

Landsharing vs. landsparing: how to reconcile crop production and biodiversity? A simulation study focusing on weed impacts

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Weeds are harmful for agricultural production but essential for biodiversity. Species composition and abundance depend on cropping systems, but also on weed seed dispersal between fields.

Question Can weed-related biodiversity and crop production be reconciled in each field or should separate fields be used to maximise either biodiversity or production?

Material and methods Simulations with a virtual-field model

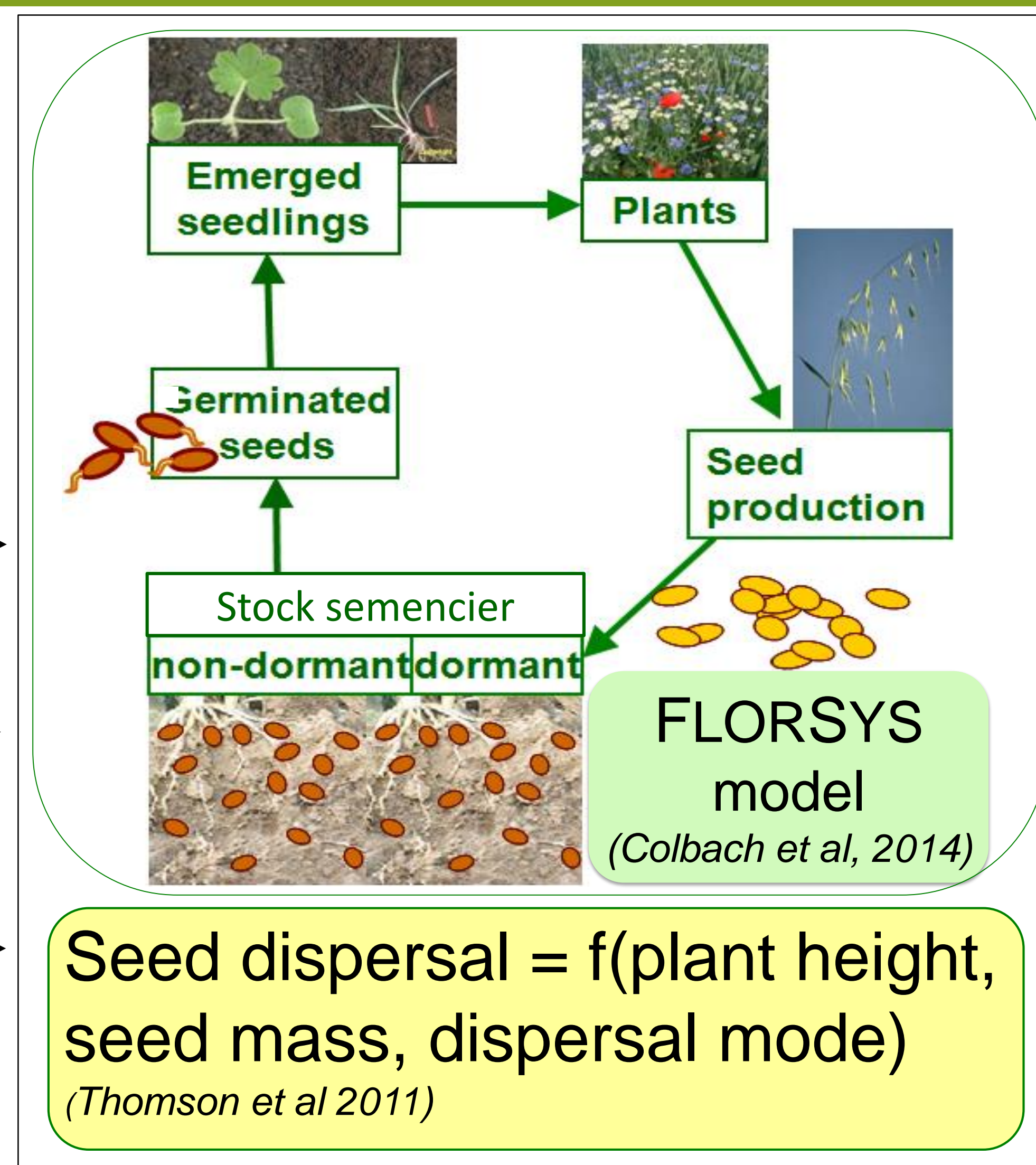
Input variables

9 landscape systems
(annual crop pattern x cropping system)

1 pedo-climate
(Aquitaine)

Initial weed community
(25 species)

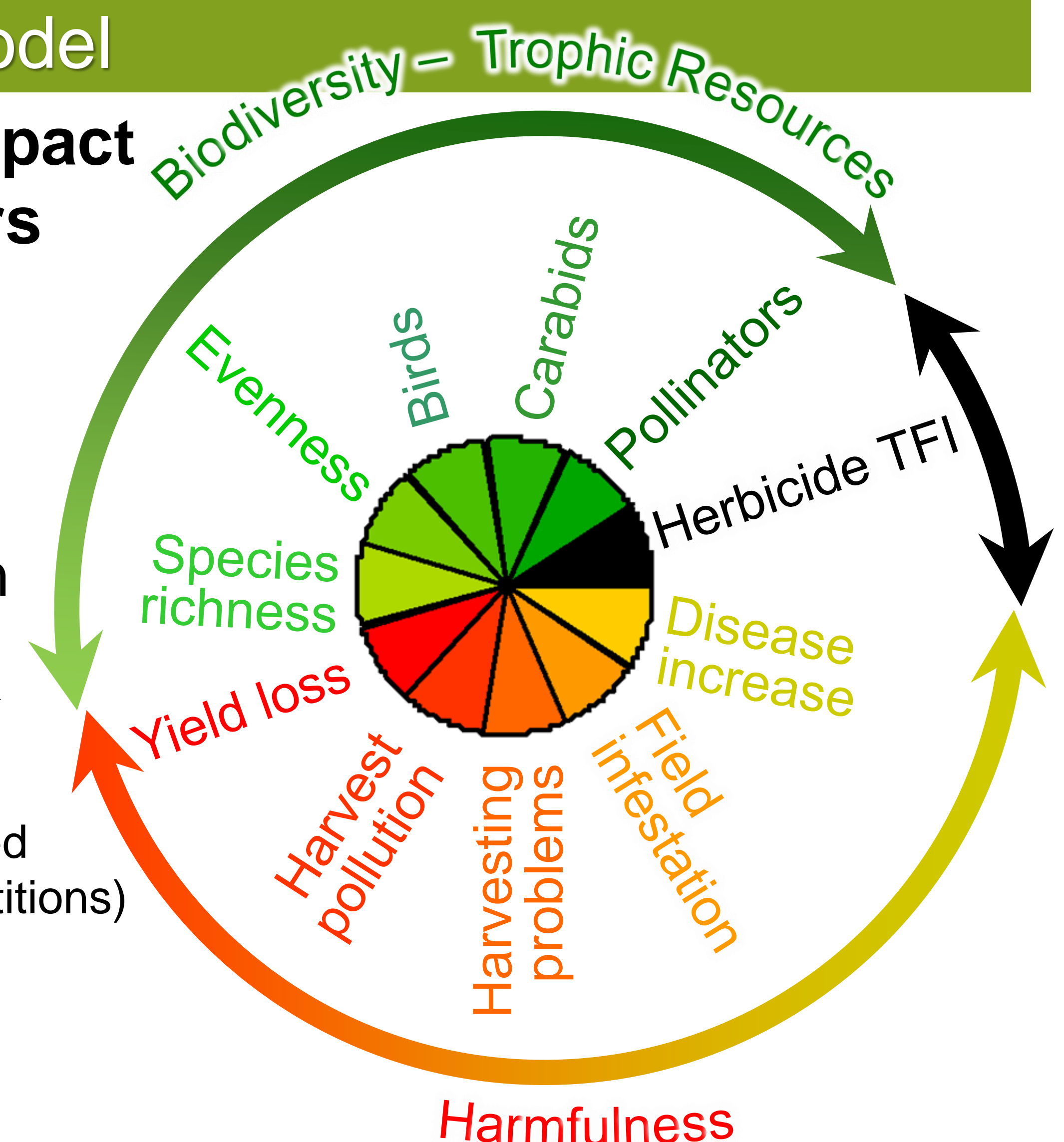
Field cluster
(4 fields)



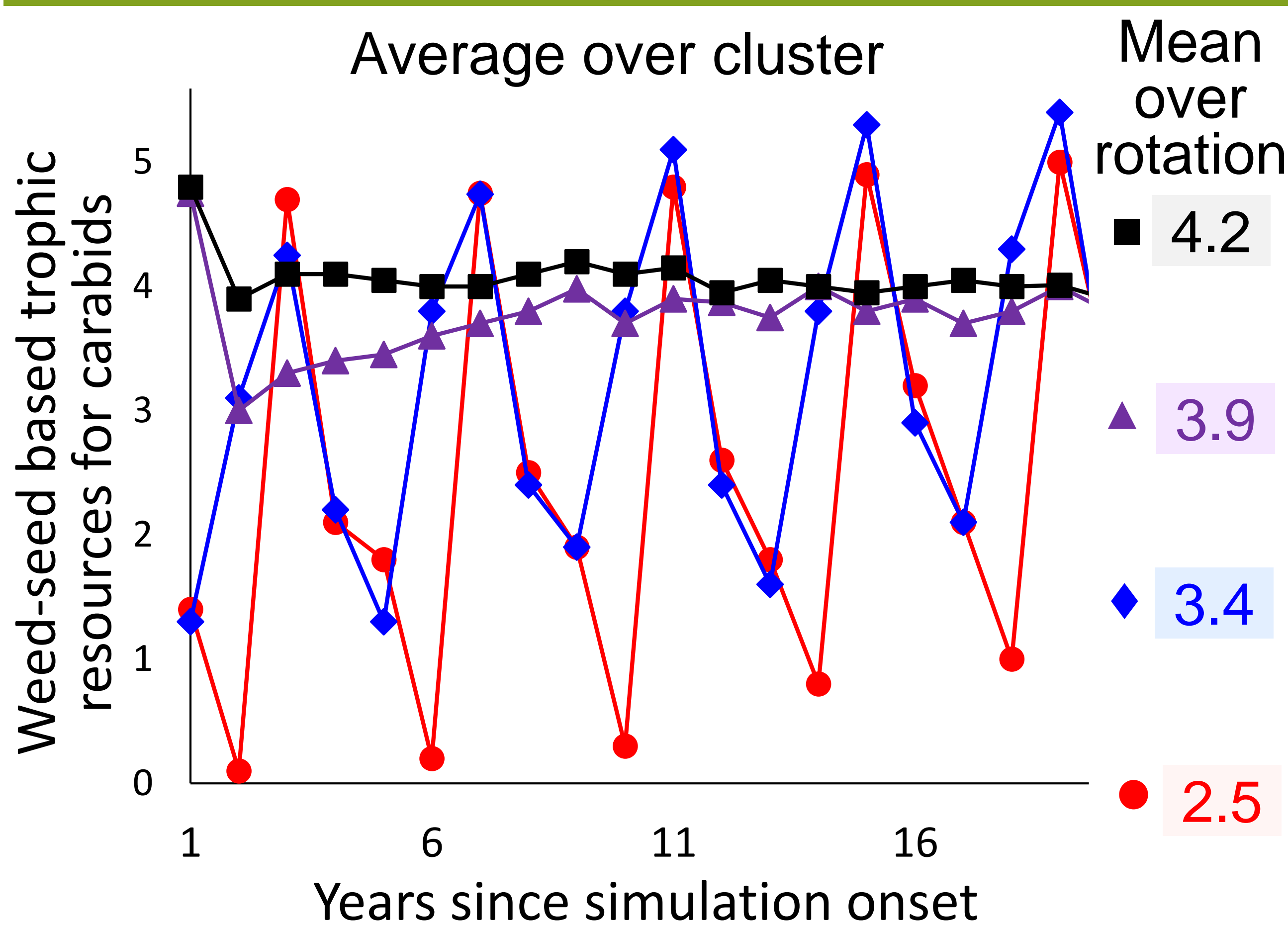
Weed-impact indicators

Simulation

(28 years, 10 randomized weather repetitions)



Result 1 Cropping system pattern can increase and smooth weed impact over time



Four 3-ha fields grown with Soya/Maize/Wheat/Maize

Year N	Year N+1	Year N+2	Year N+3	...
Soya Maize	Maize Wheat	Wheat Maize	Maize Wheat	All crops per year (separate maize)
Soya Wheat	Maize Maize	Wheat Soya	Maize Soya	All crops per year (adjacent maize)
Soya Maize	Maize Soya	Wheat Maize	Maize Soya	2 crops per year
Soya Soya	Maize Maize	Wheat Wheat	Maize Maize	1 crop per year

Result 2 Landsparing was best to reconcile crop production and biodiversity

Means over cluster and rotation	Weed-related biodiversity				Crop production (MJ/ha)	Weed harmfulness			
	Species richness	Bird food	Carabid food	Bee food		Yield loss	Harvest pollution	Harvesting problem	Field infestation
A. Landsharing: annual crop pattern in region grown with soybean/maize/wheat/maize									
One crop/year	11.2g	3.6h	2.5i	0.7f	68344d	23e	1.2f	1.6g	1.1f
Two crops/year	12.0e	4.2g	3.4h	0.9e	60184e	34c	1.6e	1.9f	1.6d
All (adjacent maize)	12.9dc	4.1g	3.9g	1.1d	55511f	40b	1.9dc	2.3de	2.0b
All (separate maize)	12.9d	4.3f	4.2e	1.1d	51920g	44a	2.0c	2.4c	2.2a
B. Landsparing: % fields with high-production vs. high-biodiversity strategies in region									
0% - 100%	15.7a	9.6a	8.7a	2.8a	59257e	41b	2.8a	3.2a	1.8c
25% - 75%	14.9b	8.9b	7.5b	2.2b	70045d	30d	2.4b	2.8b	1.4e
50% - 50%	13.7c	8.0c	6.1c	1.6c	80603c	20f	1.9d	2.2e	0.9g
75% - 25%	11.7f	7.1d	4.4d	0.9e	90257b	10g	1.2f	1.4h	0.4h
100% - 0%	8.4h	5.4e	0.6j	0.2g	100452a	0h	0.0g	0.0i	0.0i

Perspective Conclusions
cannot be extrapolated.
New simulations are needed for each case.

