

Ecosystem and Biodiversity Stresses from Agriculture

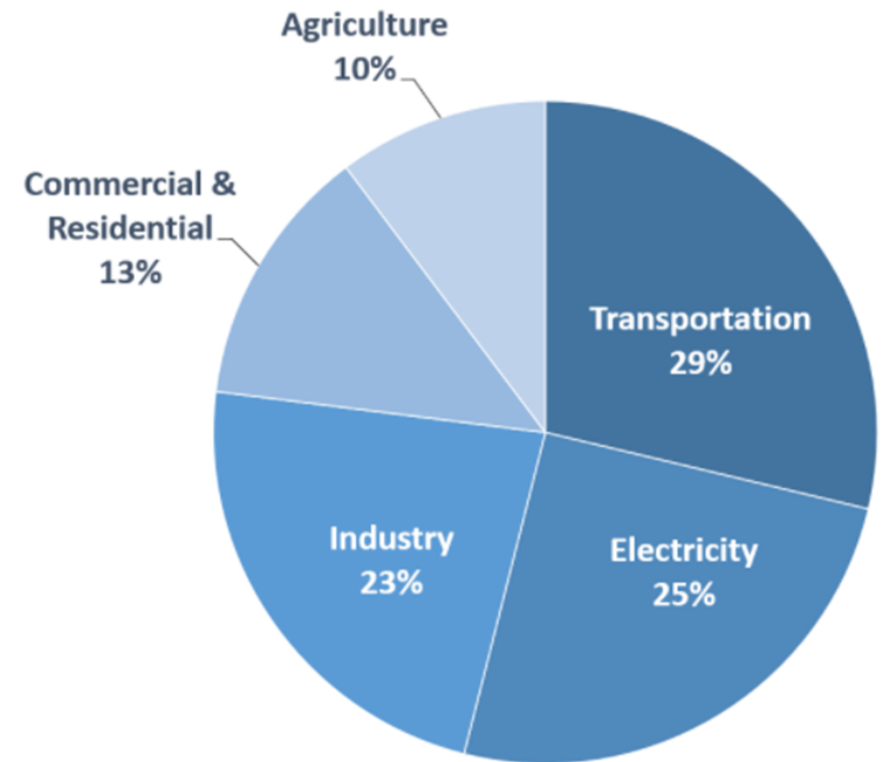
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Total U.S. Greenhouse Gas Emissions by Economic Sector in 2019



Total Emissions in 2019 = 6,558 Million Metric Tons of CO₂ equivalent. Percentages may not add up to 100% due to independent rounding.

<https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>

Agriculture's impact on ecosystems

Sectors of the resource base

- Soil
- Water
- Air
- Biological
- Energy

2 common practices negatively impacting soil, water and air?

- Tillage
- Inorganic Fertilization



Soil Health: Negative impacts & causes (illustrative NOT exhaustive)

Impact

- Erosion (soil loss)
- Loss of SOM
 - Loss of soil water holding capacity
- Loss of soil fertility
- Contamination w/ organics
- Contamination w/ undesirable heavy metals
- Salinization

Management cause

- **Tillage** and bare fallowing
- Erosion drivers & use of all ag. plant parts (**no residue return**)
- Erosion drivers & **inadequate nutrient replacement**
- Use of pest/pathogen chemical controls
- Land application of municipal wastes
- Inappropriate water management

Biology: Negative impacts & causes

Impact

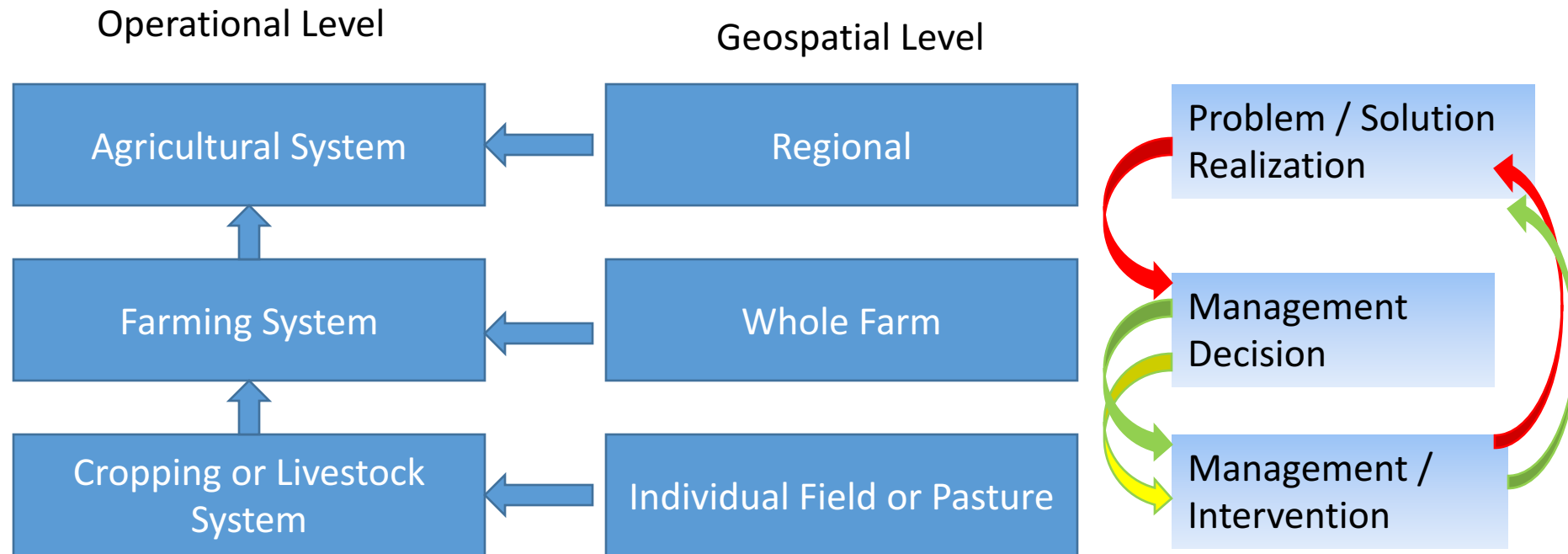
- Loss of biodiversity
 - Loss of genetic biodiversity within important crop species
- Loss of biological function
 - Beneficials & biological controls
 - Loss of biotic/abiotic stress tolerance
- Enhancement of competitiveness of undesirable species
 - Herbicide resistant weeds
- Introduction & promotion of invasive species
 - Intentional & unintentional

Management cause

- Land conversion
 - Loss of habitat (corridors & refuges),
 - Loss of critical resources
- Monocultures, pest control chemical inputs
- Overuse of a technology in space & time
 - Loss of refuge
- Unwise selection of new crops, “stowaways & hitch-hikers”, use of contaminated seeds, etc.

Modern (current) ag. practices ~ a tale of disconnected scales

(modified from Connor et al., 2011)



Take home: Scale matters and the lens through which you view value proposition of ag activities is often governed by where you "sit"

Rice production in CA: Example of ES conscious ag. via land sharing?



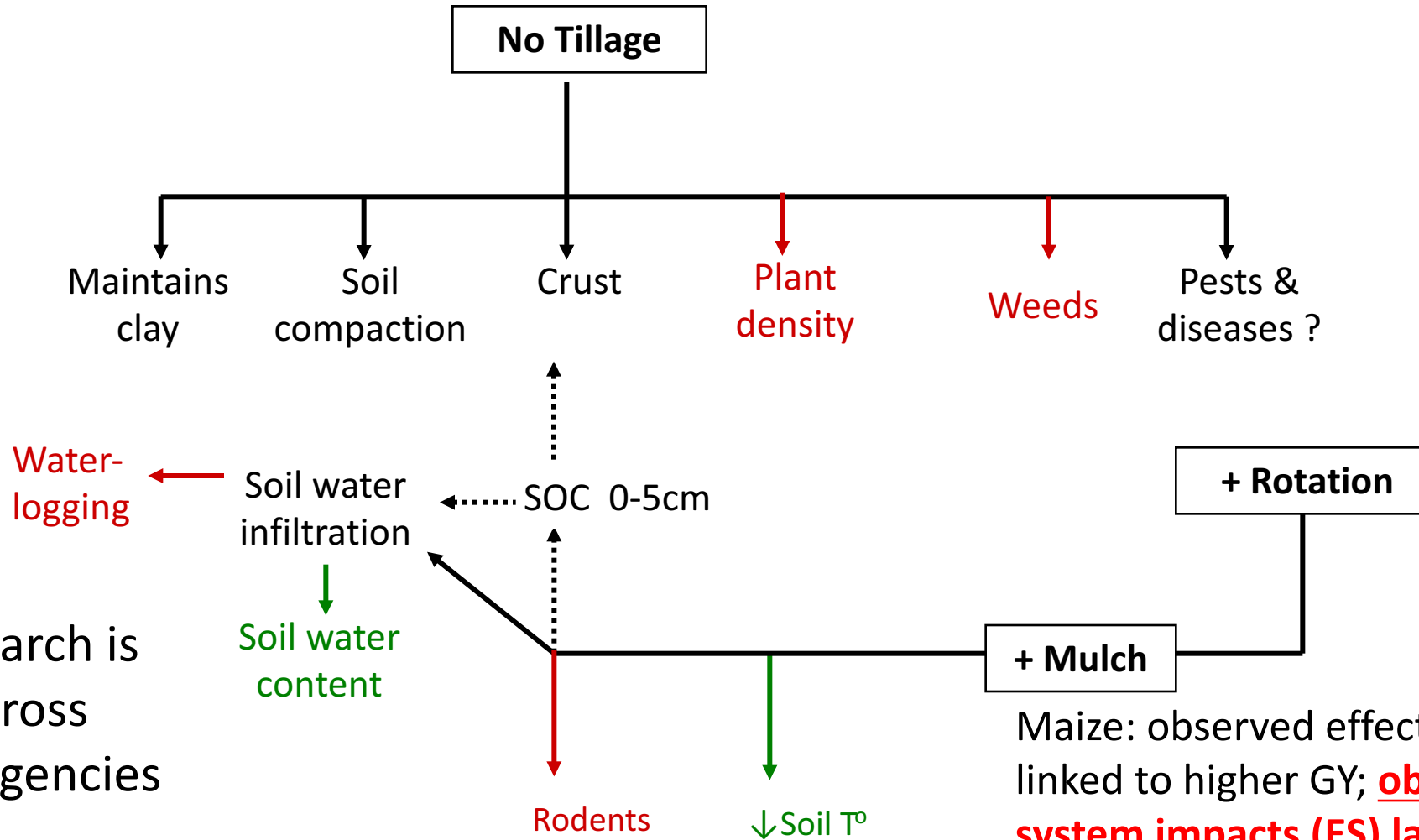
Jack Kelly Clark



Conjunctive use of farmland adds value . . .

***Winter flooding of ricelands
provides waterfowl habitat***

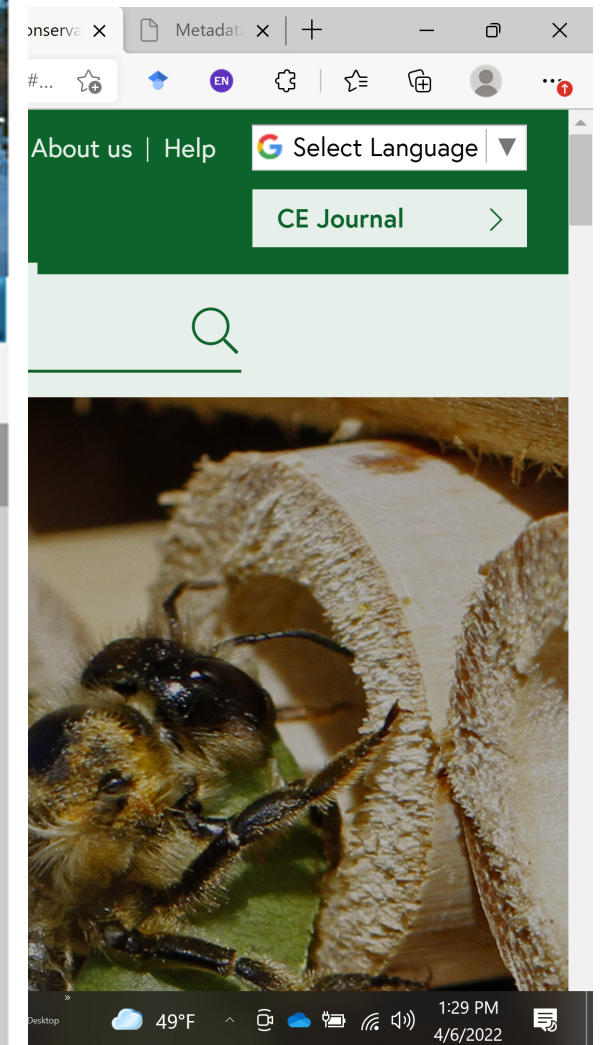
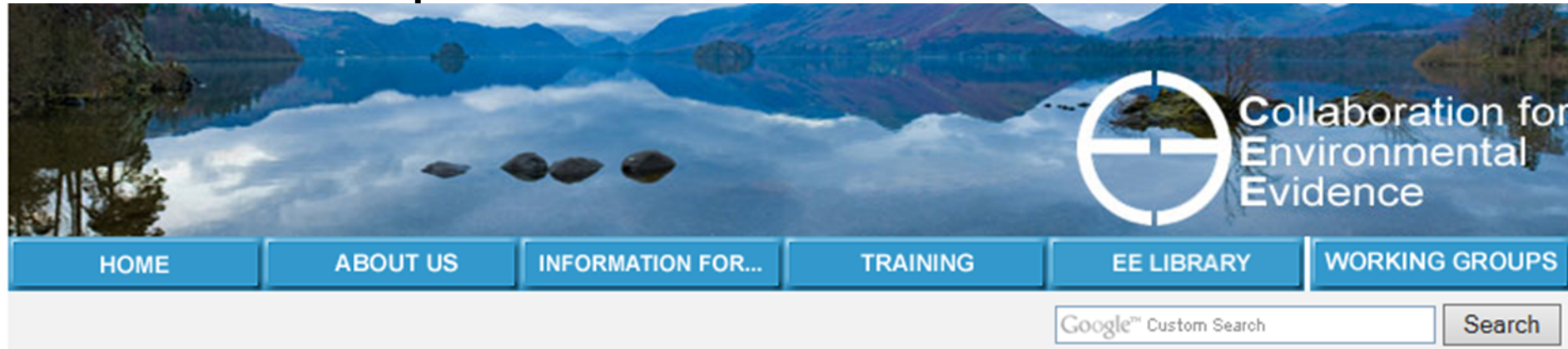
Current management recommendations ~ a tale of disorganized, fragmented, partial (?) science



Even the research is parsed out across programs & agencies with limited coordination

Maize: observed effects, not necessarily linked to higher GY; observations of other system impacts (ES) largely qualitative or lacking in quantitative rigor.

Many emerging efforts to compile knowledge about practices but....



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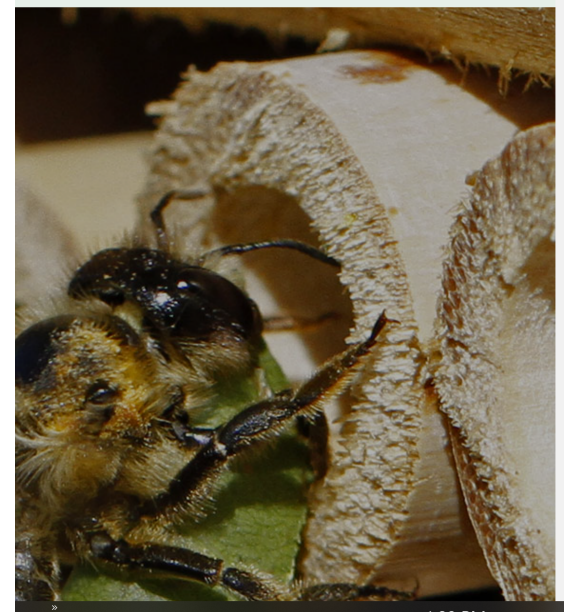
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View the Guidelines for systematic review in environmental management.

News Headlines











- 04/12/13 - Read the latest protocols published in the CEE Library and Environmental Evidence [here](#)**
- 03/12/13 - Systematic Review on the human wellbeing impacts of terrestrial protected areas [Read the full review here](#)**
- 13/11/13 - Follow CEE on twitter @EnvEvidence [here](#)**
- 16/09/13 - Evidence Aid is awarded the Unorthodox Prize 2013. See why Evidence Aid was chosen [here](#)**
- 15/07/13 - 3ie Systematic Review Call. 3ie invites proposals for systematic reviews around seven policy-relevant questions on the**



Practice to outcome ~ 81 “actions”: for “bird conservation” when threatened by “agriculture and aquaculture”

A long way to go for tools and apps that correctly identify enterprise-specific recommendations w/respect to:

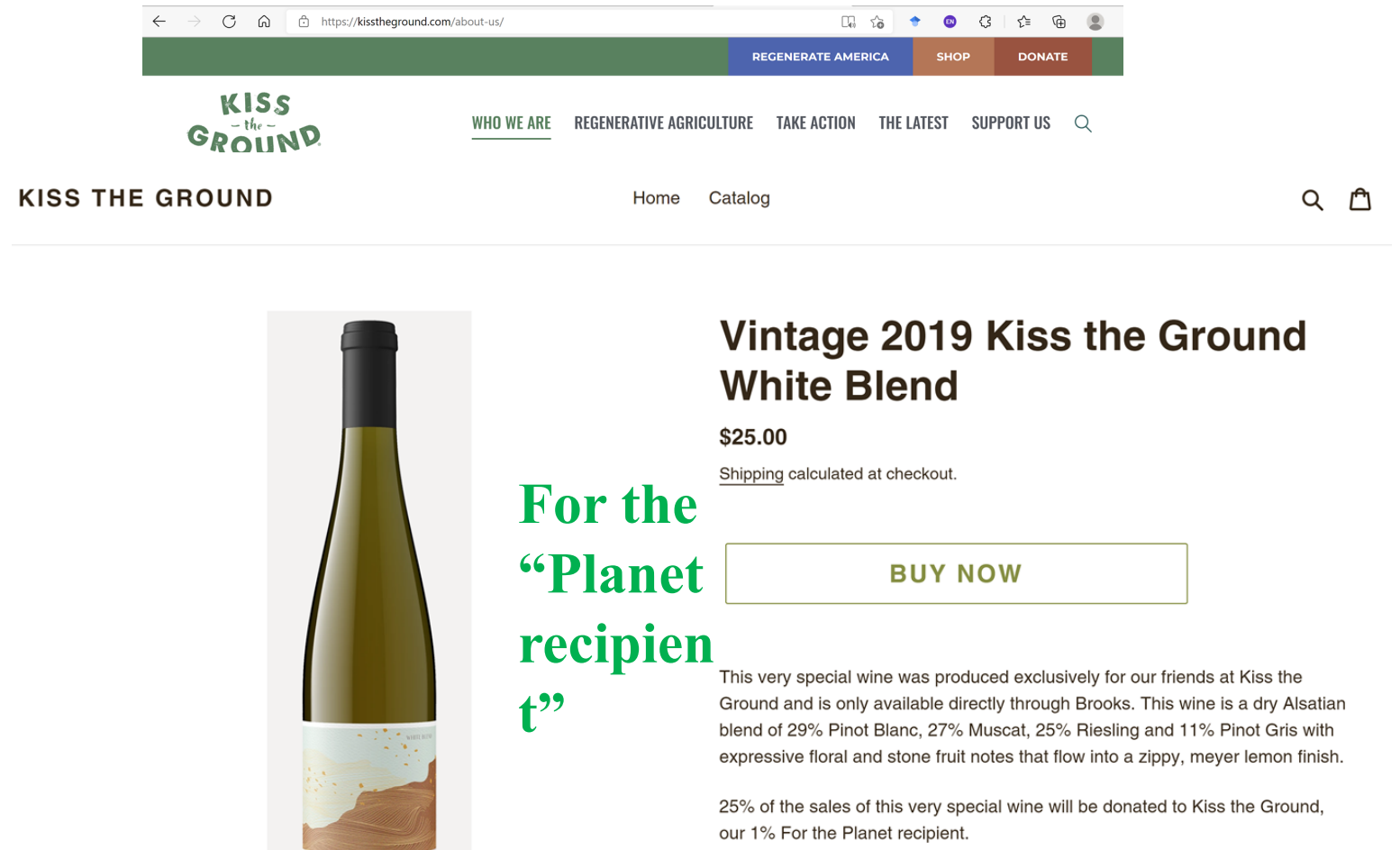
- Economic cost
- Risk & tradeoffs
- Time to impact
- Directionality of impact
- Magnitude of impact
- **Realized performance**
- ...

<input type="checkbox"/>	Ensure connectivity between habitat patches	 Unknown effectiveness (limited evidence)	2	
<input type="checkbox"/>	Exclude grazers from semi-natural habitats	 Trade-off between benefit and harms	11	
<input type="checkbox"/>	Fertilize artificial grasslands	 Unknown effectiveness (limited evidence)	4	
<input type="checkbox"/>	Increase crop diversity to benefit birds	 Unknown effectiveness (limited evidence)	1	
<input type="checkbox"/>	Increase the proportion of natural/semi-natural vegetation in the farmed landscape	 Likely to be	5	

The scientist's dilemma in creating science stories: Ride the wave or quench the euphoria?

“We must be deeply intellectually honest about these problems – soil is NOT always, *if ever*, a “win-win” solution. The parallel universe of warm fuzzy views of soil is detrimental ... adding a **whiff of wackiness** to our field...”

R. Amundson, 2021, Kiss the ground (and make a wish): soil science and Hollywood, Biogeochemistry doi.org/10.1007/s10533-021-00857-w



The screenshot shows a web browser window with the URL <https://kisstheground.com/about-us/>. The website header includes navigation links: REGENERATE AMERICA, SHOP, and DONATE. Below the header is the Kiss the Ground logo and a menu with links: WHO WE ARE, REGENERATIVE AGRICULTURE, TAKE ACTION, THE LATEST, and SUPPORT US. The main content area features the text "KISS THE GROUND" and navigation links for Home and Catalog. A search icon and a shopping bag icon are also visible. The product page displays a bottle of wine, the title "Vintage 2019 Kiss the Ground White Blend", the price "\$25.00", and a "BUY NOW" button. A green text overlay on the right side of the page reads "For the 'Planet recipient'". Below the product description, it states: "25% of the sales of this very special wine will be donated to Kiss the Ground, our 1% For the Planet recipient."