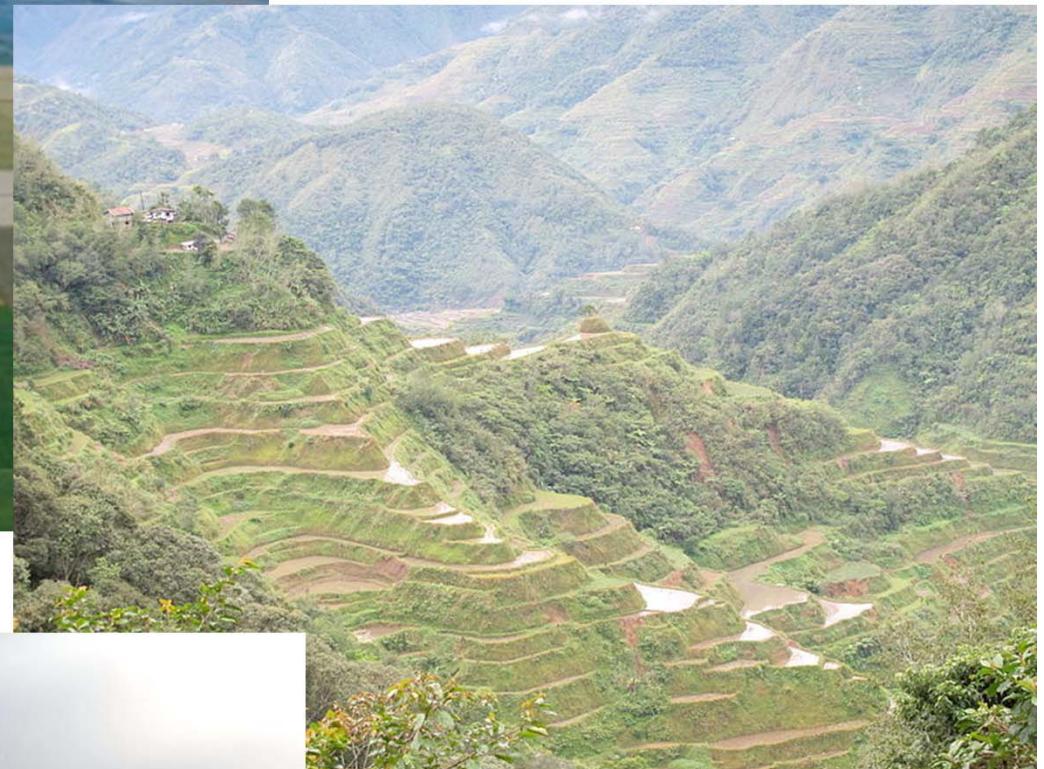
What do we know about landscape effects on ecosystem services?

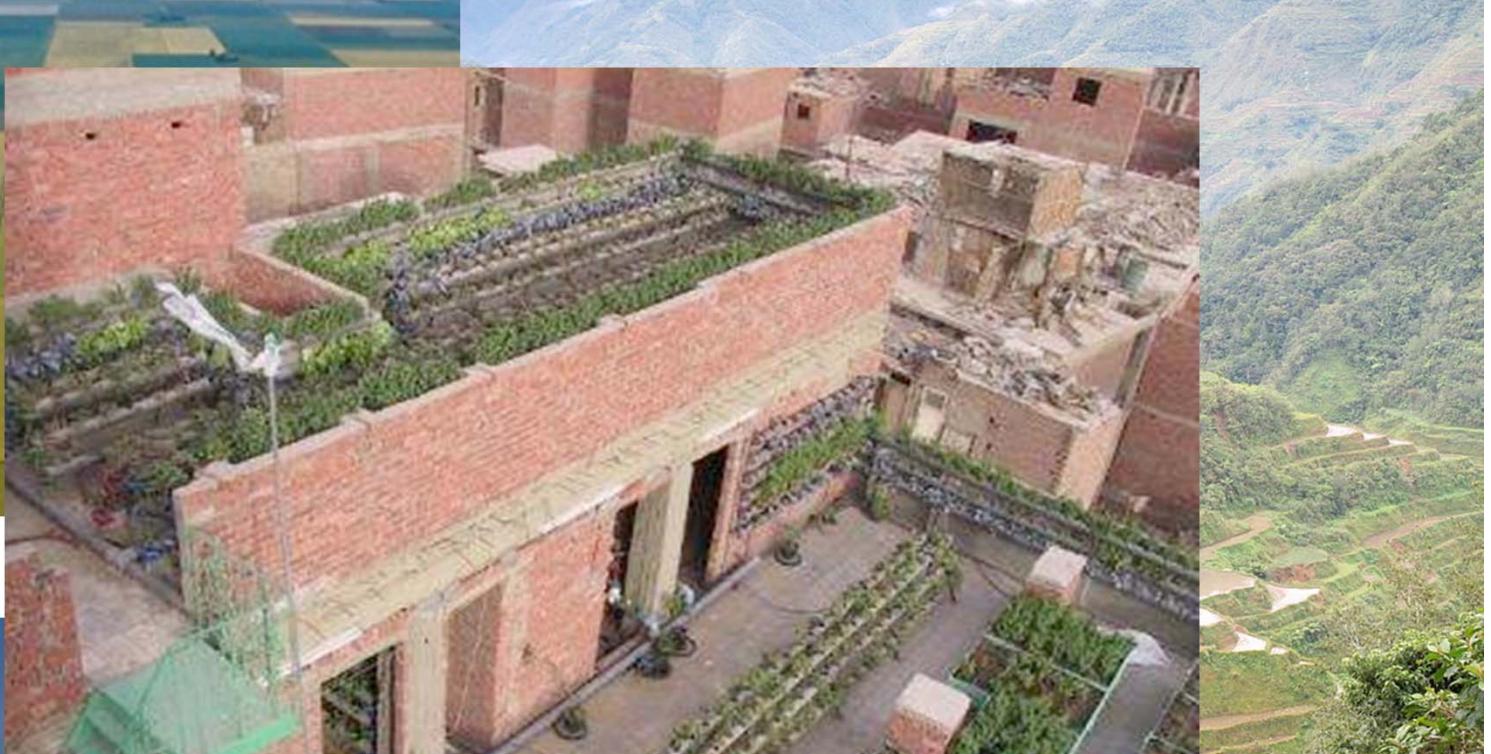


Correlative → mechanistic
composition only → spatial and temporal effects









KBS LTER Summer Research Fellowship
NSF Office of International Science and Engineering
supplemental funding

Institut National de la Recherche Agronomique

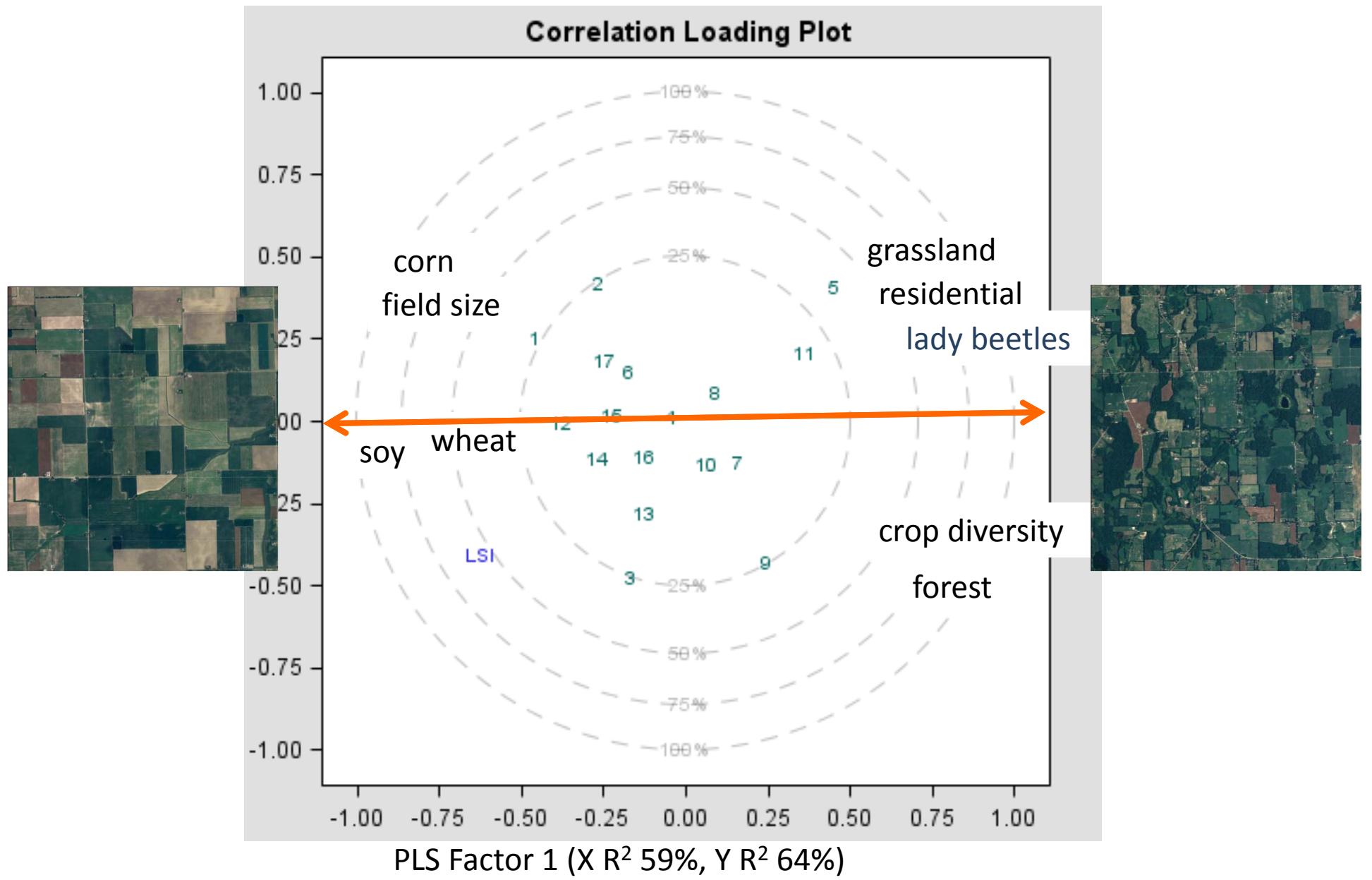
Jacques Baudry, Chloe Vassuer, Hughes Boussard

Carly Eakin, Heather Russon and Emily Franklin

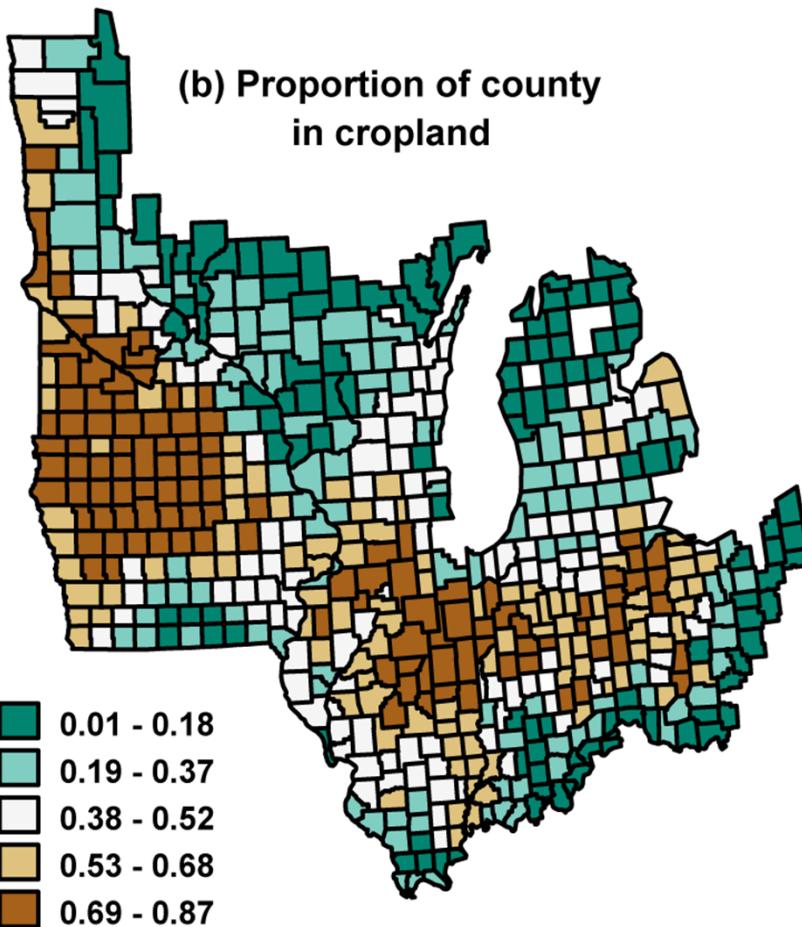
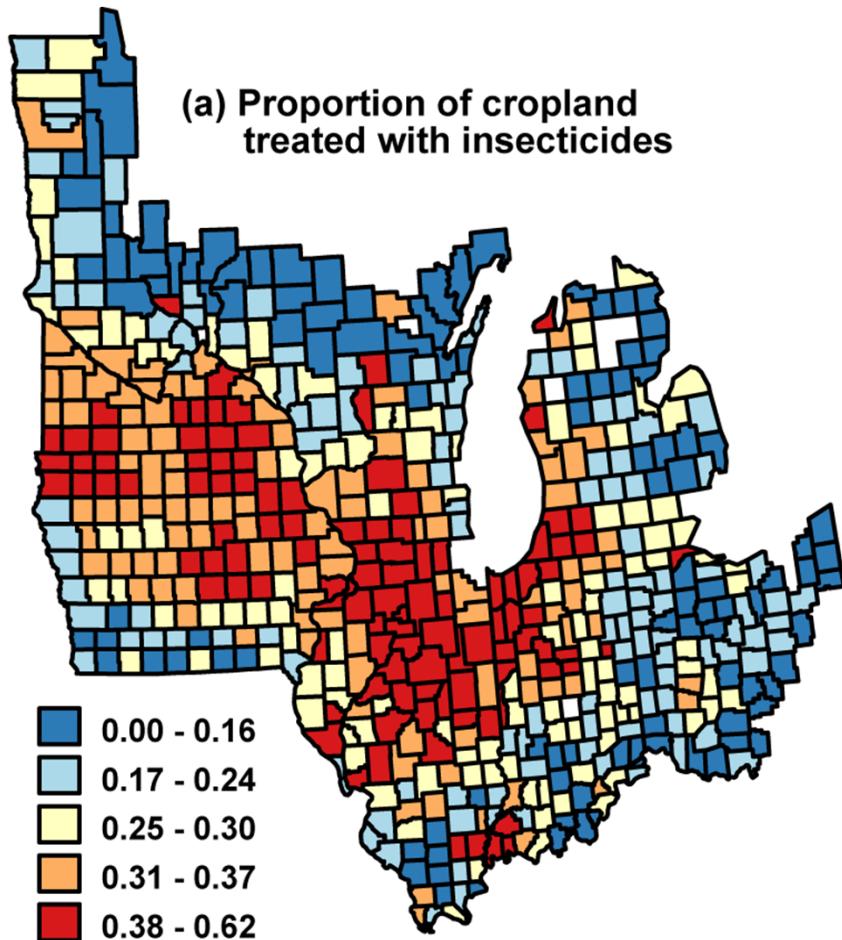


KBS LTER
Kellogg Biological Station
Long-term Ecological Research





Landscape simplification leads to increased insecticide use



Source: Meehan et al. (2011) PNAS



Megan Woltz

**Natural habitat in landscape
increases NE Abundance**

Schmidt et al 2005

Oberg et al 2007

Schmidt et al 2008

Pluess et al 2010

Gardiner et al 2010

Drapela et al 2008

Purtauf et al 2005

Elliot et al 1998

Schmidt and Tscharntke 2005

Gardiner et al 2009

Letourneau and Goldstein 2001

Prasifka et al 2004

Perovic et al 2010

**Natural habitat in landscape
increases # NE Species**

Schmidt et al 2005

Oberg et al 2007

Schmidt et al 2008

Pluess et al 2010

Gardiner et al 2010

Drapela et al 2008

Purtauf et al 2005

Elliot et al 1998

Klein et al 2006

Clough et al 2005

Weibull et al 2003

Werling and Gratton 2008

**Natural habitat in landscape
Increased Predation/ Parasitism
of Crop Pests**

Thies & Tscharntke 1999

Thies et al 2003

Eilers and Klein 2009

Thies et al 2005

Roschewitz et al 2005

Bianchi et al 2005

Bianchi et al 2008

Boccaccio and Petacchi 2008

Klein et al 2006

Gardiner et al 2009

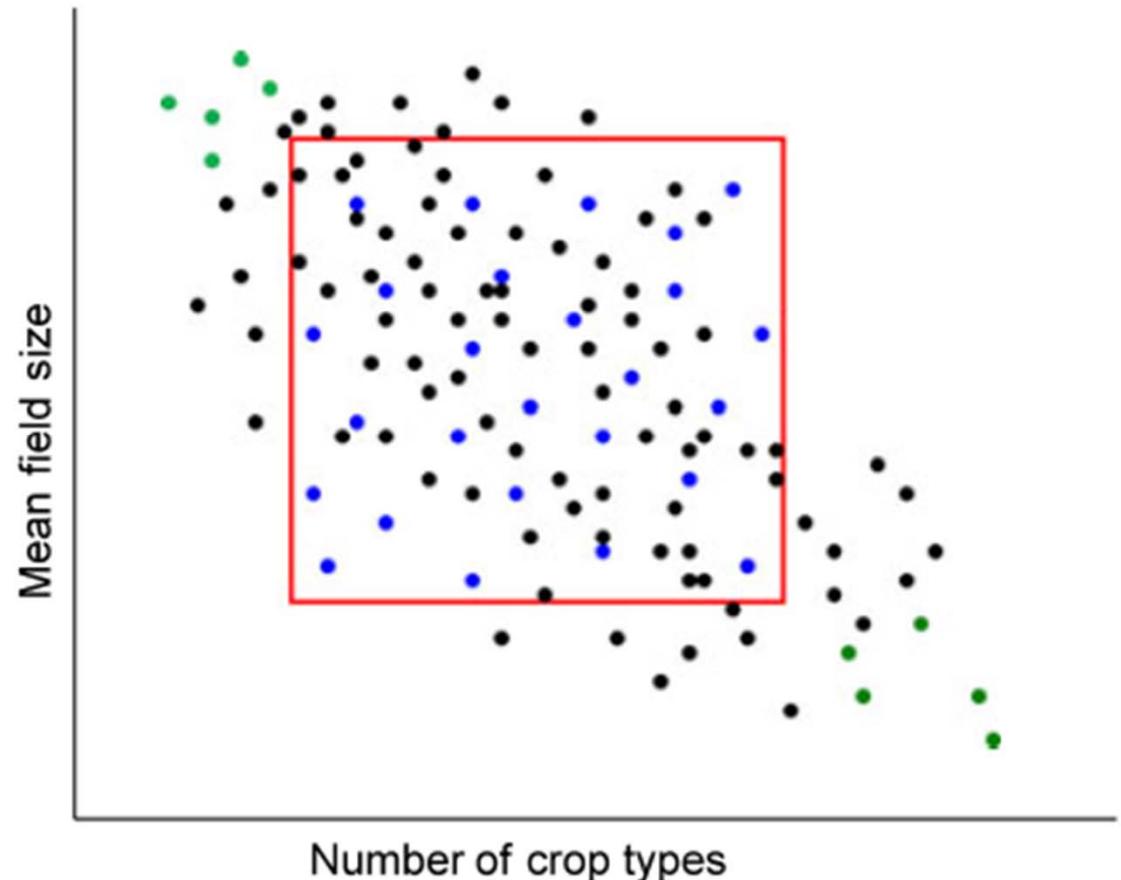
Letourneau and Goldstein 2001

Werling and Gratton 2010

To experimentally separate effects of different landscape characteristics....

40-60 landscapes
4km in diameter

5 countries, 8 regions,
40 researchers

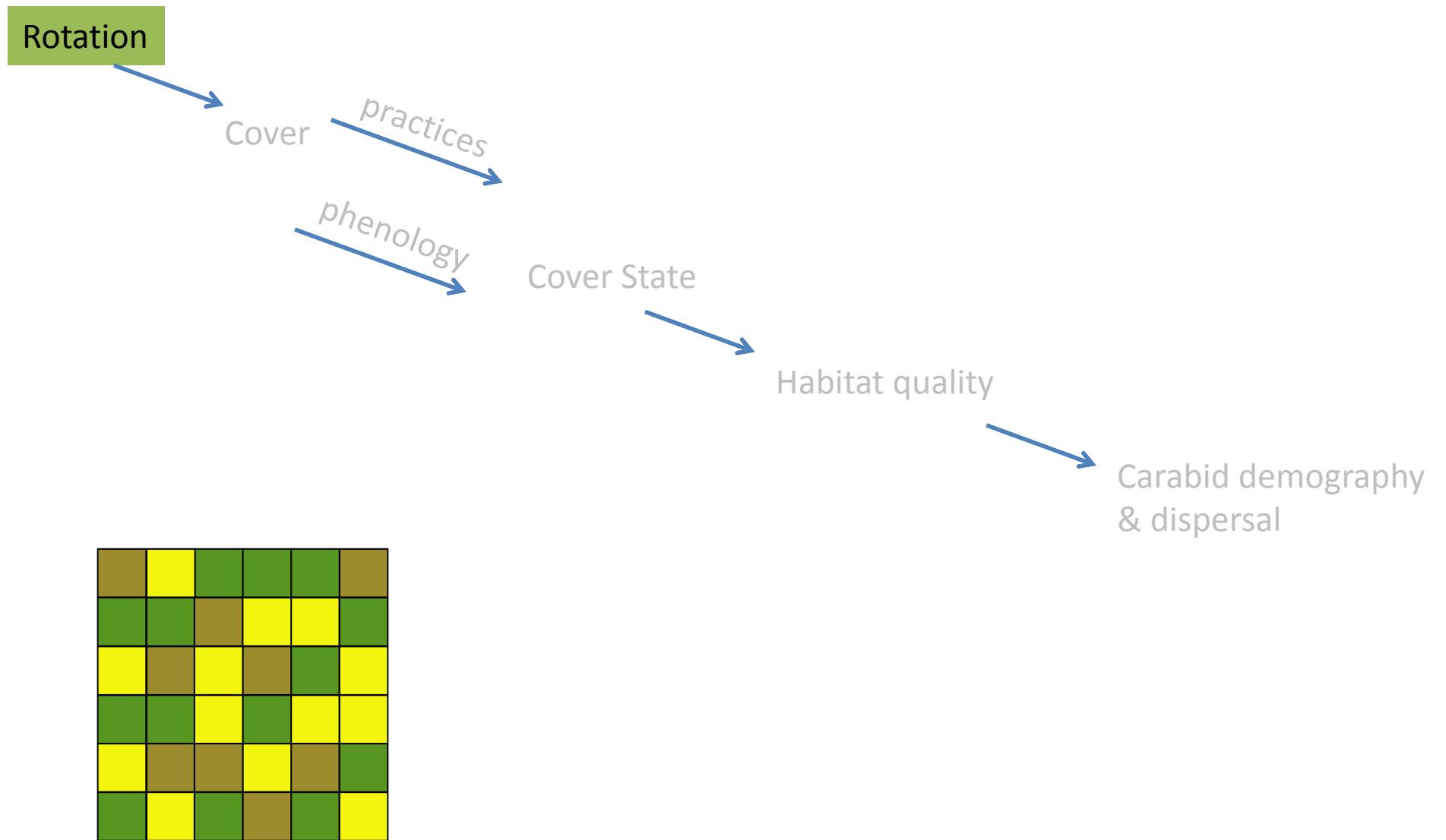


settings

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start date	15/07/2013	end date	15/07/2019
time step	10 days	scenarios	1
		simulations	1
			<input type="button" value="Submit"/>

settings

<input checked="" type="radio"/> simulator	<input type="radio"/> scenario1												
covers	/Applications/Inra/Angora/param/exp2/data/covers.txt	<input type="radio"/> imported landscape	<input type="button" value="Browse"/>										
cover states	/Applications/Inra/Angora/param/exp2/data/coverstates.txt	<input checked="" type="radio"/> generated landscape	10 landscape size	50 field size (in meter)									
		0 fieldboundary rate	1 fieldmargin width (in meter)	0 hedgerow rate									
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rotations	/Applications/Inra/Angora/param/exp2/data/rotations.txt	<input checked="" type="checkbox"/> generated initial uses allocations											
		surface rotations	<table border="1"> <tr> <th>rotation</th> <th>proportion</th> </tr> <tr> <td>M-W-B</td> <td>100</td> </tr> </table>	rotation	proportion	M-W-B	100	linear rotations	<table border="1"> <tr> <th>rotation</th> <th>proportion</th> </tr> <tr> <td></td> <td></td> </tr> </table>	rotation	proportion		
rotation	proportion												
M-W-B	100												
rotation	proportion												
species	/Applications/Inra/Angora/param/exp2/data/pterostichus_me	<input type="button" value="Add"/>	<input type="button" value="Remove"/>	<input type="button" value="Add"/>	<input type="button" value="Remove"/>								
demography date	24/02/2016	start acti	1 hedgerow behaviour	50 kMax	50 dMax								
initialization count of population per patch	1,000	end activ	practices	/Applications/Inra/Angora/param/exp2/data/practices.txt	<input type="button" value="Browse"/>								
			itks	/Applications/Inra/Angora/param/exp2/data/itks.txt	<input type="button" value="Browse"/>								
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			demography	/Applications/Inra/Angora/param/exp2/data/demography	<input type="button" value="Browse"/>								



Rotation

Cover

prac

phenolo



Carabid demography
& dispersal



Rotation

Cover

practices

phenology



demography
al

Rotation

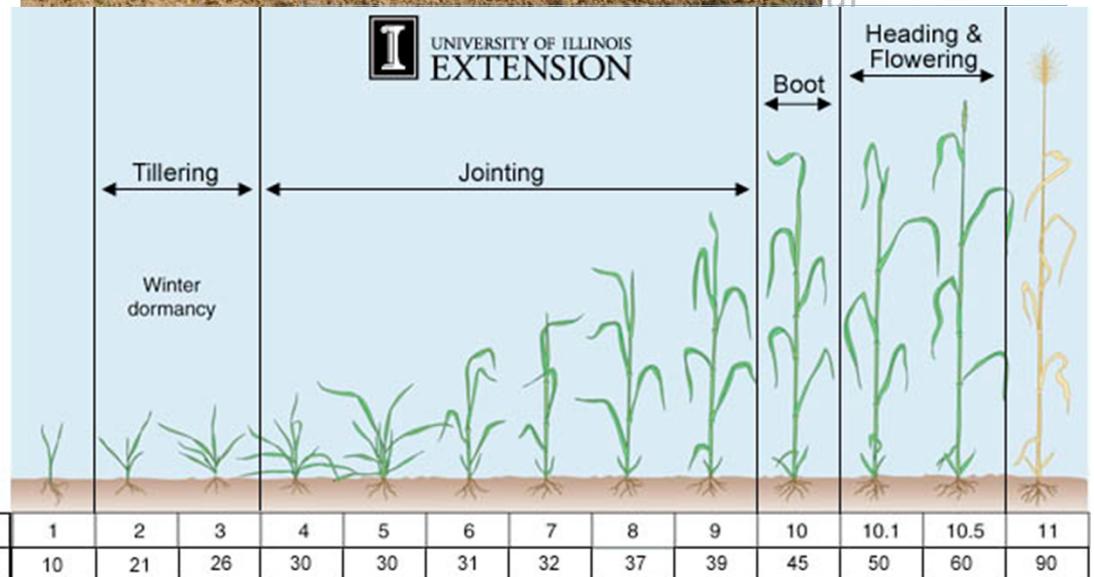
Cover

practices

phenology



demography
al



Grab File Edit Capture Window Help

Angora

Simulator Project

project outputs

outputX

population = 879736655, demography at 28/6/2019
population = 795134021, demography at 8/7/2019
population = 764262336, demography at 18/7/2019
population = 683548441, demography at 28/7/2019
population = 638226101, demography at 7/8/2019
population = 579406847, demography at 17/8/2019
population = 507213148, demography at 27/8/2019
population = 425273021, demography at 6/9/2019
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population = 117310097, demography at 26/10/2019
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population = 92246822, demography at 15/11/2019
population = 83429786, demography at 25/11/2019
population = 76062670, demography at 5/12/2019
population = 69830753, demography at 15/12/2019
population = 64493266, demography at 25/12/2019
population = 59865587, demography at 4/1/2020
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population = 48978772, demography at 3/2/2020
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population = 38575335, demography at 14/3/2020
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population = 23241677, demography at 3/5/2020
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population = 231959159, demography at 2/6/2020
population = 268489695, demography at 12/6/2020
population = 282349859, demography at 22/6/2020
population = 251588363, demography at 2/7/2020
close simulation 2_1_1
close scenario 2_1
close simulator 2

24/2/2016

Year

2013 2014 2015 2016 2017 2018 2019 2020

Month

1 2 3 4 5 6 7 8 9 10 11 12

Day

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

New Save Load Settings Initialization Run SIMULATOR STATE : FINISHED Previous Next DATE : 24/2/2016

