

**pollinator declines
is an environmental management challenge case
globally**



@cjlortie

environmental management challenge case

REPORT

Plant-Pollinator Interactions over 120 Years: Loss of Species, Co-Occurrence, and Function

Laura A. Burkle^{1,2,*}, John C. Marlin³, Tiffany M. Knight¹

¹Washington University, Department of Biology, St. Louis, MO 63130, USA.

²Montana State University, Department of Ecology, Bozeman, MT 59717, USA.

³University of Illinois, Illinois Sustainable Technology Center, Champaign, IL 61820, USA.

✉*Corresponding author. E-mail: laura.burkle@montana.edu

- Hide authors and affiliations

Science 29 Mar 2013:
Vol. 339, Issue 6127, pp. 1611-1615
DOI: 10.1126/science.1232728

novelty

network thinking

historical data reuse

reproducible science

embraced variation in natural systems

explored many explanations

challenge



90% of flowering plant species rely on animals

food from plants pretty useful



secondary and indirect support from flowering plants critical

methods

repeated sampling completed in the late 1880s

26 spring-blooming plants and 109 pollinating bees

collected pollen grains on *C. virginica*
[important floral resource locally]
[6 visiting bee species]

nearly perfect observational natural experiment

long-term
same methods

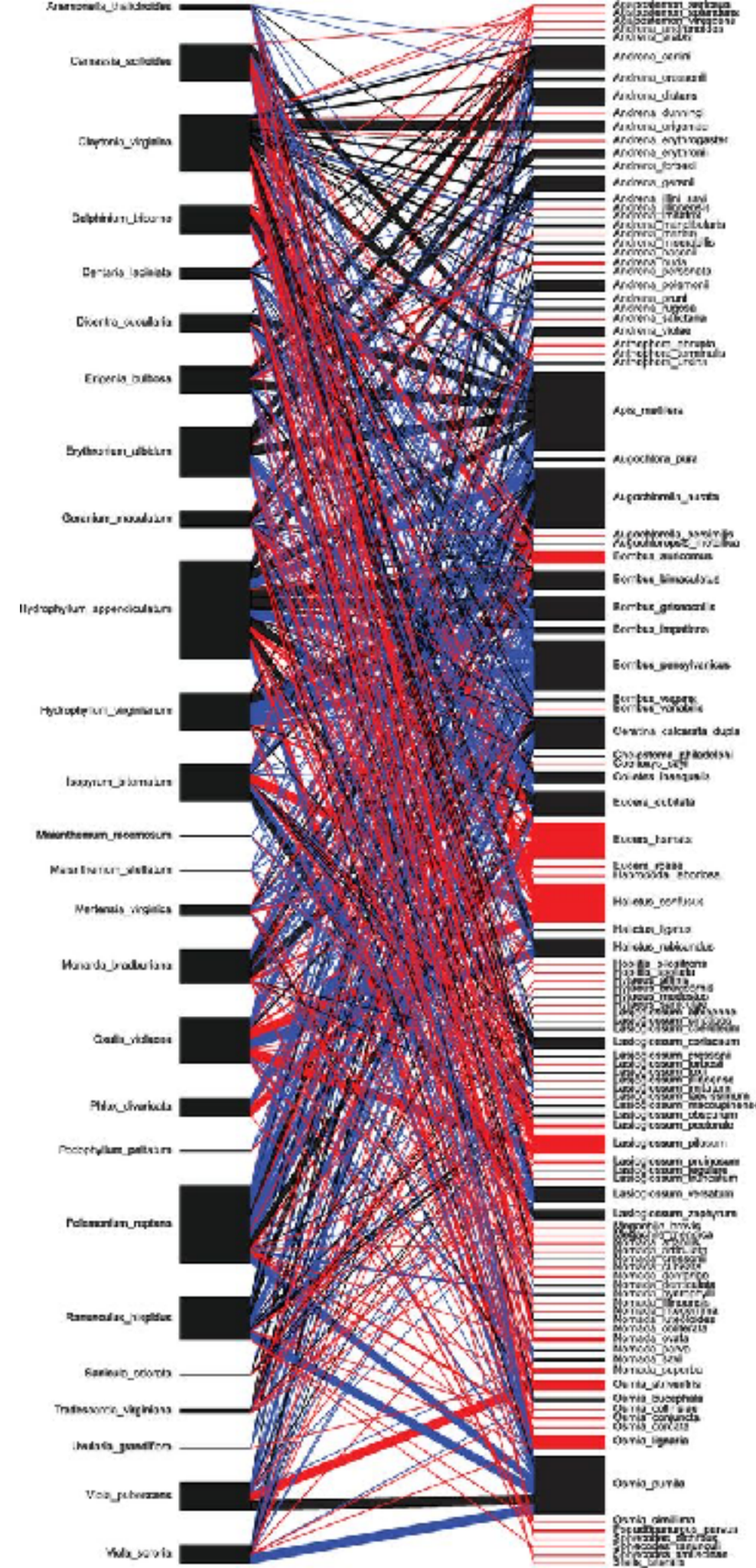
‘natural’ changes included
+2C

land conversion
shift in species

approach also focussed on connections between species
and not just counts

red = extirpation

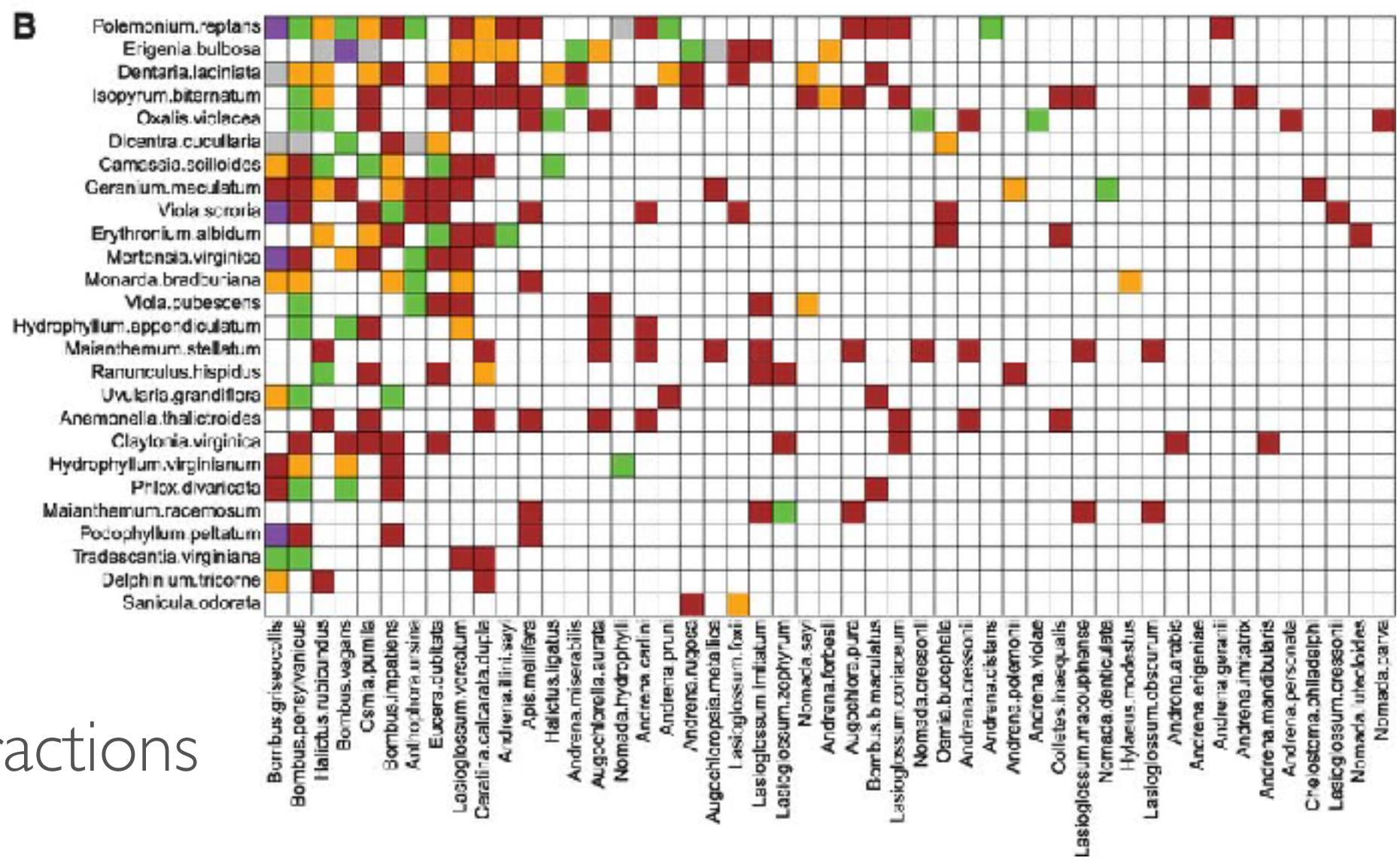
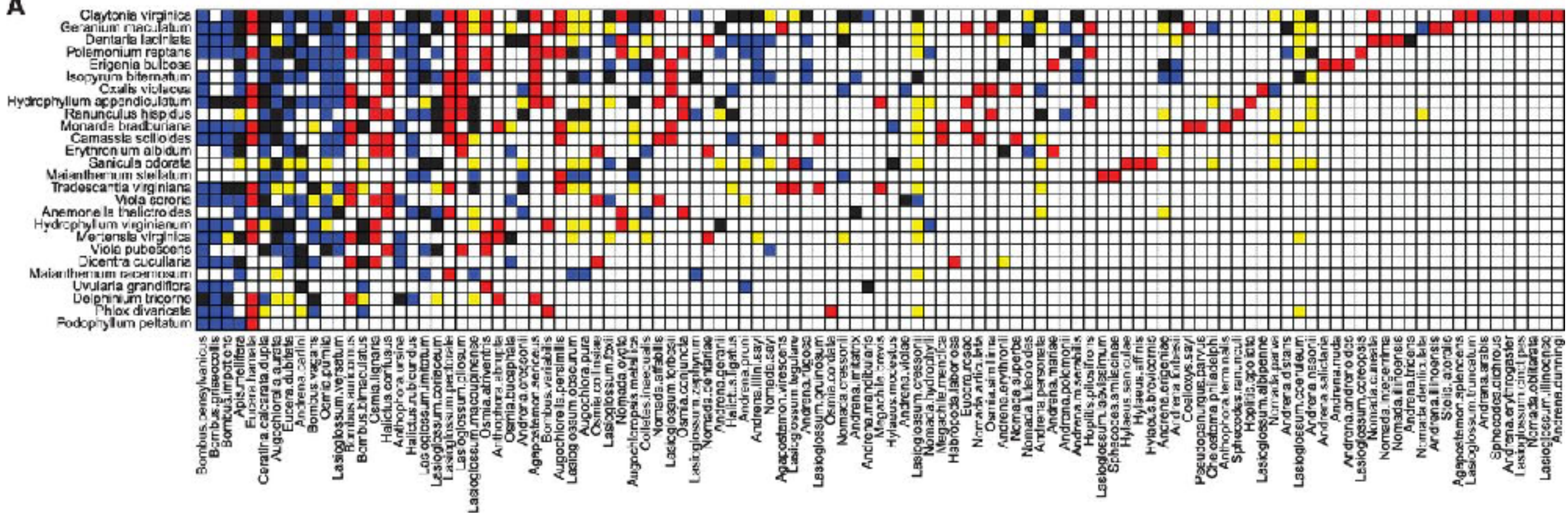
evidence



24% of interactions remain

>50% of bees extirpated

lost specialists, parasites, and cavity nesters



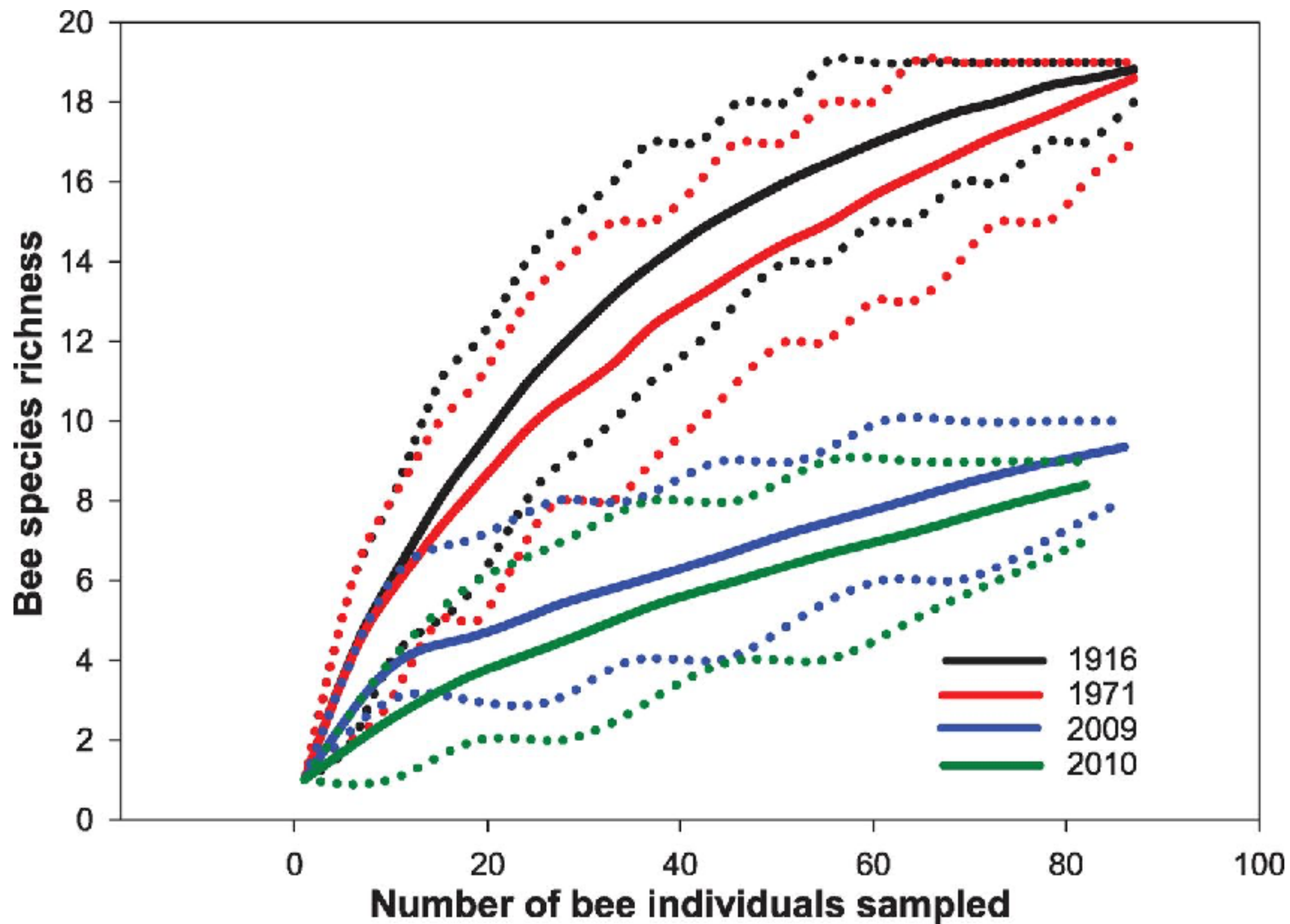
yellow = novel interactions

41% lack of spatial co-occurrence

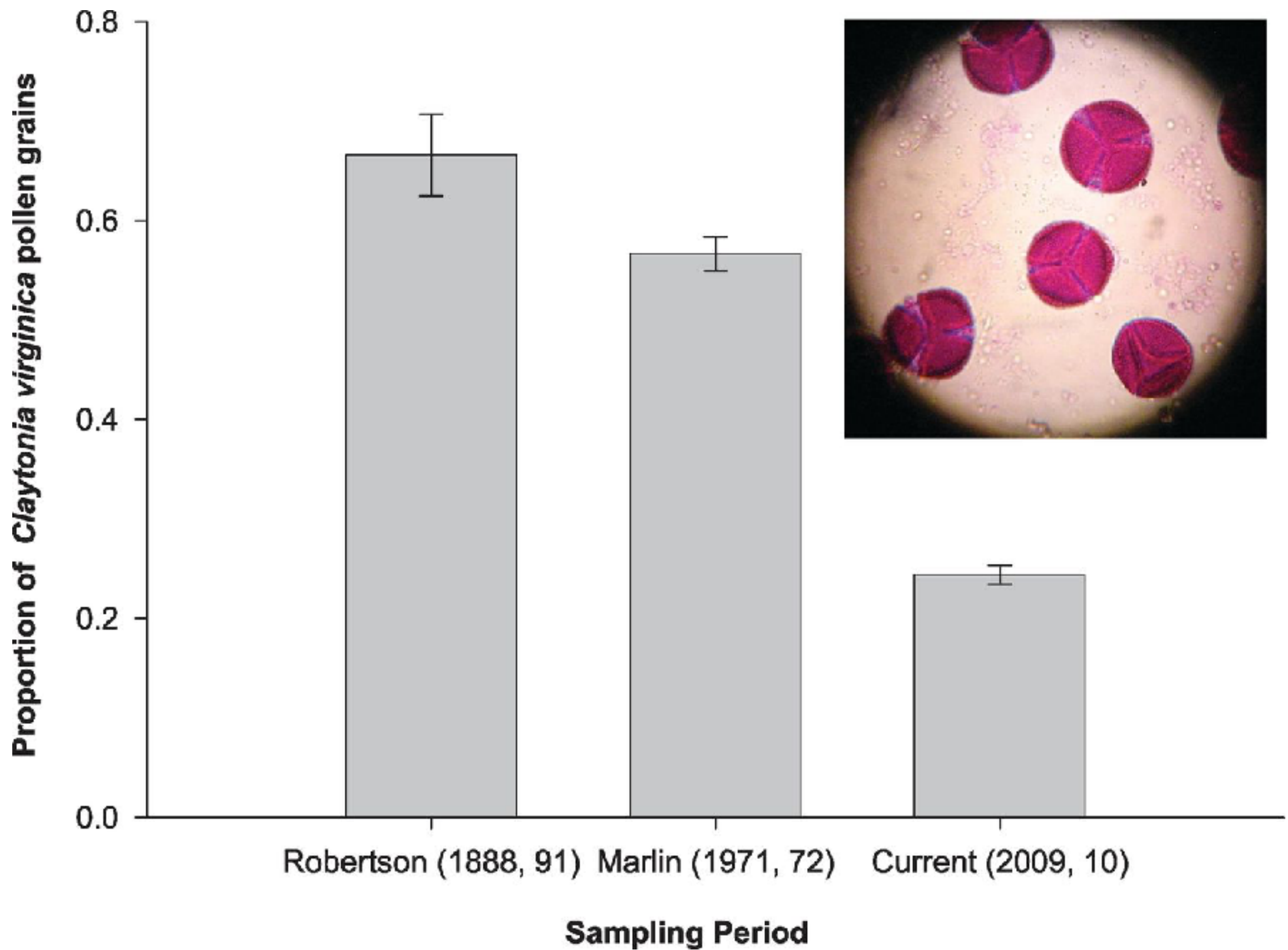
temporal co-occurrence (i.e. phenological mismatches)

or

both



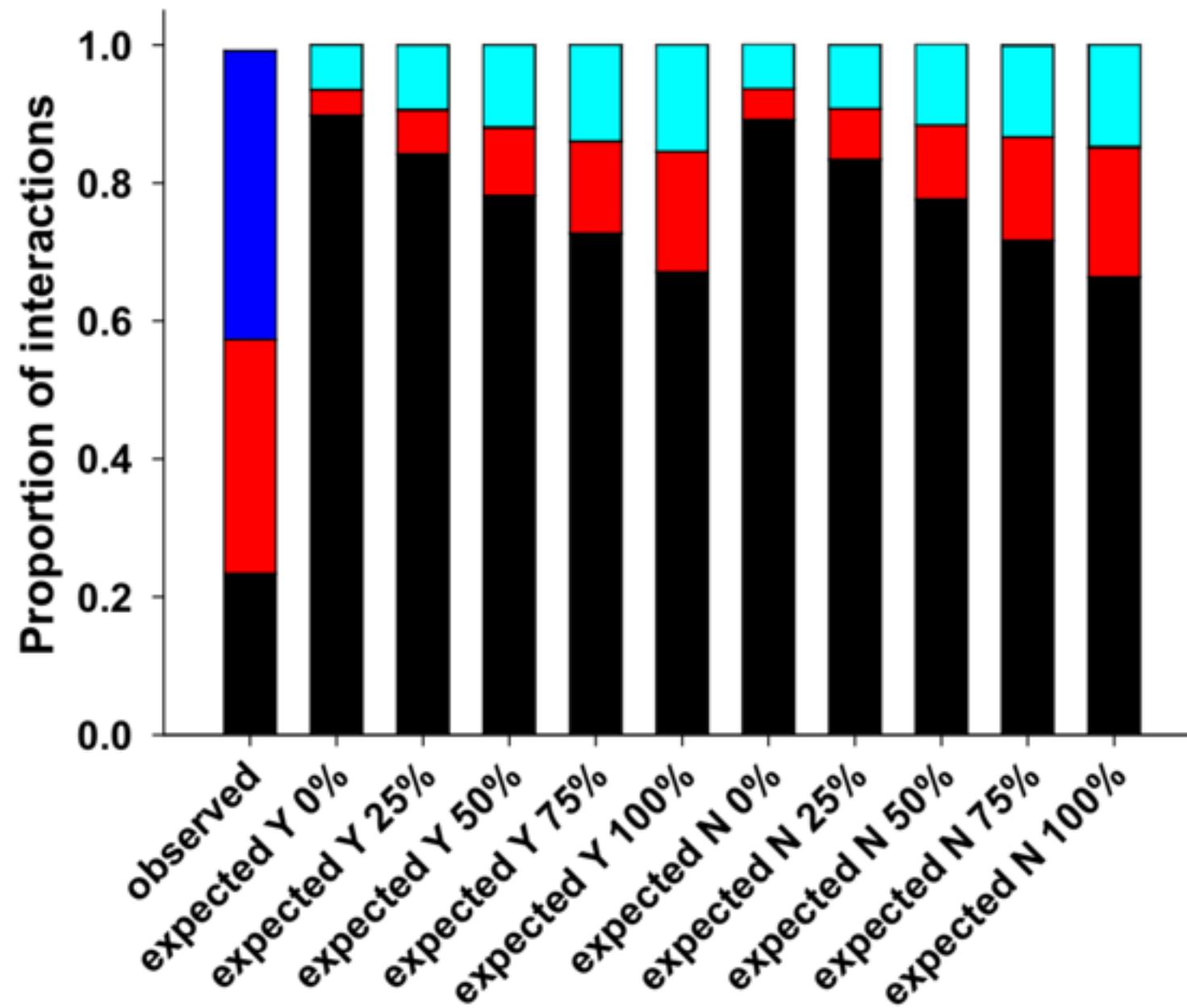
more visits to fewer species of flowers by
fewer remaining species locally



even though more visits, lower efficiency of pollen transfer

this is a critical ecological change

a total of 10 null models tested



bio4enviro connection

biodiversity > interactions > function > change

tools

citizen science

data reuse

null models

many others in this emc2 domain

implications



there is hope because networks can adapt
but numerous other critical ecological dimensions
changed including timing, redundancy, diversity,
and non-random loss from the region