Eric Lee-Mäder

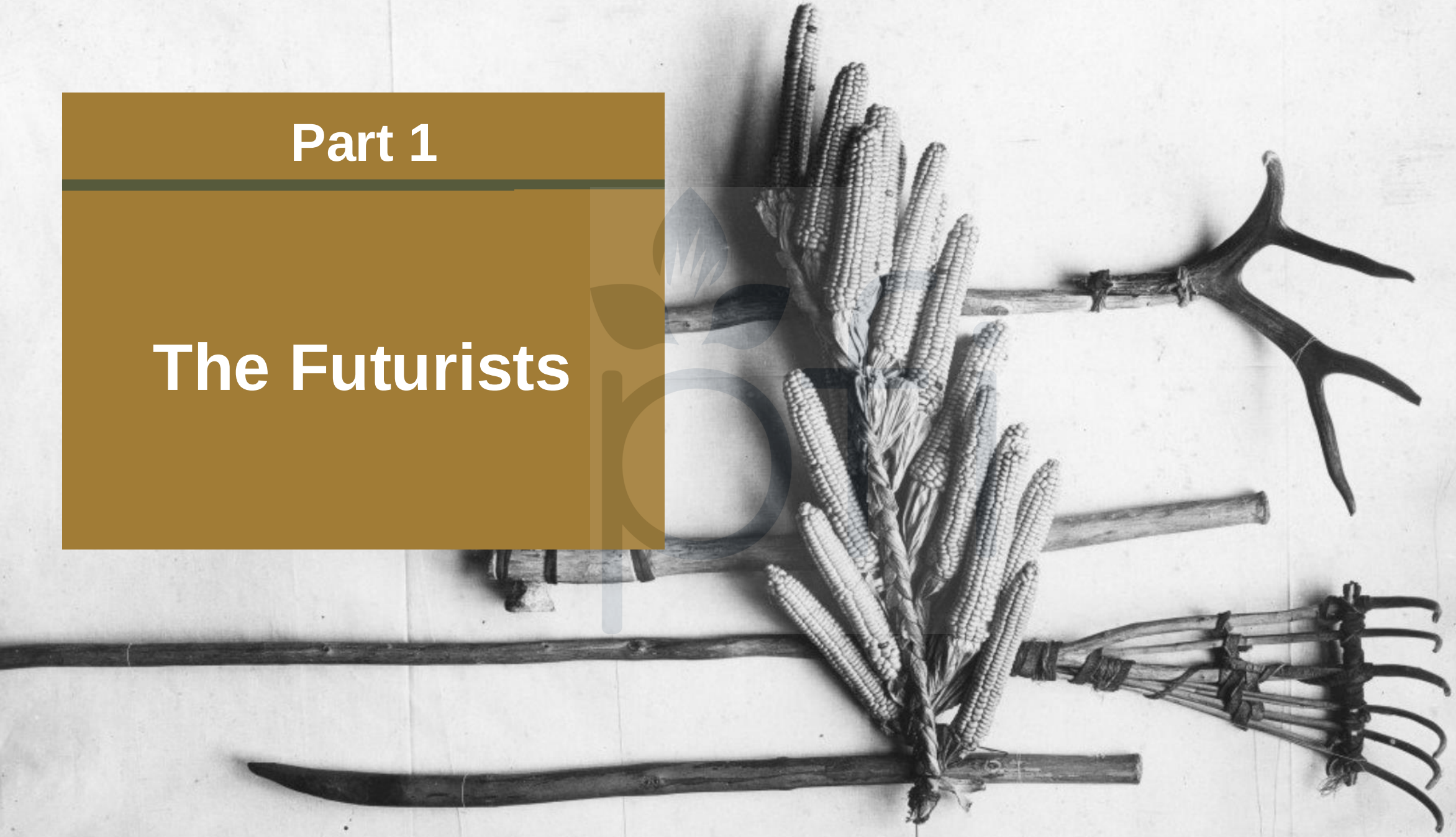
Farmers of Forty Centuries

Reconciling Nature and Agriculture

Prairie Roots

Part 1

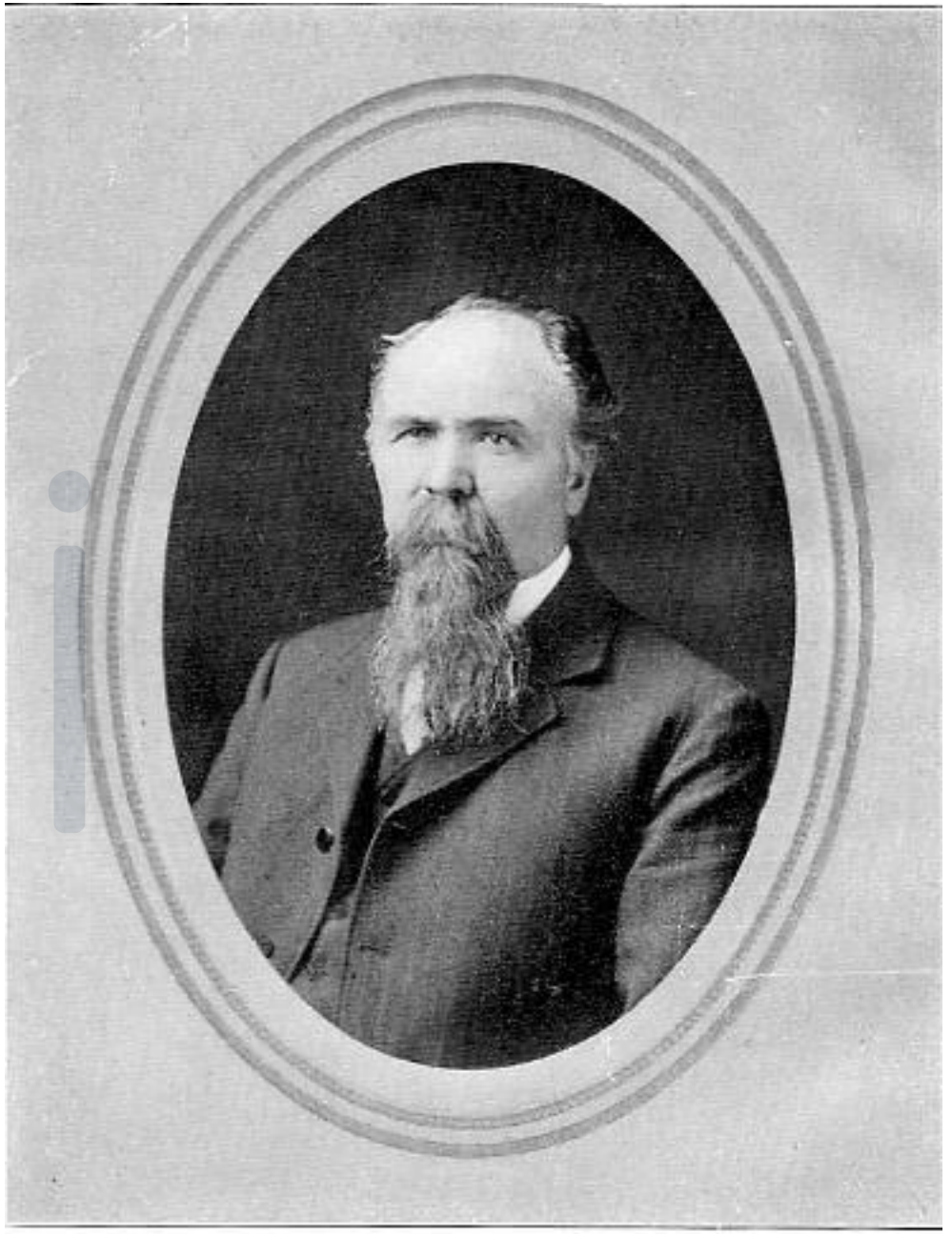
The Futurists



Franklin Hiram King (1848-1911)

Farmers of Forty Centuries - explorations into the permanence of agriculture (published 1911)

- *The Economic Importance of Wisconsin Birds*, published 1882
- Architect of the cylinder silo
- USDA Chief of the Division of Soil Management



F. H. KING

1,000+ Years of Corn Production in Midwest Prairies

Hidatsa Woman, *Waheenee* *Buffalo Bird Woman's Garden* published, 1917

- The corn varieties of Hidatsa women are the foundation of modern field corn varieties*
- Contemporary farming practices are still new, and untested on any significant timescale

*Will, George F. and George E. Hyde. Corn Among the Indians of the Upper Missouri. University of Nebraska Press, 1964

Part 2

The Empire of Grass

- Photo: Mari Lee-Mader

Where We Come From

The Great Agrarian Project

The Empire of Grass

50% of Earth’s Habitable Land is Used for Agriculture

A Landscape Dominated Only a Dozen Species

Monarch Butterflies Decline by 90% Since 1990s

25% of Bumble Bee Species At-Risk of Extinction

Photos: John Anderson, Johanna James-Heinz

Evans, E.,R. Thorp, S. Jepsen, and S. Hoffman Black, 2009. Status Review of Three Formerly Common Species of Bumble Bee in the Subgenus *Bombus*. Xerces Society.

Cameron et al. 2011. Patterns of widespread decline in North American bumble bees. PNAS

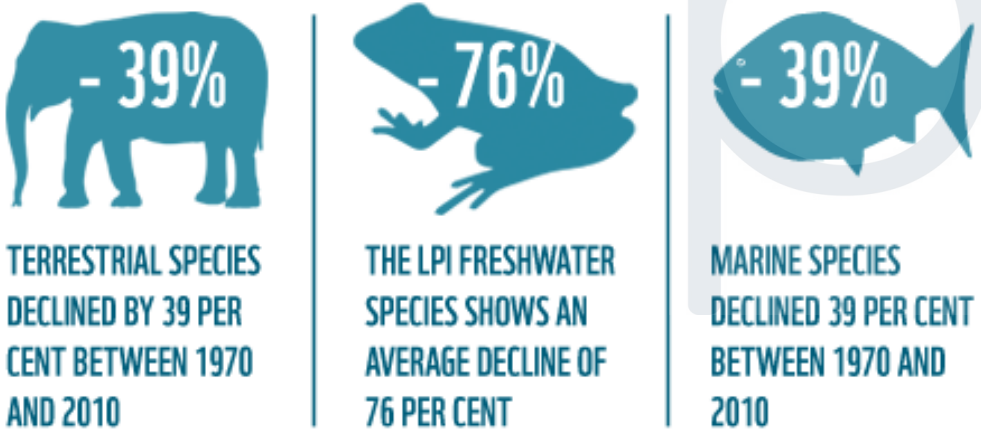
Global Disappearance of Insects

Between 1986 and 2016, insect biomass declined by 76% in German nature reserves

Hallmann, et al. 2017. More than 75 percent decline over 27 years in total flying insect biomass in protected areas. PLoSOne.https://doi.org/10.1371/journal.pone.0185809.

Living Planet Index - Meta Analysis

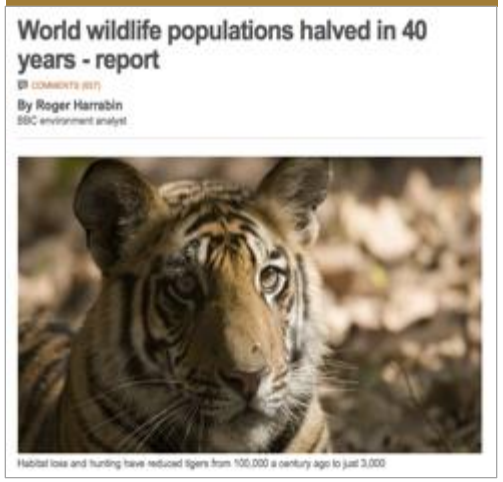
Earth Has ~60% of its Wildlife in the Past 40 Years



Photos: WWF, BBC, Gory Sowie

Ecosystems are degrading at a rate unprecedented in human history

Largest global analysis of thousands of animal species (birds, mammals, fish, reptiles, etc.)


World wildlife populations halved in 40 years - report

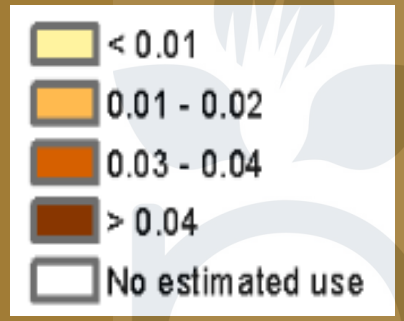
By Roger Harrabin
BBC environment analyst

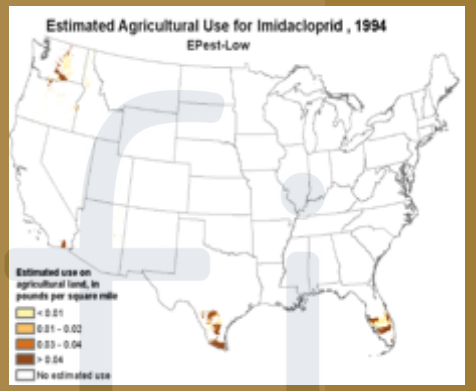
Habitat loss and hunting have reduced tigers from 100,000 a century ago to just 3,000

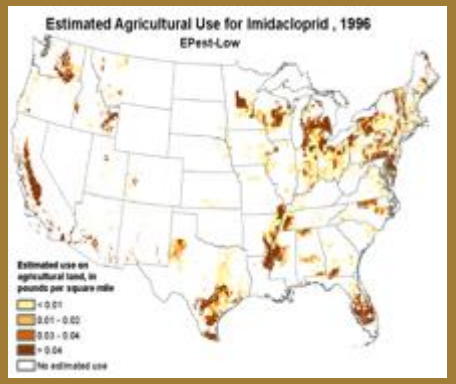
The Rise of Long-Lived Insecticides

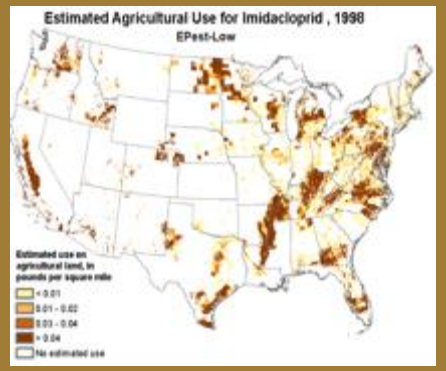
Neonicotinoid Insecticide Use 1994 to 2013

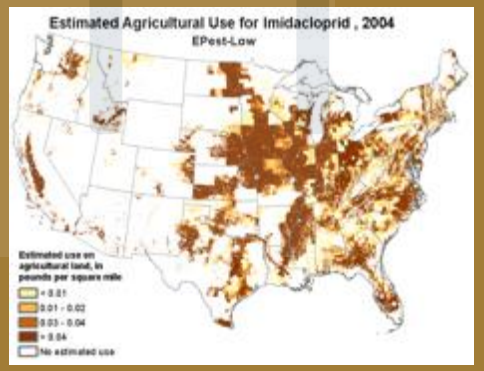
Estimated use on agricultural land in pounds per square mile over 10 years







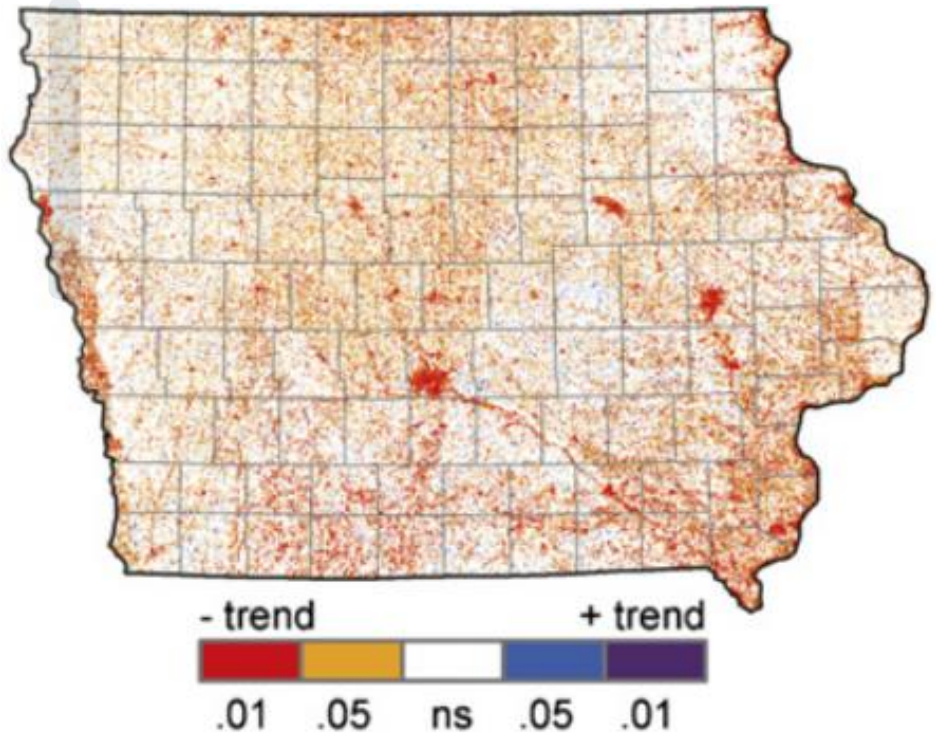




- U.S. Geological Survey

Unrelenting Landscape Change

- 376,000 acres of Iowa prairie converted to corn/soy between 2006-2011
- >5000 acres of grassland lost every day in North America
- Millions of acres of grassland & prairie converted to cropland since 2001



Toward a Future Without Nature

Only 3-5% of American landscape is undisturbed habitat for plants and animals

Source: Rosenzweig 2003.

Farm Scale Isn’t A Nature-Killer

Research mostly doesn’t show us a strong relationship between farm size and factors like increased pesticide use.

Fernandez-Cornejo et al. 2014. Pesticide Use in U.S. Agriculture: 21 Selected Crops, 1960-2008. USDA Economic Information Bulletin Number 124.

Larsen et al. 2021. Identifying and characterizing pesticide use on 9,000 fields of organic agriculture. Nature Communications. 12: 5461.

Rosenheim et al. 2022. Increasing crop field size does not consistently exacerbate insect pest problems. PNAS. Vol. 119. No. 37.

Landscape Diversity Is The Leading Factor For Nature

Simplistic Farms = More pesticides and less nature

Zhang et al. 2024. Pesticide use is affected more by crop species than by crop diversity at the cropping system level. European Journal of Agronomy. Vol. 159.

Guinet et al. 2023. Fostering temporal crop diversification to reduce pesticide use. Nature Communications. 14: 7416.

Aizen et al. 2019. Global agricultural productivity is threatened by increasing pollinator dependence without a parallel increase in crop diversification. Global Change Biology. Vol. 25. No. 10.

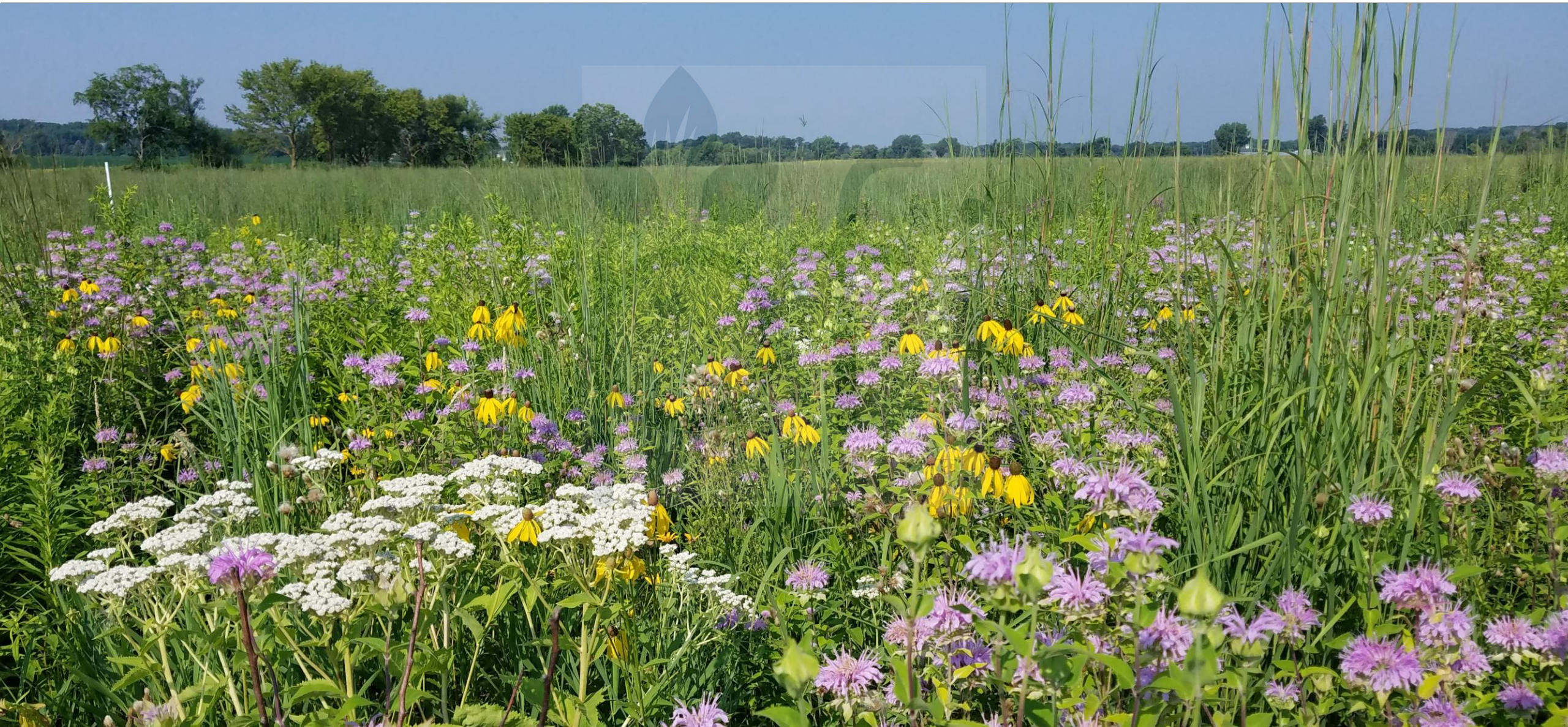
Nicholson, C., and N. Williams. 2021. Cropland heterogeneity drives frequency and intensity of pesticide us. Environmental Research letters. Vol. 16. No. 7

Nandillion et al. 2024. Crop management strategy redesign enables a reduction in reliance on pesticides: A diachronic approach based on diversity of French commercial farms. Agriculture, Ecosystems & Environment. Vol. 366.

Perrot et al.. 2023. Both long-term grasslands and crop diversity are needed to limit pest and weed infestations in agricultural landscapes. PNAS. 120 (49).

Redlich et al. 2018 Landscape-level crop diversity benefits biological pest control. Journal of Applied Ecology. Vol. 55. No. 5.

Do We Have Any Models For Landscape Diversity?

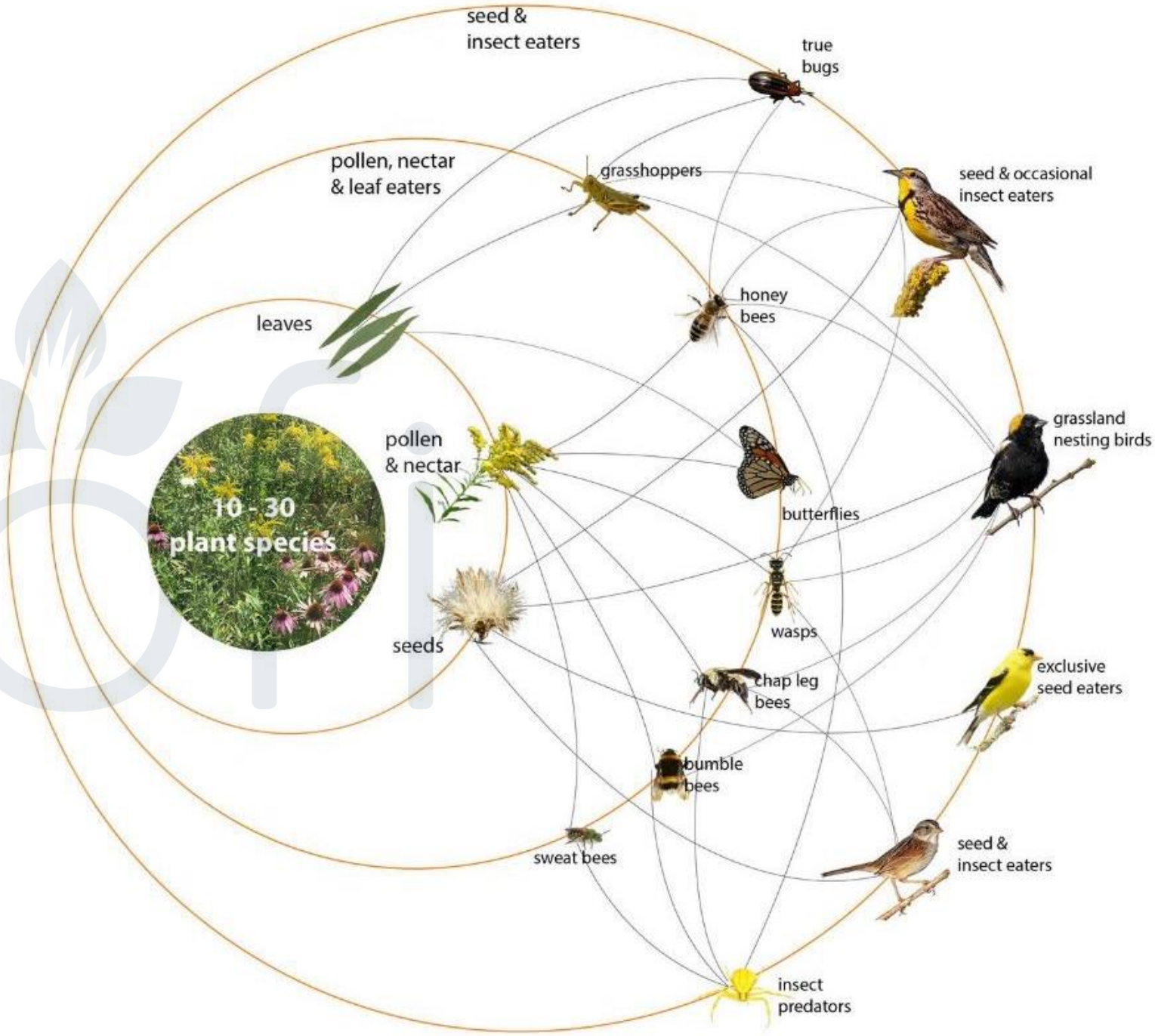


Part 3

Wild Values

Prairie Life

- Just 10 to 30 prairie plant species may support hundreds of wildlife species
- Grasslands hold ~20% of global soil carbon
- Biofiltering and groundwater capture
- Deep soil formation



When Prairie Life Comes Back to the Farm

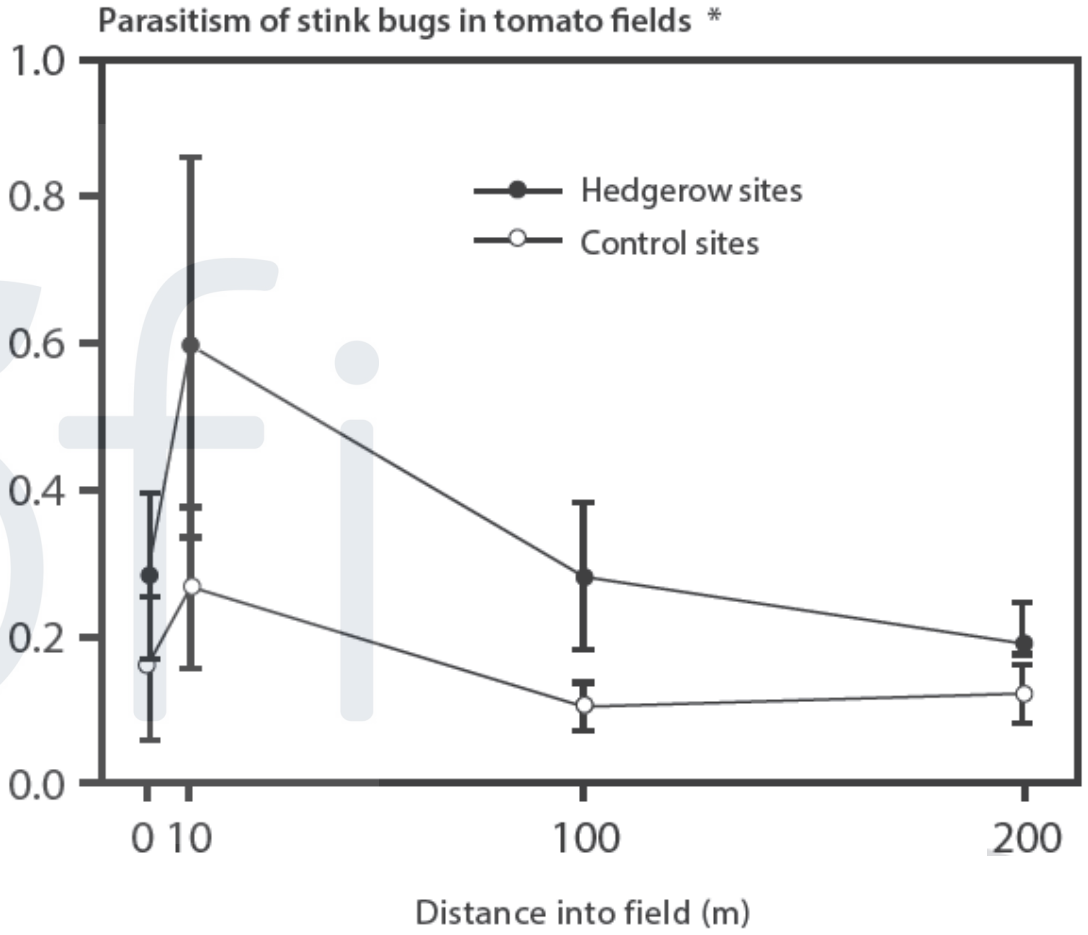
Pest Suppression by Beneficial Insects = $4.5 to $12 Billion Annually

Observable Throughout Fields When >20% of Farm Has Natural Habitat

Habitat Edges Provide Pest Suppression

UC Berkeley / Xerces Society Case Study

- More stink bug eggs parasitized (by wasps) in fields with nearby native plant habitat (than in fields without)
- Vertical axis is proportion of parasitized egg masses observed at distances from the field edge



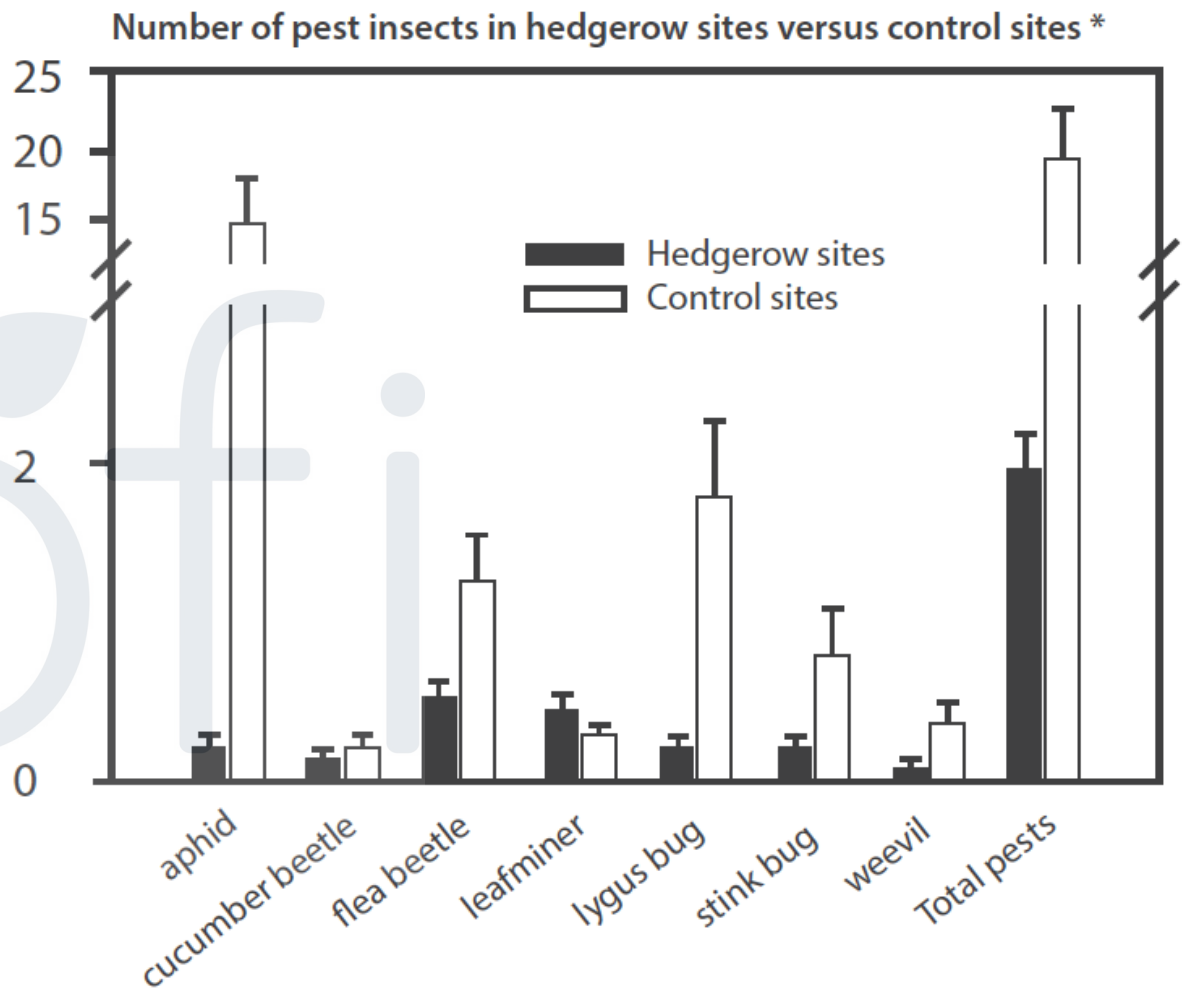
*Morandin, L., R. Long, and C. Kremen. 2014. Hedgerows enhance beneficial insects on adjacent tomato fields in an intensive agricultural landscape. Agriculture, Ecosystems, and Environment. 189: 164-170.

- Graph: Lora Morandin

Habitat Edges Don't Increase Pests

UC Berkeley / Xerces Society Case Study

- Sweep net samples of insect activity
- Native plant edges versus weedy field edges
- Fewer pests on the farms with habitat edges



- Graph: Lora Morandin

*Morandin, L., R. Long, and C. Kremen. 2014. Hedgerows enhance beneficial insects on adjacent tomato fields in an intensive agricultural landscape. Agriculture, Ecosystems, and Environment. 189: 164-170.

Weed Suppression by Ground Beetles

- 74 to 208 seeds consumed in 48 hours
- Lambsquarters, ragweed, pigweed, velvetleaf, foxtail, crabgrass, etc.

Lundgren, J. 2005. Ground beetles as weed control agents: effects of farm management. American Entomologist. 224-226.

Decomposition by Dung Beetles

- Can reduce parasites by 75%
- Eliminate methane by up to 12%
- Eliminate e.coli

Fincher, G. T. 1975. Effects of dung beetle activity on number of nematode parasites acquired by grazing cattle. Journal of Parasitology 61: 759–762. (Available online at: https://doi.org/10.2307/3279480 (verified 3 Oct 2017).

Jones, M. S., S. Tadepalli, D. F. Bridges, V.C.H. Wu, and F. A. Drummond. 2015. Suppression of *Escherichia coli* O157:H7 by dung beetles (Coleoptera: Scarabaeidae) using the lowbush blueberry agroecosystem as a model system. PLoS ONE 10: e0120904.

Slade, E. M., T. Riutta, T. Roslin, and H. L. Tuomisto. 2016. The role of dung beetles in reducing greenhouse gas emissions from cattle farming. Scientific Reports 6: 18140. (Available online at: 10.1038/srep18140

Pest Control by Songbirds

33% reduction of pests in some crops when nearby habitat is available to support nesting/roosting (e.g. trees)

Kross, S. , T.R. Kelsey, C. McColl, J. Townsend. 2016. Field-scale habitat complexity enhances avian conservation and avian –mediated pest-control services in an intensive agricultural crop. Agriculture, Ecosystems & Environment. 225:140-149.

- Photo: Gregory Heath

Crop Pollination By Wild Bees

12% higher yields adjacent to wildflowers

Return on investment in 3-to- 4 years

Blaauw, B., and R. Isaacs. 2014. Flower plantings increase wild bee abundance and the pollination services provided to a pollination-dependent crop. Journal of Applied Ecology. doi: 10.1111/1365-2664.12257

- Photos: Nancy Adamson; Brett Blaauw

Landscape Diversity And Nature's Economy

A review of 24 studies showed landscape complexity enhanced natural beneficial insect populations in 74% of cases[1]

Photo: by Matthew Roth, Lynn Betts

Bianchi, F. J. J. A., C. J. H. Booij, and T. Tscharntke. 2011. Sustainable pest regulation in agricultural landscapes: a review on landscape composition, biodiversity and natural pest control. *Proc. R. Soc. B* 273: 1715-1727.
Forehand, L. M., D. B. Orr, and H. M. Linker. 2006. Insect communities associated with beneficial inset habitat plants in North Carolina. *Environmental Entomology* 35 (6): 1541-1549.

The Oldest Farms On Earth Are Semi-Wild

The Oldest Farms on Earth Are Semi-Wild

"the quamash is now in blume and from the colour of its bloom and at a short distance it resembles lakes of fine clear water, so complete is this deseption that on first sight I could have swoarn it was water.“ -Meriwether Lewis

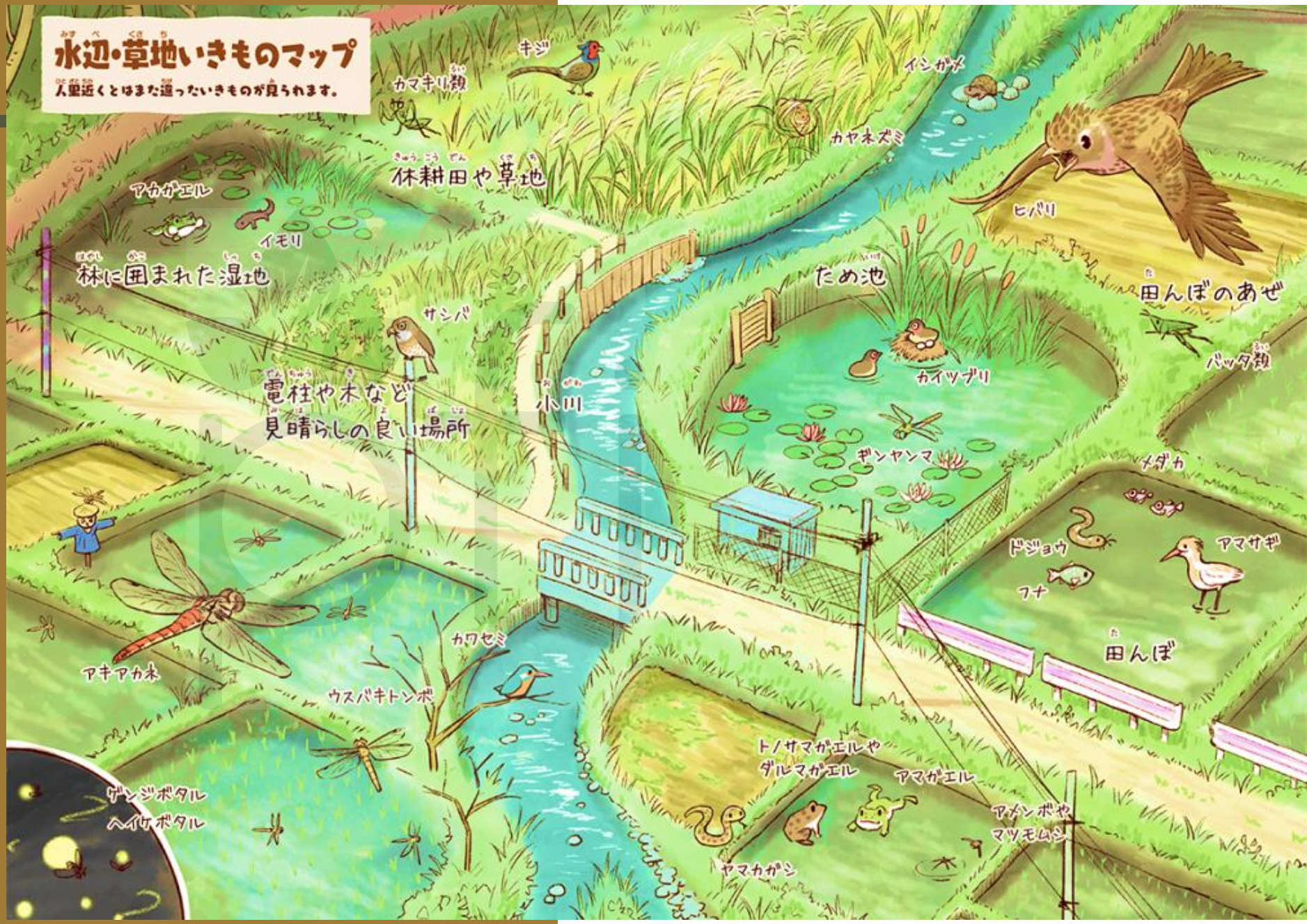
The Oldest Farms on Earth Are Semi-Wild

The Oldest Farms on Earth Are Semi-Wild

Satoyama

By definition, multi-enterprise operations:

- Rice
- Barley
- Millet
- Buckwheat
- Livestock
- Wood Products
- Bamboo
- Indigo
- Vegetables
- Mushrooms
- Wild Vegetables
- Fish
- Tree Fruit



Part 4

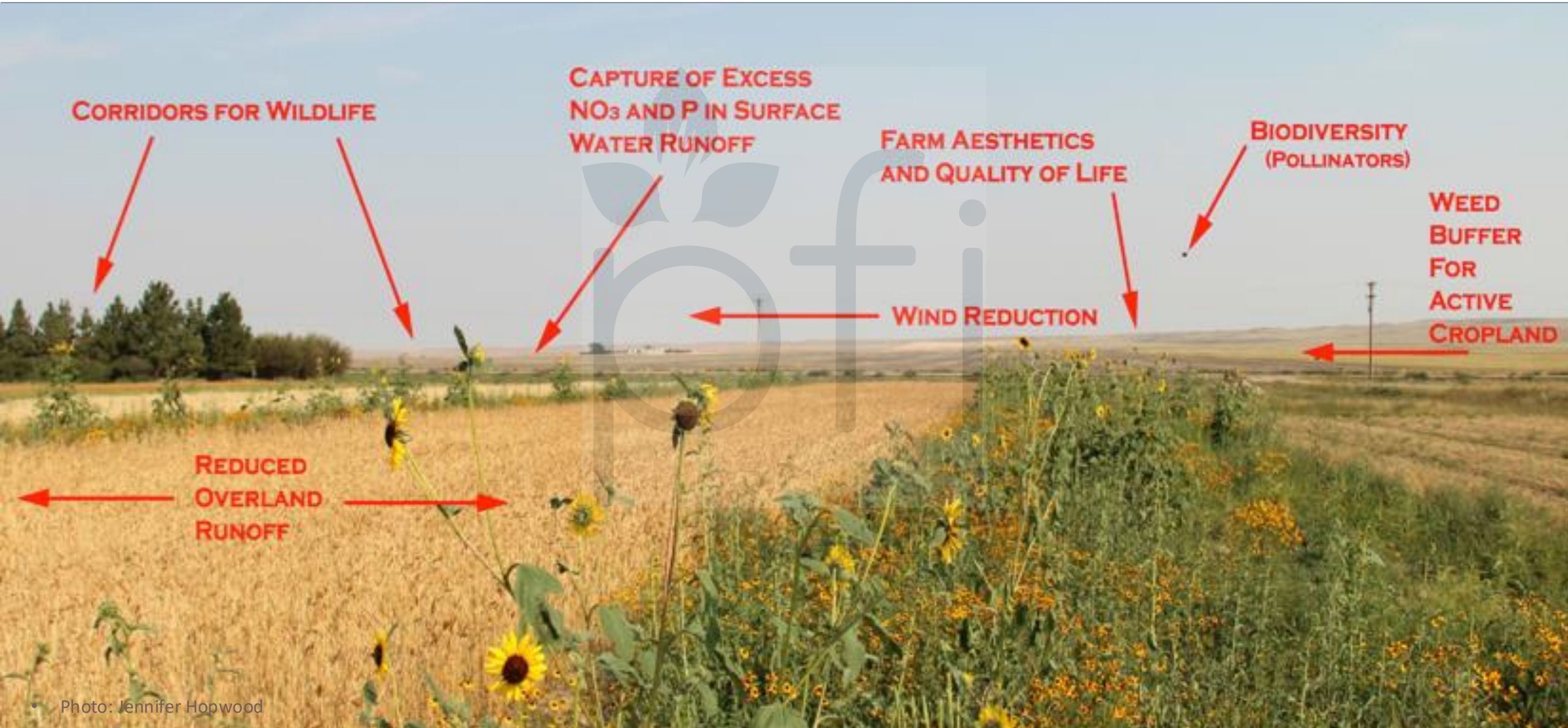
Bringing The Prairie

(and Everything Else)

Back to the Farm

A Living Farms Model

12,000-Acre Montana Organic Grain Farm



- Photo: Jennifer Hopwood

12,000-Acre Montana Organic Grain Farm

Iowa Market Vegetable Farm

Beetle Banks for Pest Management

- Permanent native prairie grass strips
- Daytime and overwintering habitat for beetles

- Photo: Grinnell Heritage Farm

Wisconsin Prairie-Dairy

New England Meadow-Orchard

New England Blueberry Borders

Washington Prairie Vineyard

Oregon Blueberry Field Borders

California Almonds and Native Wildflower Edges

California Wildflower Cover Crops

And Then There Are The Hedgerows…

1-Year Old Hedgerow Surrounding 2000-Acres of Almonds

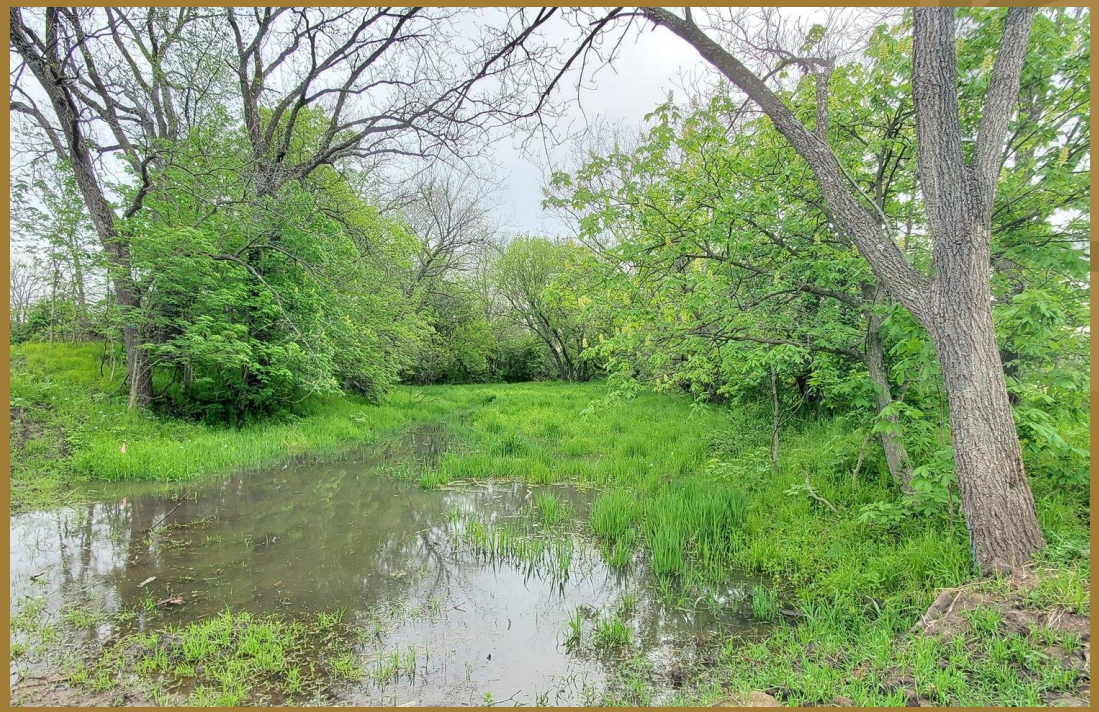
Part 5

PFI's Farmers of 40-Centuries

Ruth Rabinowitz

St. Charles, IA

Prairie habitat, cover crops, filter strips, restored oxbows



Peoples Community Health Clinic Garden

Kamyar Enshayan

Free fresh produce and beneficial insect habitat for the community of Waterloo

Paul Mugge
Sutherland, IA

Prairie strip pioneer, organic field crops, third-crops like flax, canola!

Sweet Tooth Farm

Monika Owczarski

Prairie habitat, fresh produce, and community compost in Des Moines' River Bend neighborhood

Rolling Acres Farm

Denise O’Brien

Producing vegetable starts, flowers, and prairie wildflowers in Atlantic, IA

Your Work

Last Part

The Farmer as a Conservationist

Aldo Leopold, 1939

Many labored arguments are in print proving that conservation pays economic dividends. I can add nothing to these arguments. It seems to me, though, that something has gone unsaid. It seems to me that the pattern of the rural landscape, like the configuration of our own bodies, has in it (or should have in it) a certain wholeness. No one censures a man who loses his leg in an accident, or who was born with only four fingers, but we should look askance at a man who amputated a natural part on the grounds that some other is more profitable. The comparison is exaggerated; we had to amputate many marshes, ponds and woods to make the land habitable, but to remove any natural feature from representation in the rural landscape seems to me a defacement which the calm verdict of history will not approve, either as good conservation, good taste, or good farming.

No More Water

No More Bees

No More Soil

No More Pesticide Options

No More of Anything

The Farm Had No More Soul

You Are the Farmers of Forty Centuries

Thank You!

The landscape of any farm is the owner's portrait of himself.

Aldo Leopold