



Industrial agriculture: Environmental impacts and implications for our health

Megan O'Rourke, Gina Angelella, Mike Graham

Virginia Tech, megorust@vt.edu

Pittsburgh, Mar. 2019





Industrialization: Bigger farms, more intensive production (inputs, tillage)



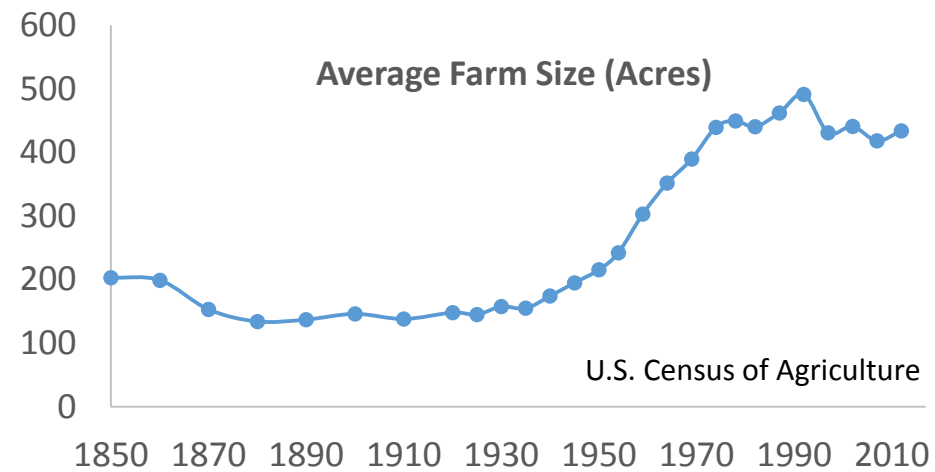
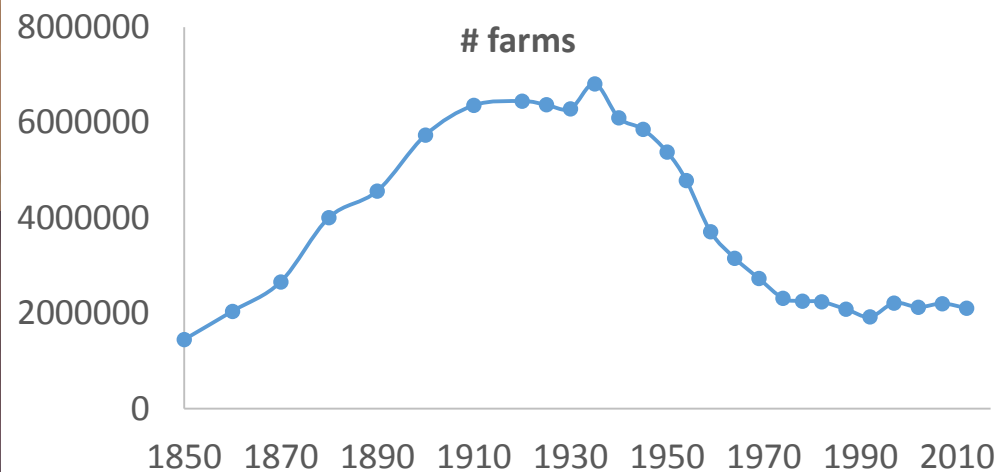
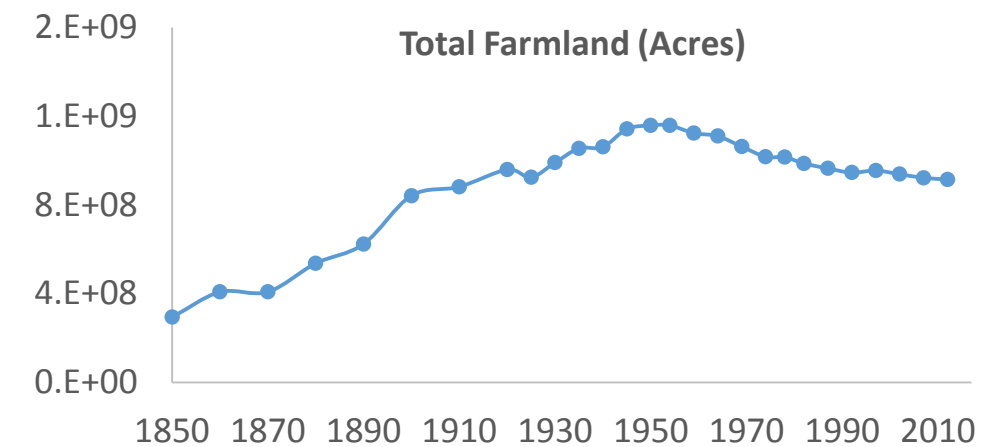
“Plow up every bit of land you can get your tractor on and plant fence row to fence row”

“Get big or get out”

—Earl Butz, Secretary of Agriculture, 1973

US Industrial Agriculture:

More Farmland
Fewer Farmers
Larger Farms



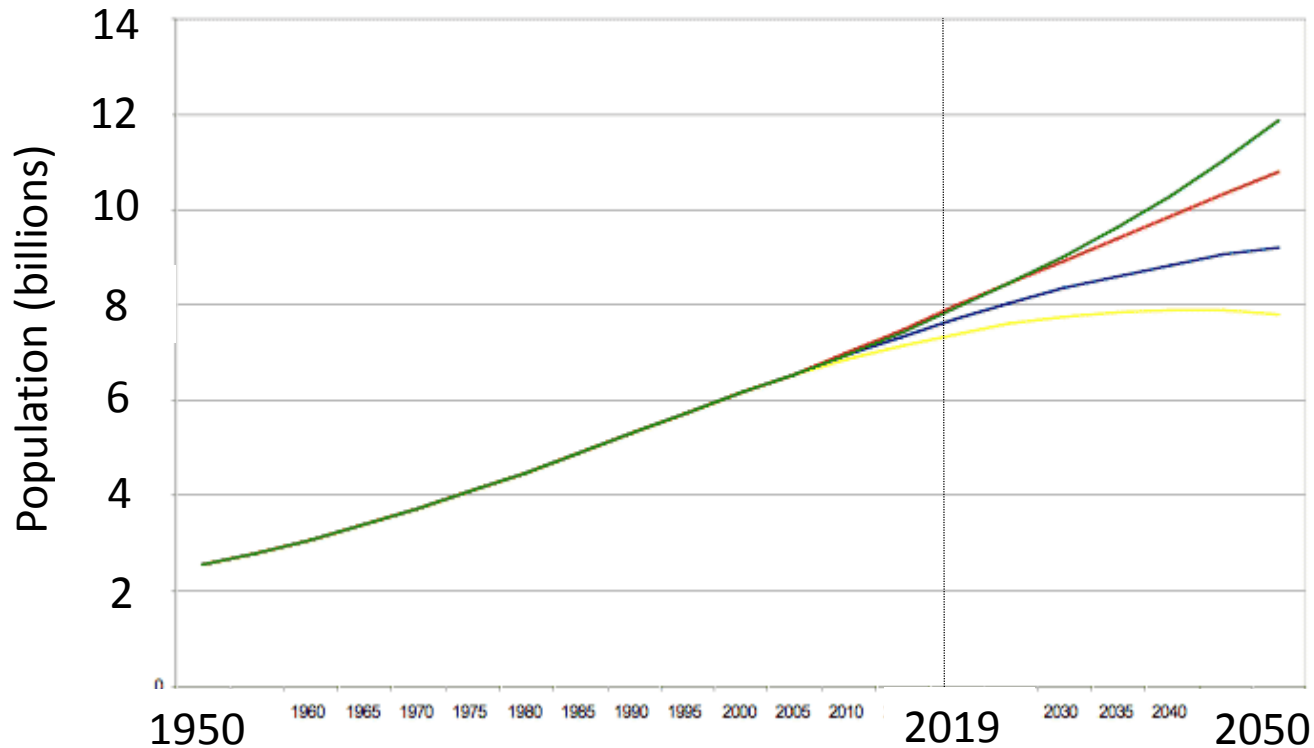
Global Agricultural Industrialization: “How to Feed the World in 2050”



70% More Food Production by 2050

Bruinsma/FAO 2009

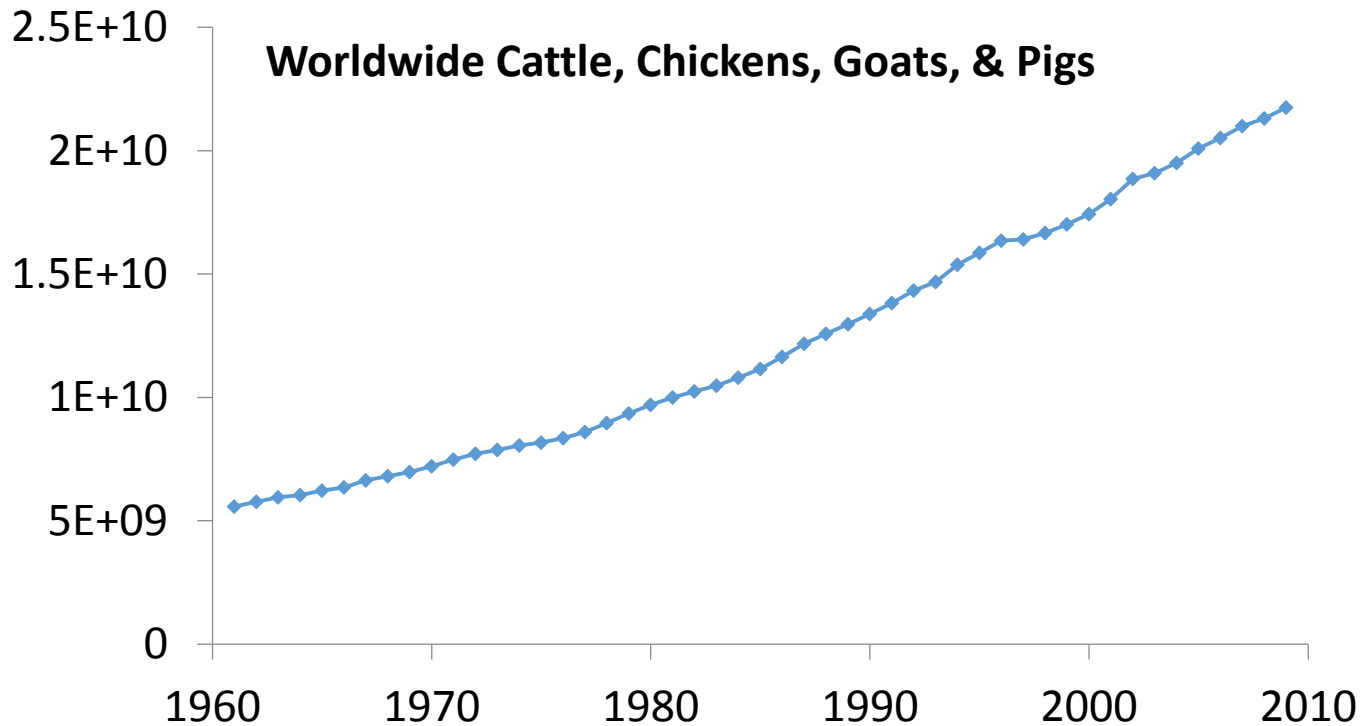
Driver of Change: Population Growth



UN, 2008



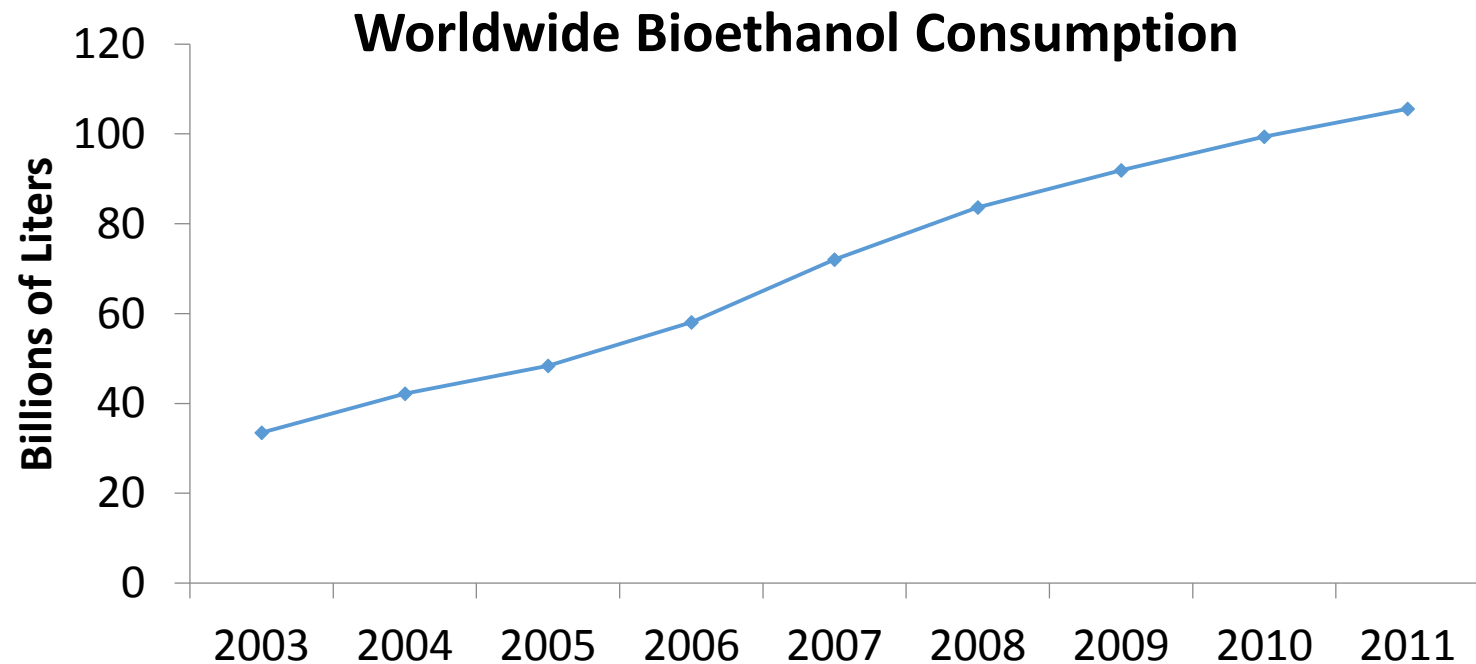
Driver of Change: \$ = Meat Consumption



FAO, 2011



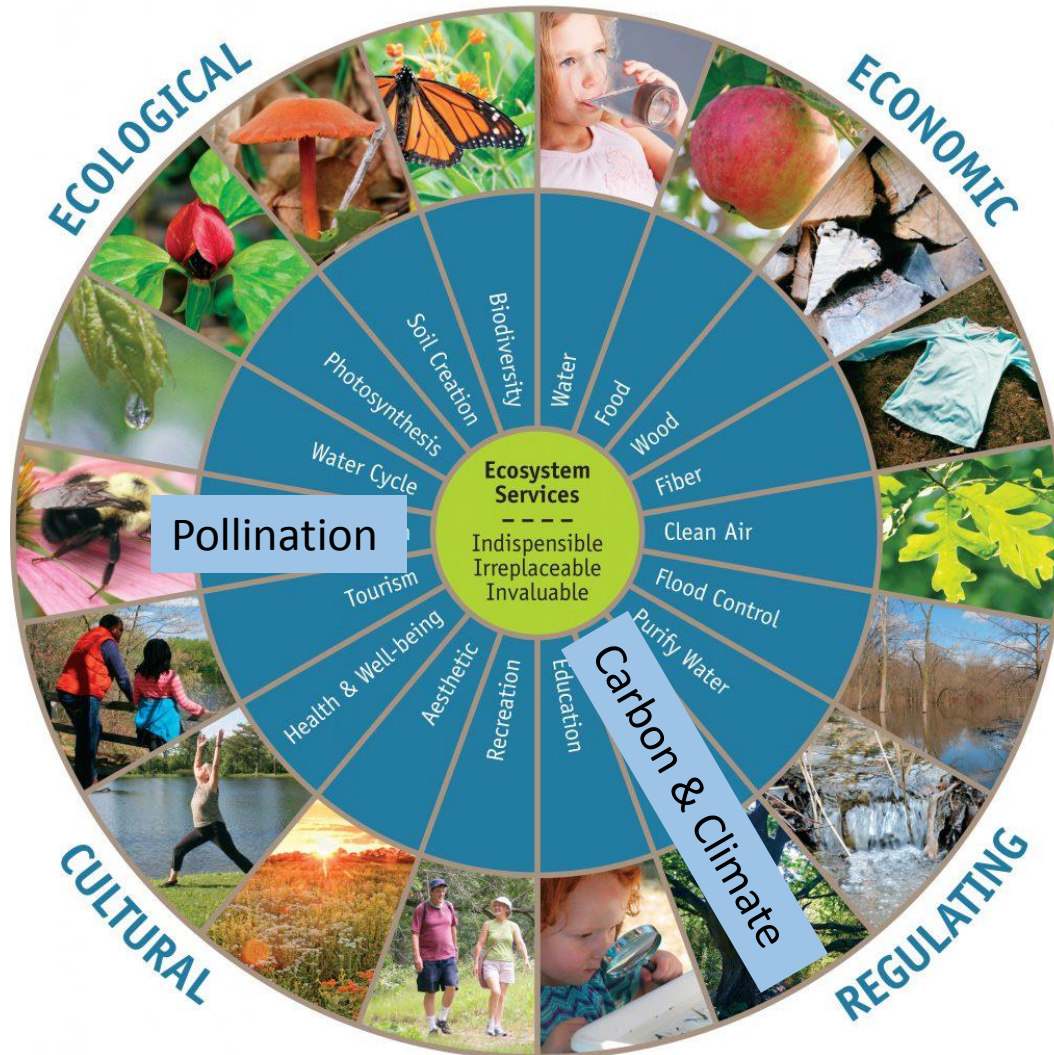
Driver of Change: Policy e.g. Biofuels



OECD, 2012

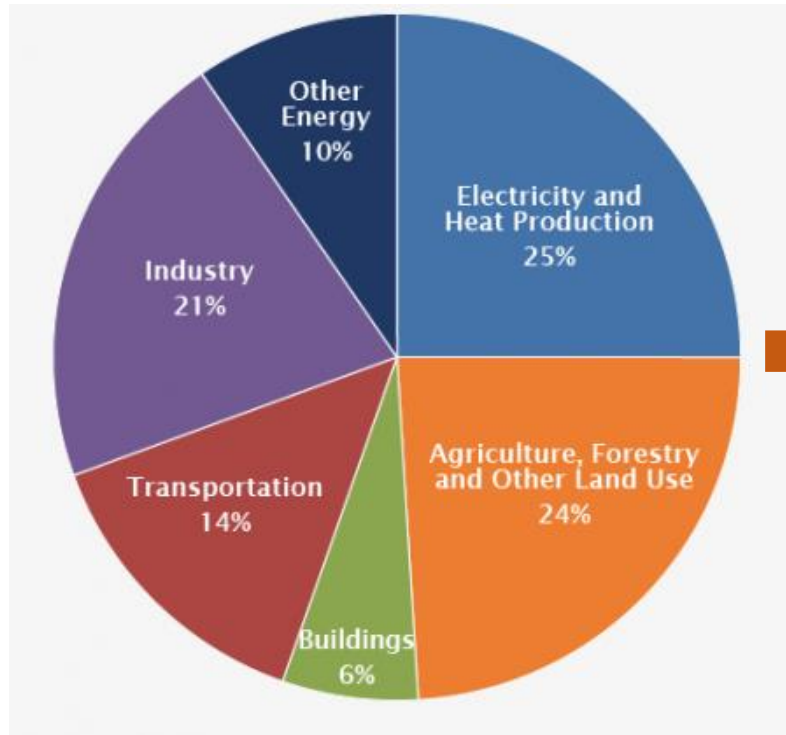


Industrialized agriculture can disrupt ecosystem services



Agriculture – Climate Change – Our Health

Greenhouse Gas Emissions



IPCC 2014

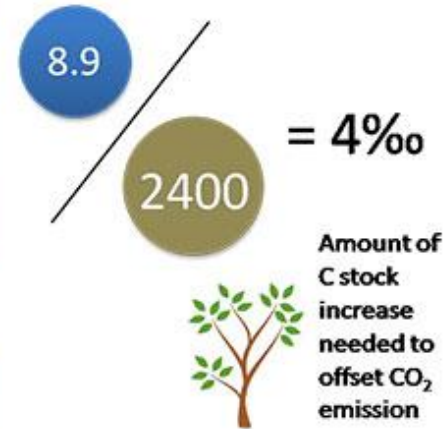
Lead to Climate Change & Threaten Food Production



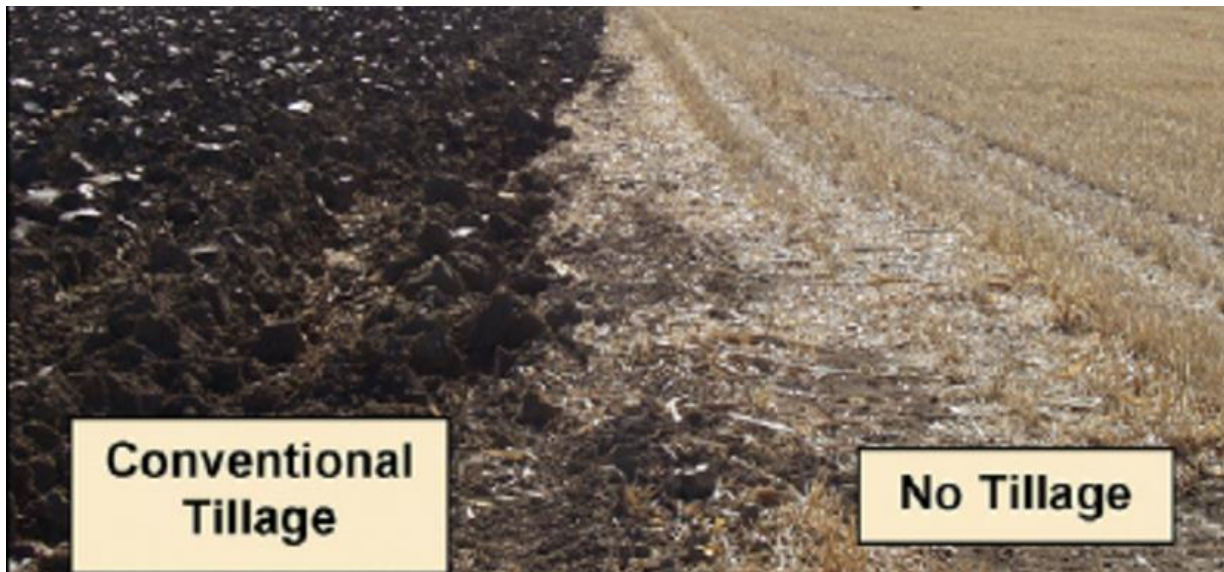
<https://climate.nasa.gov/effects/>

Can no-till agriculture mitigate climate change?

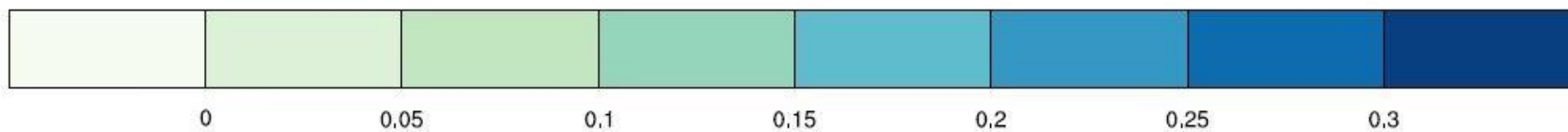
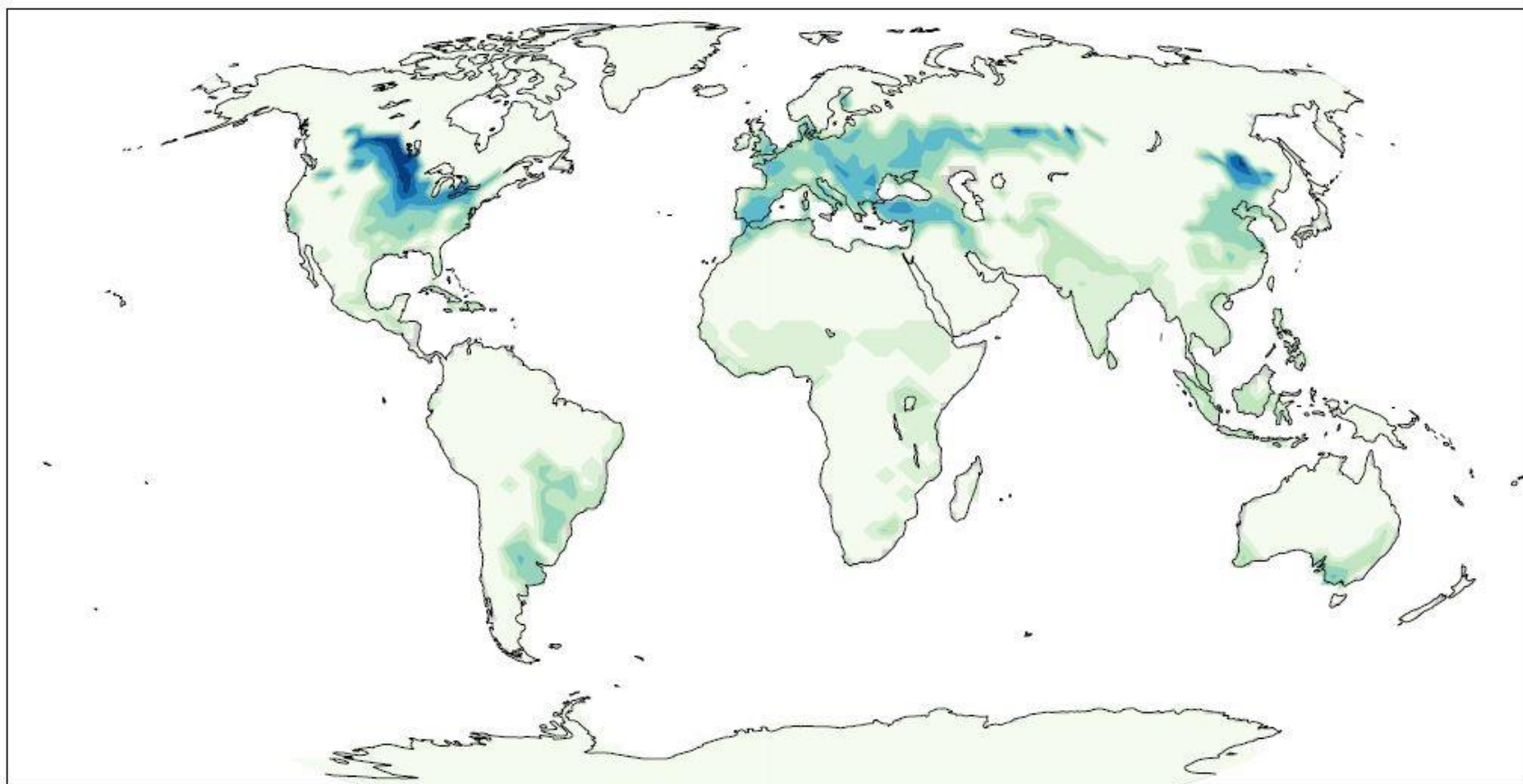
‘4 per mille’
initiative under
UNFCCC at
Paris Agreement
(2015)



From Minasny et al., 2017

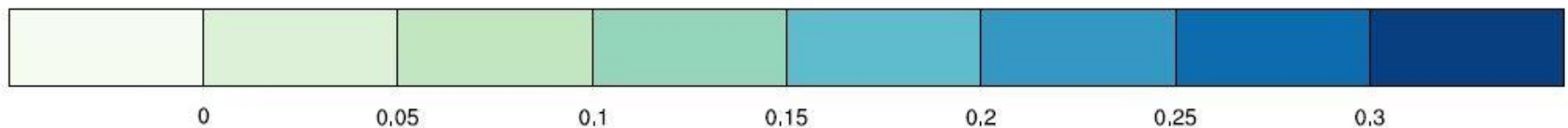
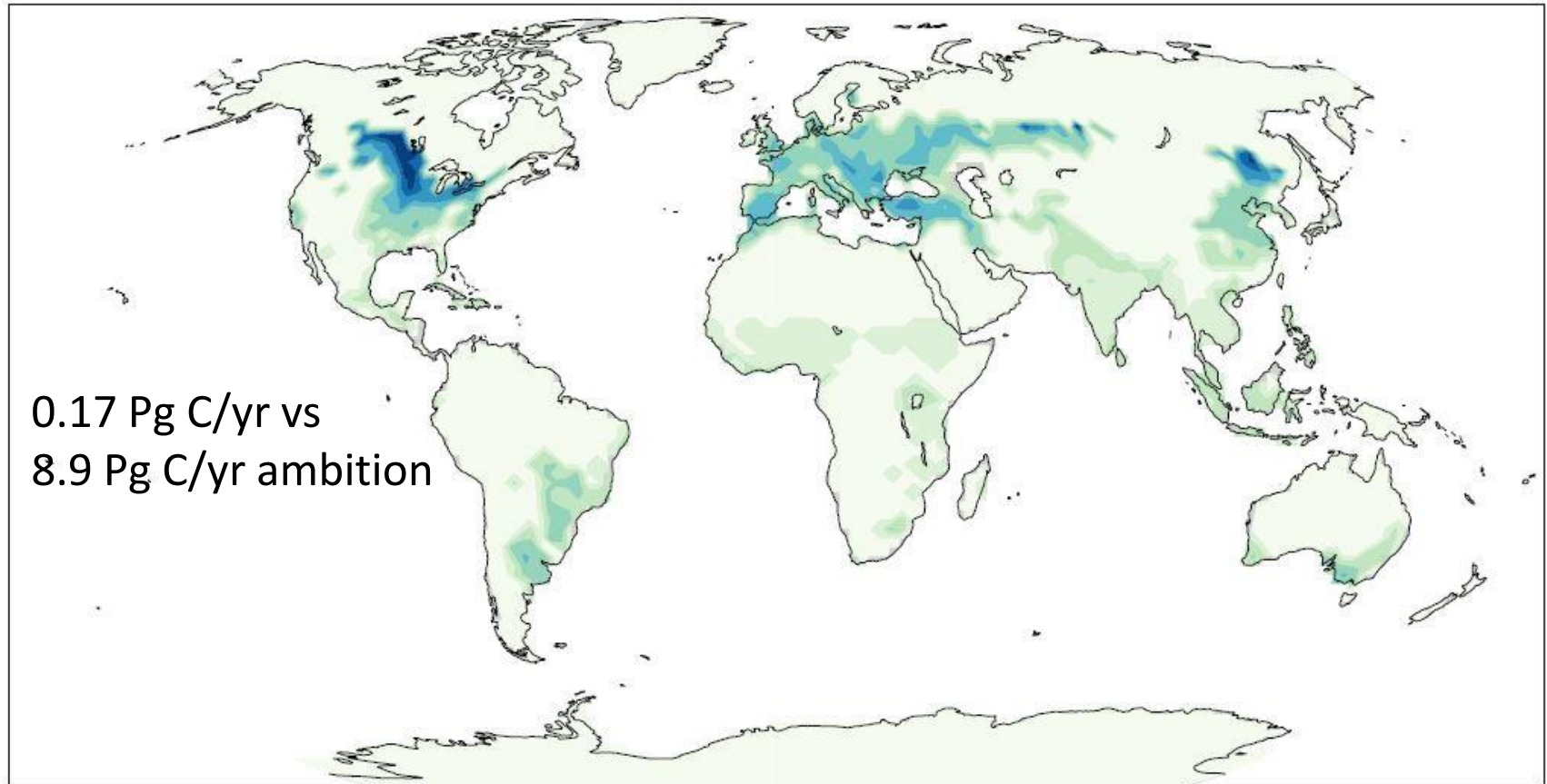


Strudley et al., 2008



Average Annual Change in Total SOM Carbon per hectare of cropland ($\text{Mg C ha}^{-1} \text{ yr}^{-1}$)

No-till agriculture does not even come close to offsetting CO₂ emissions

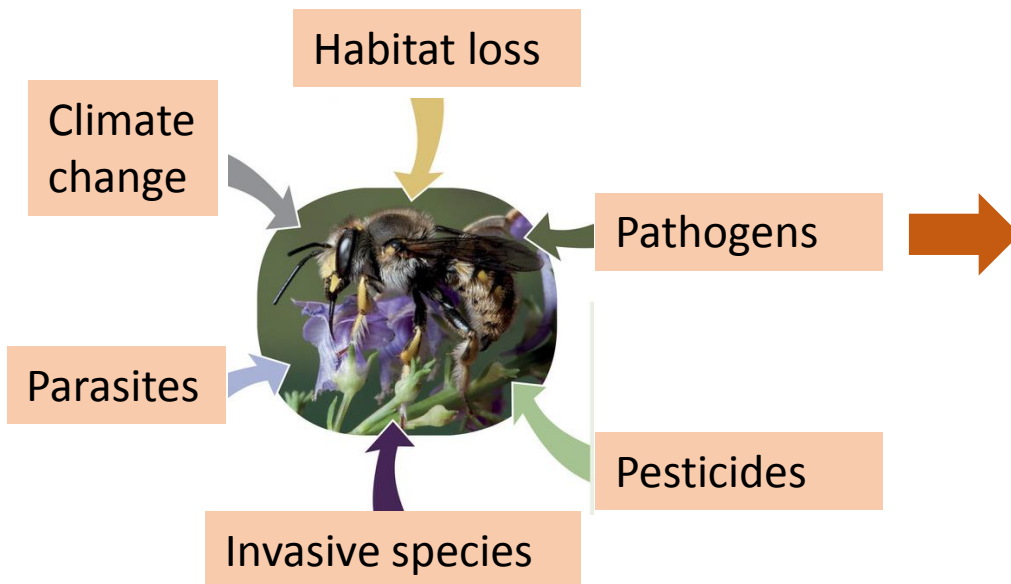


Average Annual Change in Total SOM Carbon per hectare of cropland (Mg C ha⁻¹ yr⁻¹)

Agriculture – Pollination – Our Health

60% of pollinator species in decline

Threatens our most nutritious foods



Brown et al. Peer J., 2016

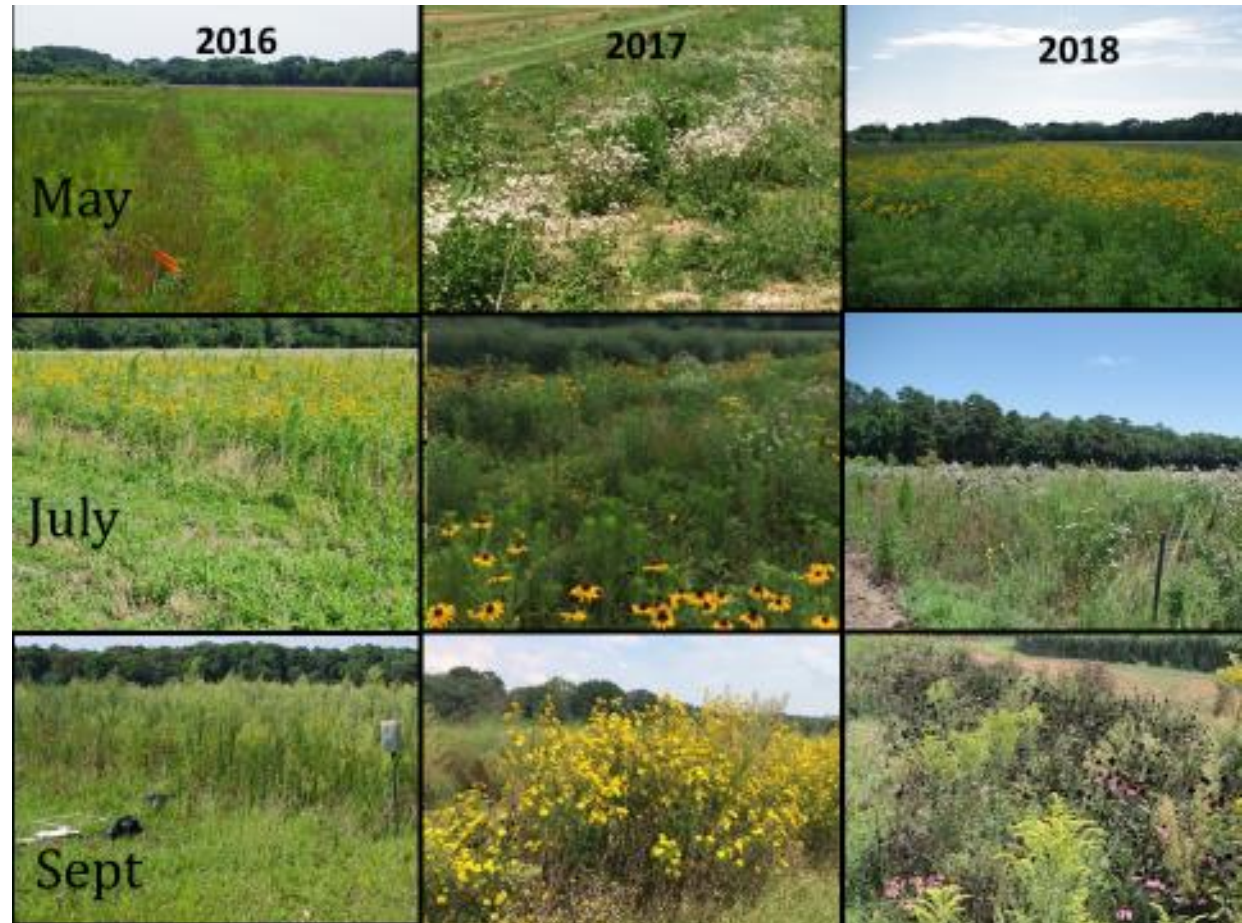


Blog.blueapron.com/americas-tiny-farmers

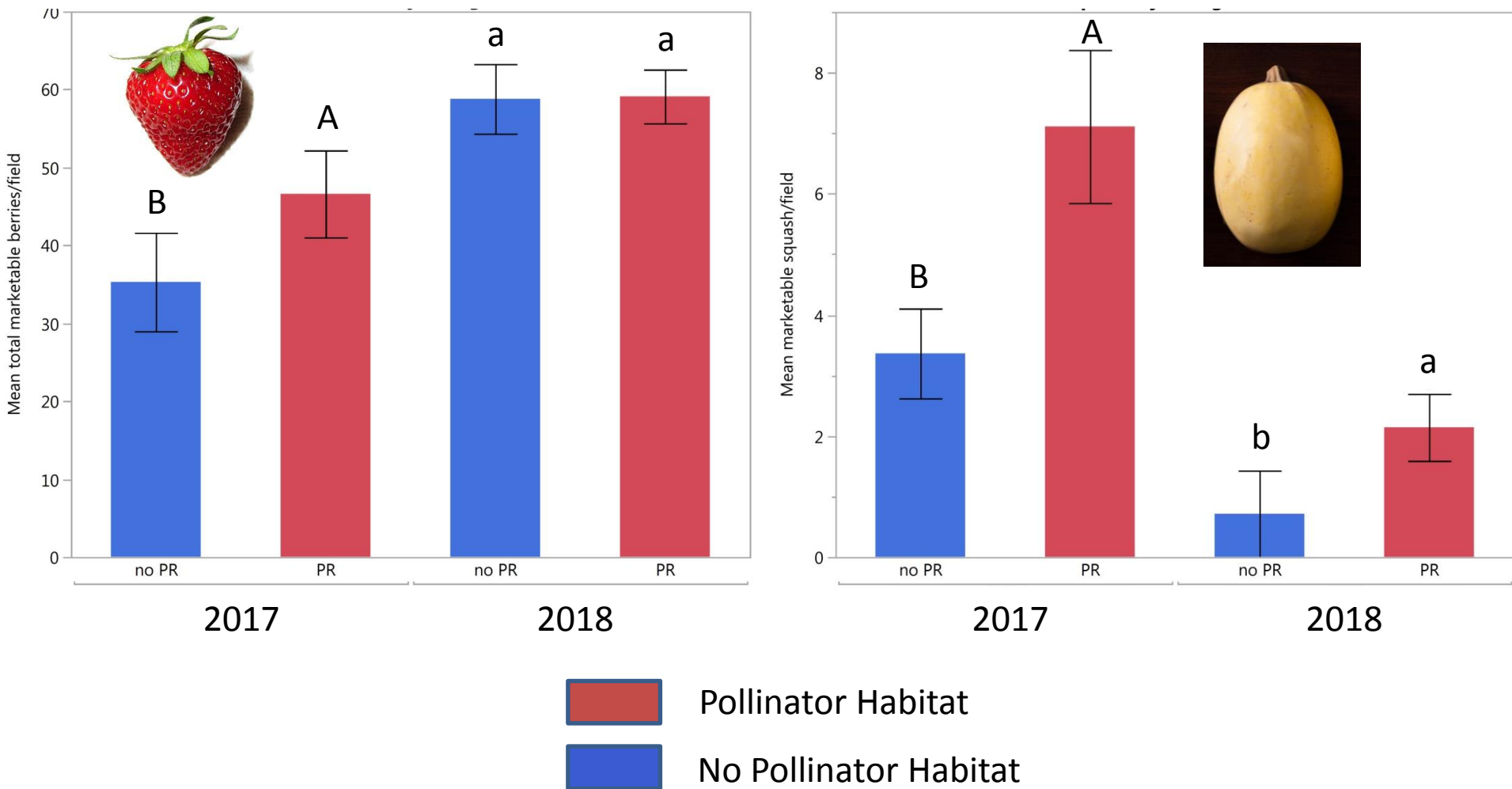
Can restoring pollinator habitat preserve pollination?

White House
Pollinator
Partnership Action
Plan (2016)

Restoring 7 million
acres of pollinator
habitat by 2021



Pollinator habitats increase marketable yields of strawberries and squash



Small Improvements to Industrial Agriculture May Not Be Enough

- Changing tillage practices alone will not stop climate change
- Pollinator habitats can improve pollination but is it enough?



Paradigm Shift → Agriculture & Health

- Cannot take for granted a consistent and nutritious food supply
- Stop looking for silver bullet solutions to agricultural sustainability
- Change research funding for integrated health & agricultural research (O'Rourke et al. 2017)
- Enough is enough! → eat less meat and roll back biofuel mandates
- Pay more for food → more resources for agricultural stewardship

Sustainable Intensification

- Efficient - Less waste
- New, smarter technologies
- Multifunctional: Food & ecosystem services & our health