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Effects of biocontrol on sustainability

Valter Ceppi

New Business Development

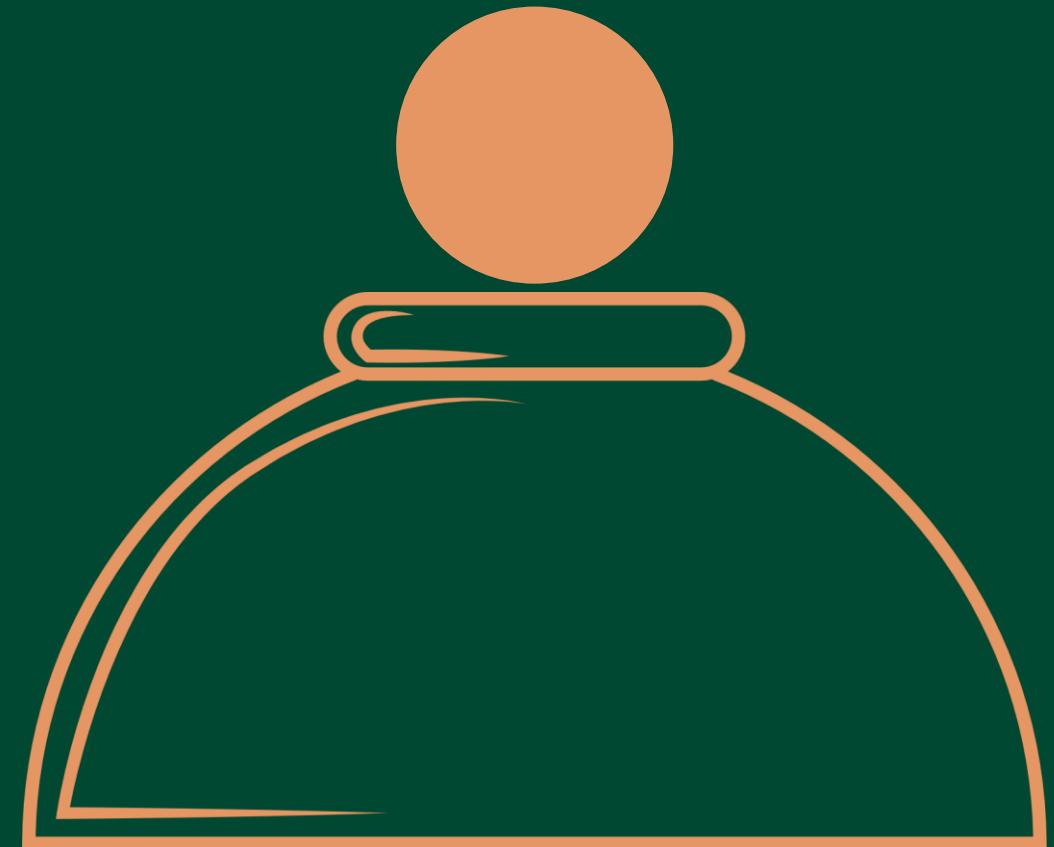
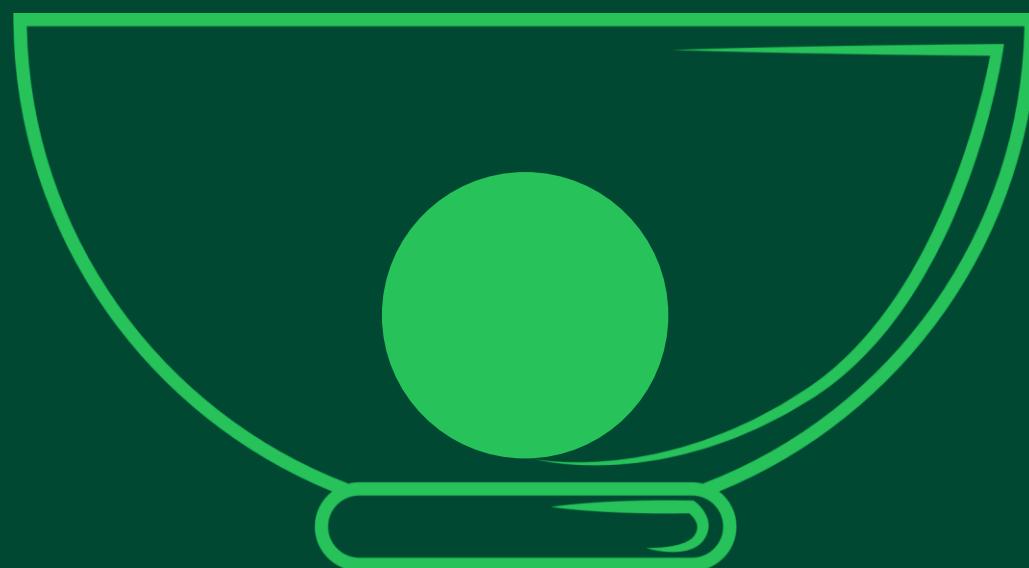
Koppert Spain



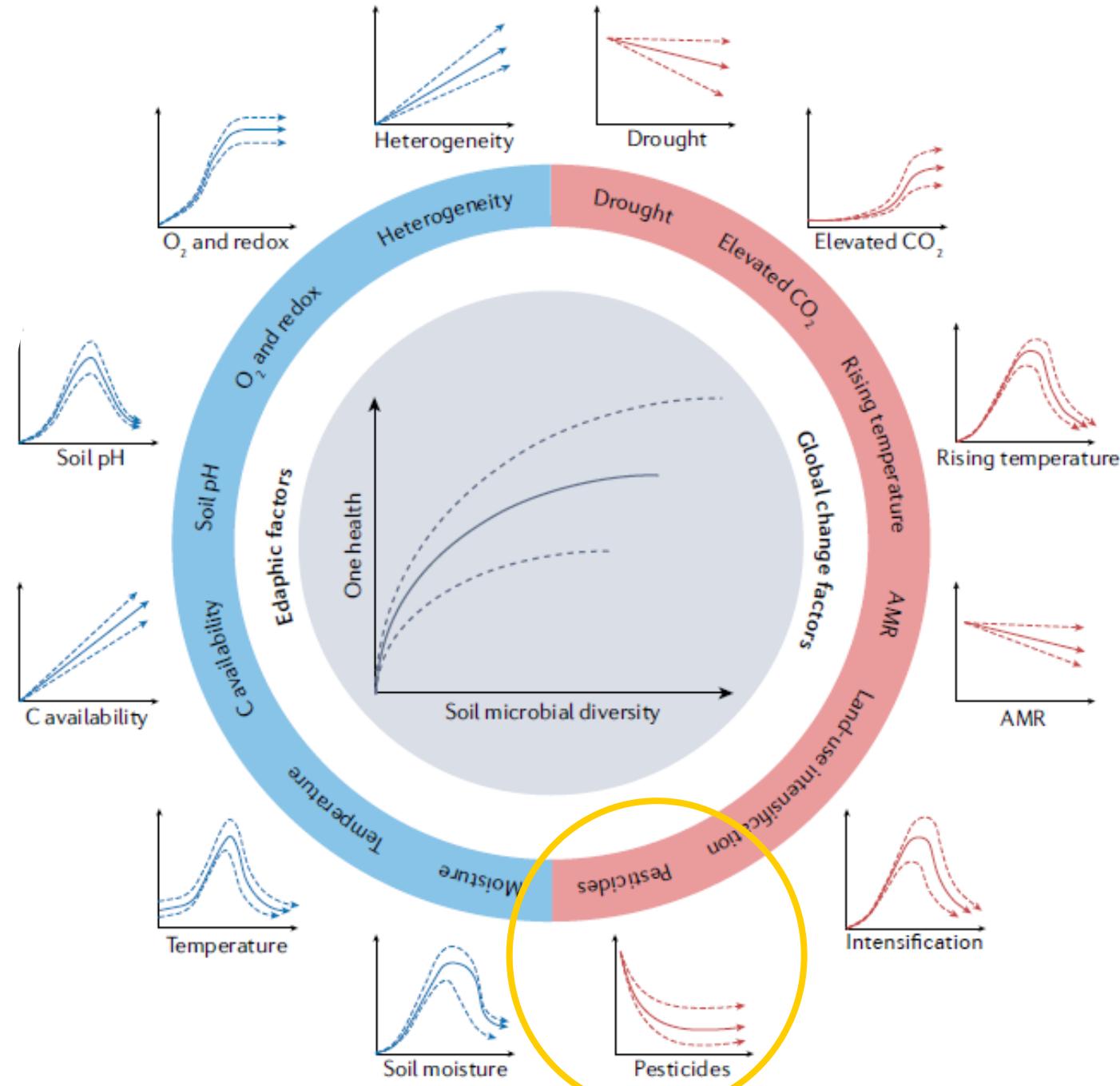


Our vision

**The world needs
100% sustainable agriculture**



Reducing chemicals increases biodiversity



- *Soil microbiomes and one health*
- *Samiran Banerjee¹ and Marcel G. A. van der Heijden ^{2,3}*

Biodiversity strengthens ecosystem balance

- A global synthesis reveals biodiversity-mediated benefits for crop production

• Matteo Dainese^{1,2*}, Emily A. Martin², Marcelo A. Aizen³, Matthias Albrecht⁴, Ignasi Bartomeus⁵, Riccardo Bömmarco⁶, Luisa G. Carvalheiro^{7,8}, Rebecca Chaplin-Kramer⁹, Vesna Gagic¹⁰, Lucas A. Garibaldi¹¹, Jaboury Ghazoul¹², Heather Grab¹³, Mattias Jonsson⁶, Daniel S. Karp¹⁴, Christina M. Kennedy¹⁵, David Kleijn¹⁶, Claire Kremen¹⁷, Douglas A. Landis¹⁸, Deborah K. Letourneau¹⁹, Lorenzo Marini²⁰, Katja Poveda¹³, Romina Rader²¹, Henrik G. Smith^{22,23}, Teja Tscharntke²⁴, Georg K. S. Andersson²², Isabelle Badenhausen^{25,26}, Svenja Baensch^{24,27}, Antonio Diego M. Bezerra²⁸, Felix J. V. A. Bianchi²⁹, Virginie Boreux^{12,30}, Vincent Bretagnolle³¹, Berta Caballero-Lopez³², Pablo Cavagliasso³³, Aleksandar Cetkovic³⁴, Natacha P. Chacoff³⁵, Alice Classen², Sarah Cusser³⁶, Felipe D. da Silva e Silva^{37,38}, G. Arjen de Groot³⁹, Jan H. Dudenhofer⁴⁰, Johan Ekoos²², Thijss Fijen¹⁶, Pierre Franck⁴¹, Breno M. Freitas²⁸, Michael P. D. Garratt⁴², Claudio Gratton⁴³, Julianá Hipólito^{11,44}, Andrea Holzschuh², Lauren Hunt⁴⁵, Aaron L. Iverson¹³, Shalene Jha⁴⁶, Tamar Keasar⁴⁷, Tania N. Kim⁴⁸, Miriam Kishinevsky⁴⁹, Björn K. Klatt^{23,24}, Alexandra-Maria Klein³⁰, Kristin M. Krewnka⁵⁰, Smitha Krishnan^{12,51,52}, Ashley E. Larsen⁵³, Claire Lavigne⁴¹, Heidi Liere⁵⁴, Bea Maas⁵⁵, Rachel E. Mallinger⁵⁶, Eliana Martinez Pachon⁵⁷, Alejandra Martinez-Salinas⁵⁸, Timothy D. Meehan⁵⁹, Matthew G. E. Mitchell⁶⁰, Gonzalo A. R. Molina⁶¹, Malke Nesper¹², Lovisa Nilsson²², Megan E. O'Rourke⁶², Marcell K. Peters², Milan Plecaš³⁴, Simon G. Potts⁴³, Davi de L. Ramos⁶³, Jay A. Rosenheim⁶⁴, Mai Rundlöf²³, Adrien Rusch⁶⁵, Agustín Sáez⁶⁶, Jeroen Schepers^{16,39}, Matthias Schleuning⁶⁷, Julia M. Schmack⁶⁸, Amber R. Sciligo⁶⁹, Colleen Seymour⁷⁰, Dara A. Stanley⁷¹, Rebecca Stewart²², Jane C. Stout⁷², Louis Sutér⁴, Mayura B. Takada⁷³, Hisatomo Takei⁷⁴, Giovanni Tamburini³⁰, Matthias Tschumi⁴, Blandina F. Viana⁷⁵, Catrin Westphal²⁷, Bryony K. Willcox²¹, Stephen D. Wratten⁷⁶, Akira Yoshioka⁷⁷, Carlos Zaragoza-Trello⁵, Wei Zhang⁷⁸, Yi Zou⁷⁹, Ingolf Steffan-Dewenter²

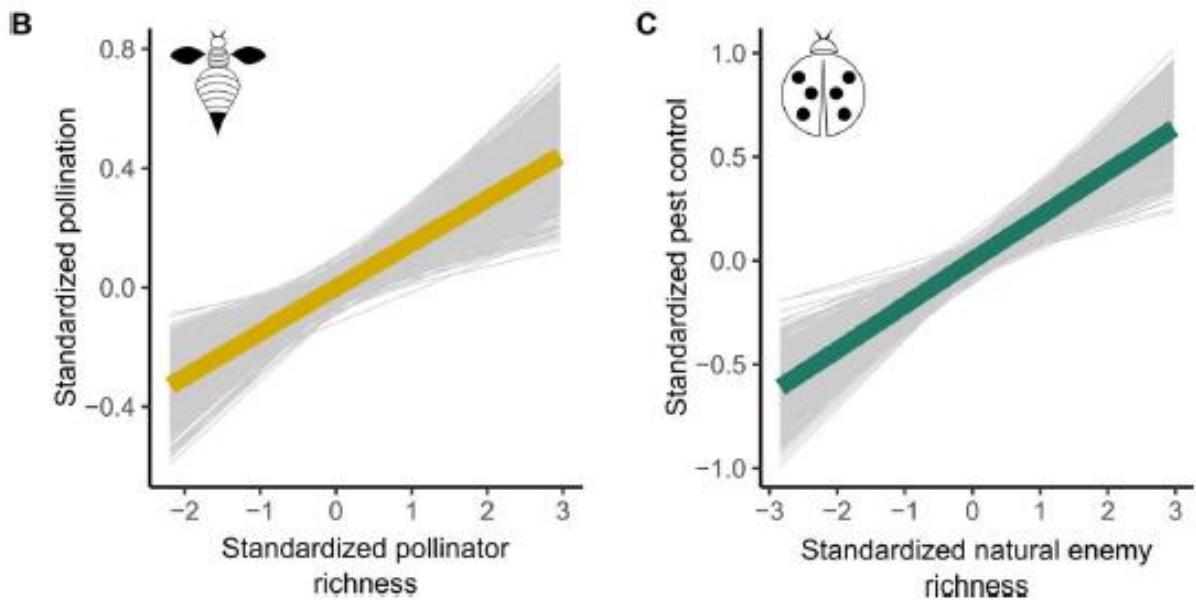
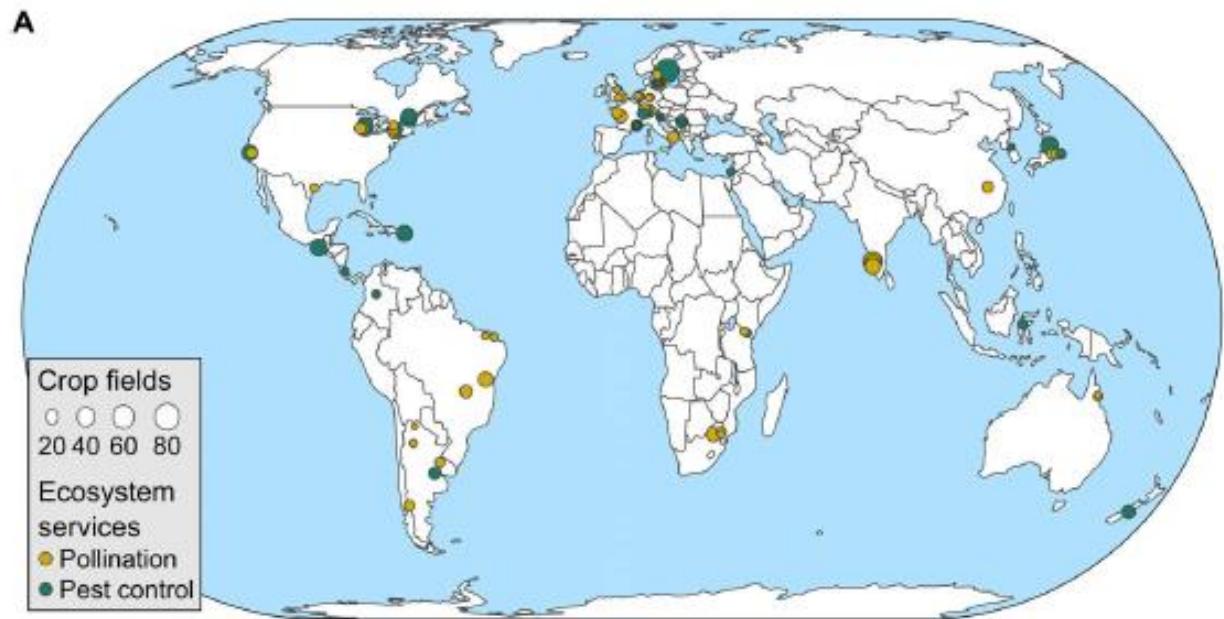


Fig. 1. Distribution of analyzed studies and effects of richness on ecosystem services provisioning. (A) Map showing the size (number of crop fields sampled) and location of the 89 studies (further details of studies are given in table S1). (B) Global effect of pollinator richness on pollination ($n = 821$ fields of 52 studies). (C) Global effect of natural enemy richness on pest control ($n = 654$ fields of 37 studies). The thick line in each plot represents the median of the posterior distribution of the model. Light gray lines represent 1000 random draws from the posterior. The lines are included to depict uncertainty of the modeled relationship.

Biodiversity increases production

- A global synthesis reveals biodiversity-mediated benefits for crop production
- Matteo Dainese^{1,2*}, et al.

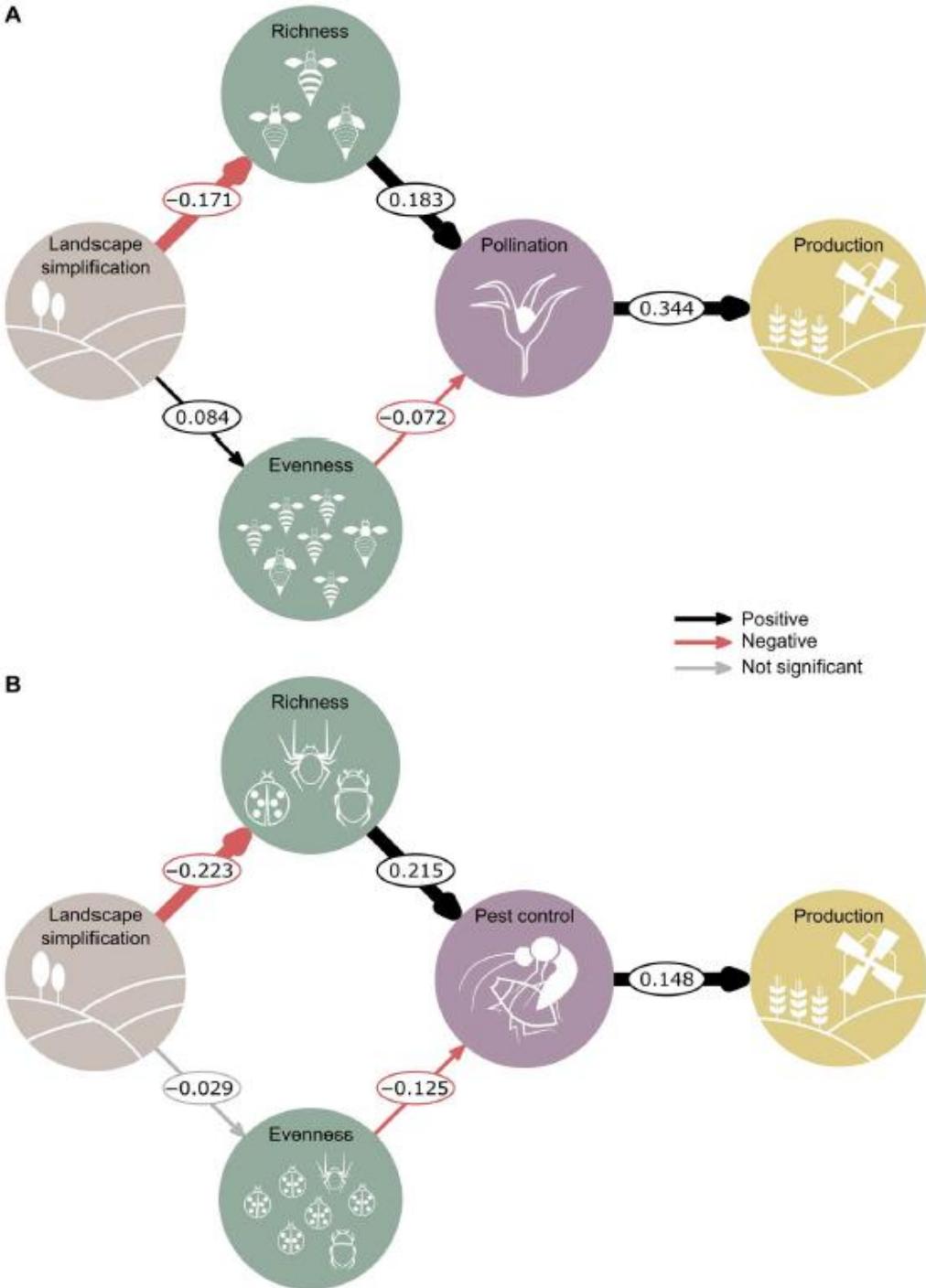
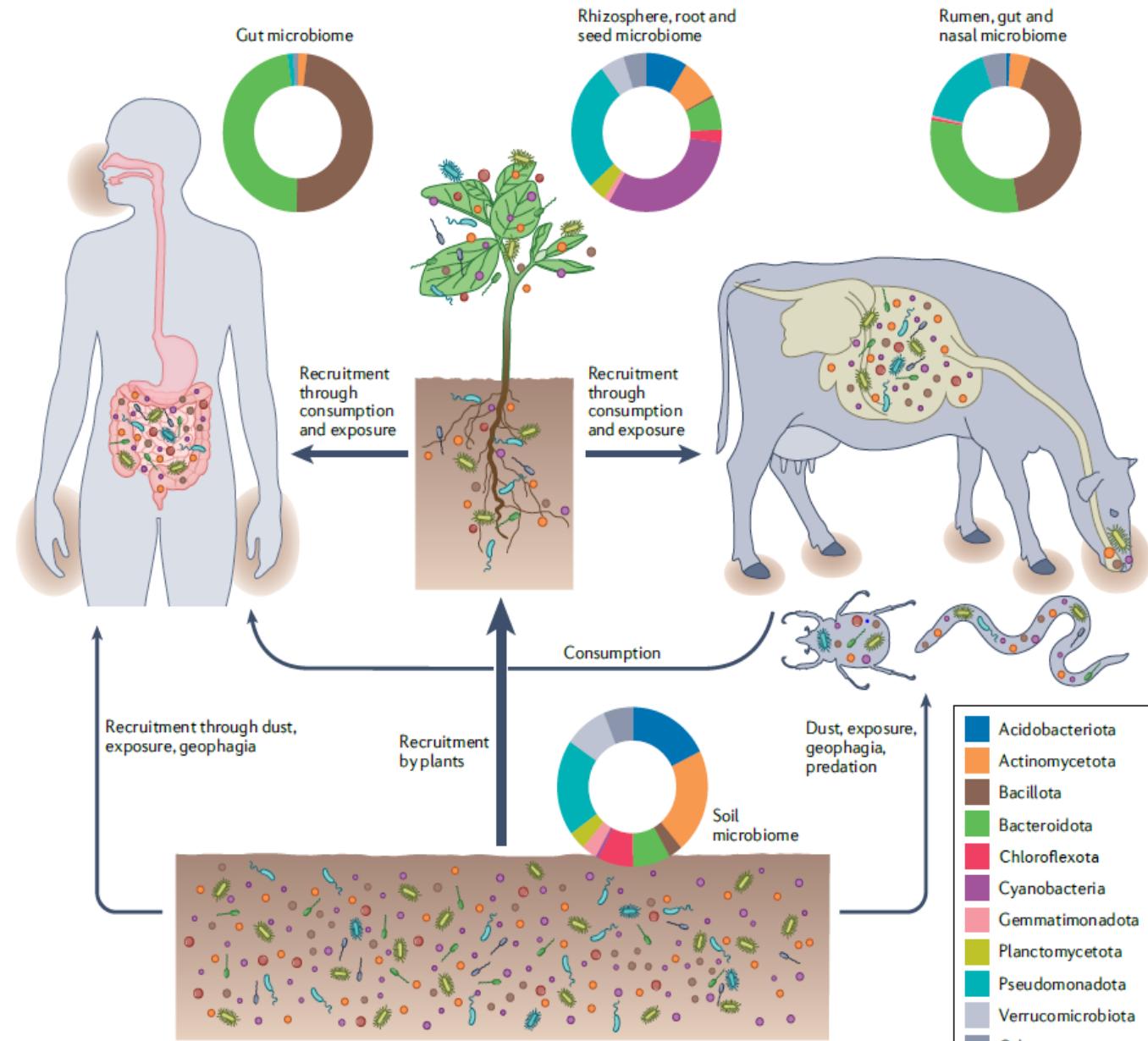
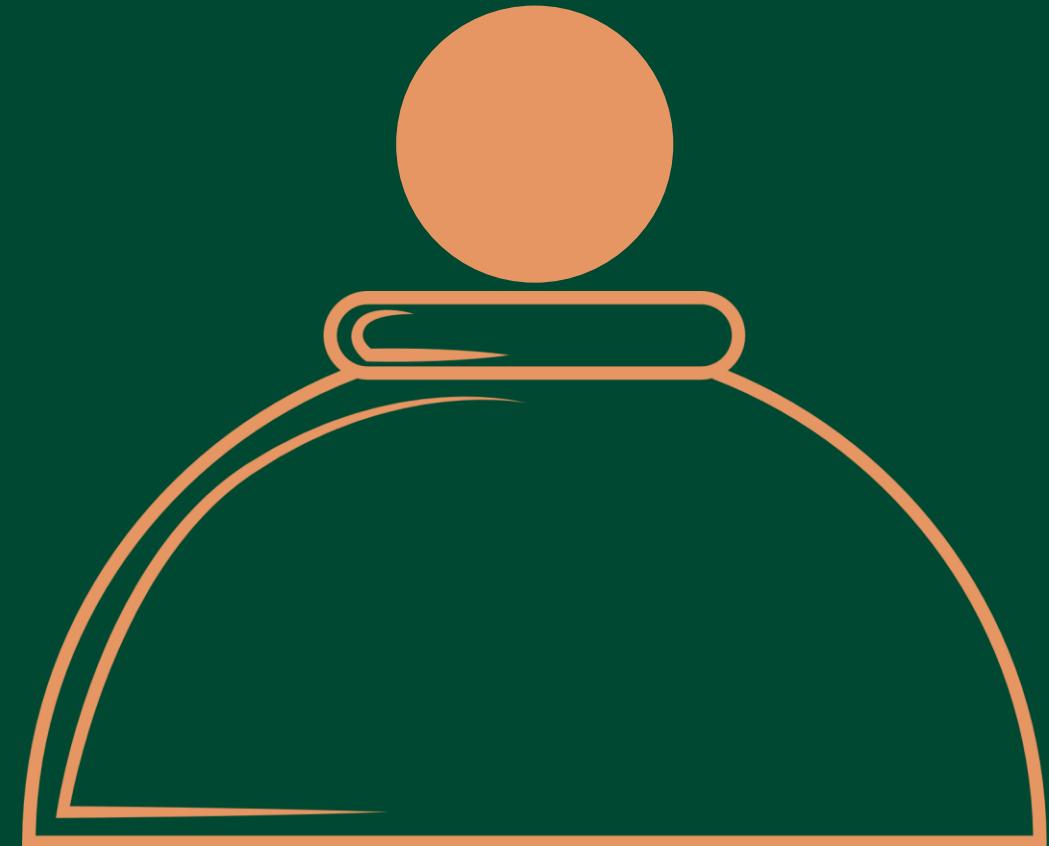
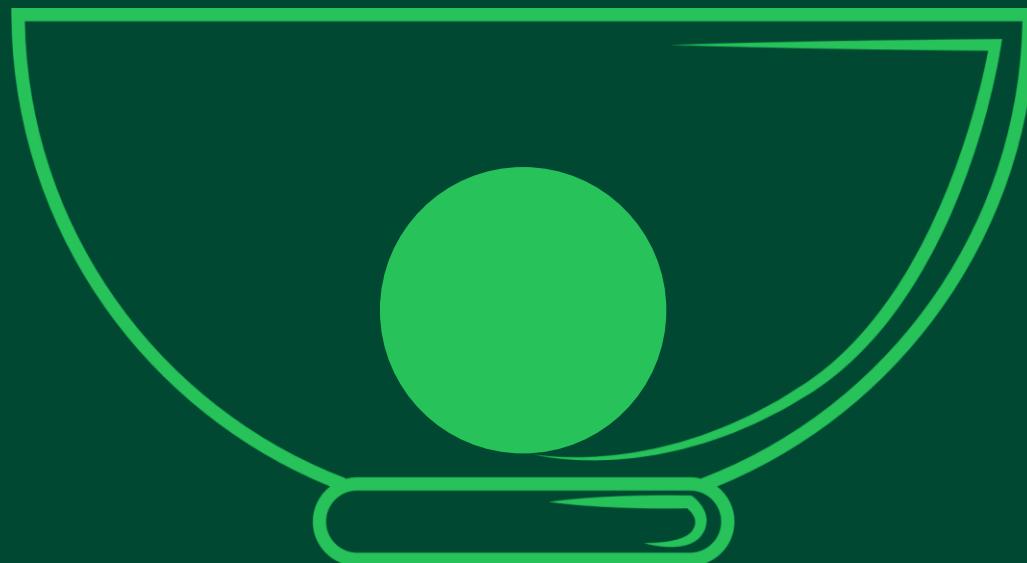


Fig. 4. Direct and cascading effects of landscape simplification on final crop production via changes in richness, evenness, and ecosystem services. (A) Path model representing direct and indirect effects of landscape simplification on final crop production through changes in pollinator richness, evenness, and pollination ($n = 438$ fields of 27 studies). (B) Path model representing direct and indirect effects of landscape simplification on final crop production through changes in natural enemy richness, evenness, and pest control [only in pesticide-free areas were considered in the model ($n = 185$ fields of 14 studies)]. Path coefficients are effect sizes estimated from the median of the posterior distribution of the model. Black and red arrows represent positive and negative effects, respectively. Arrow widths are proportional to HDIs. Gray arrows represent nonsignificant effects (HDIs overlapped zero).



Soil biodiversity and human health

- *A global synthesis reveals biodiversity-mediated benefits for crop production*
- *Matteo Dainese^{1,2*}, et al.*





**And you...how do you
partner with nature?**

**Come meet us!
Pabellon 9
Stand 9 E24**



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