



# Industrial agriculture: Environmental impacts and implications for our health

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

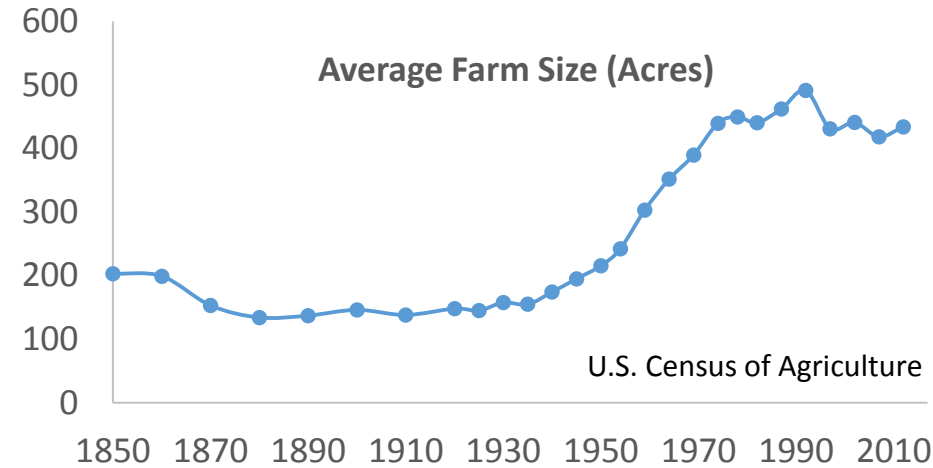
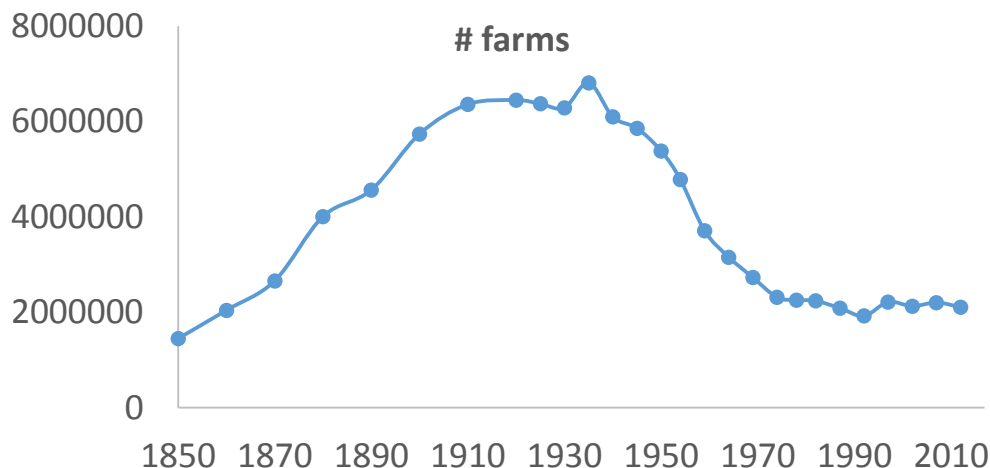
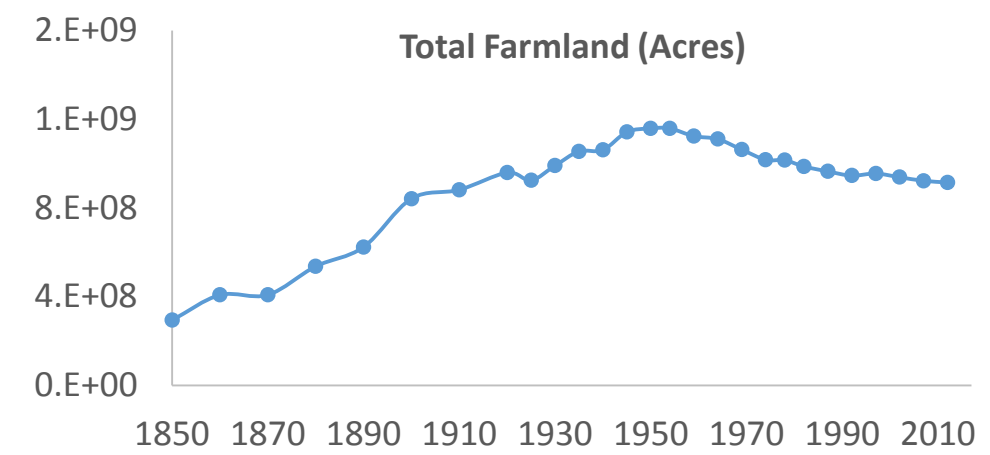


**“Plow up every bit of land you can get your tractor on and plant fence row to fence row”**

**“Get big or get out”**

**–Earl Butz, Secretary of Agriculture, 1973**

**US Industrial Agriculture:**  
More Farmland  
Fewer Farmers  
Larger Farms



U.S. Census of Agriculture



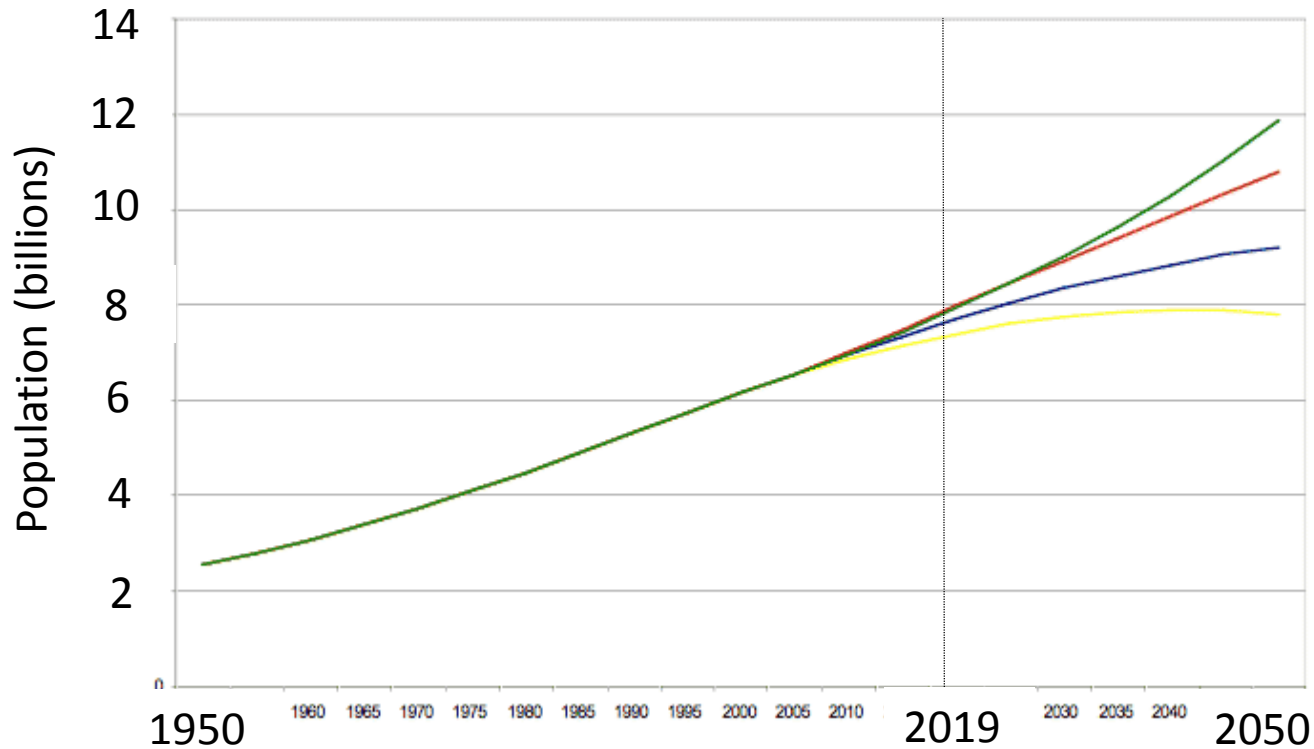
# Global Agricultural Industrialization: “How to Feed the World in 2050”



70% More Food Production by 2050

Bruinsma/FAO 2009

# Driver of Change: Population Growth

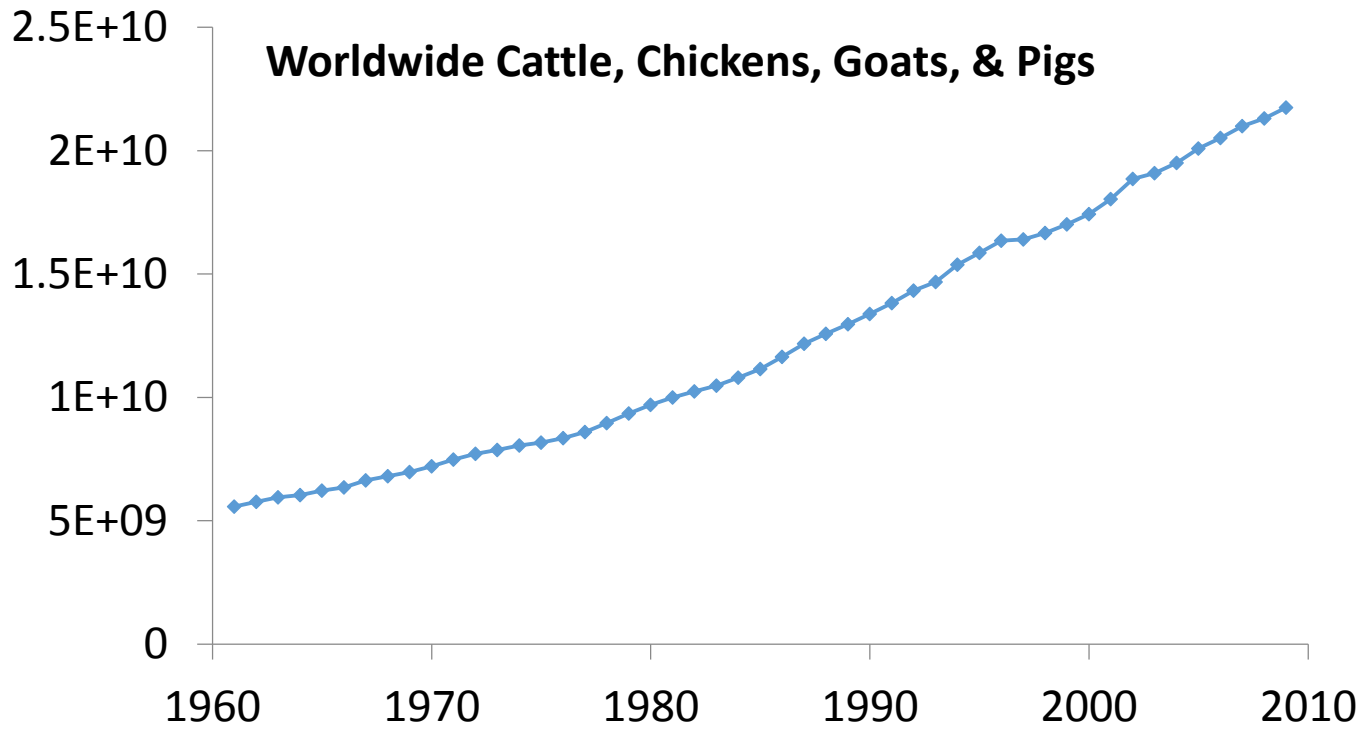


UN, 2008





# Driver of Change: \$ = Meat Consumption

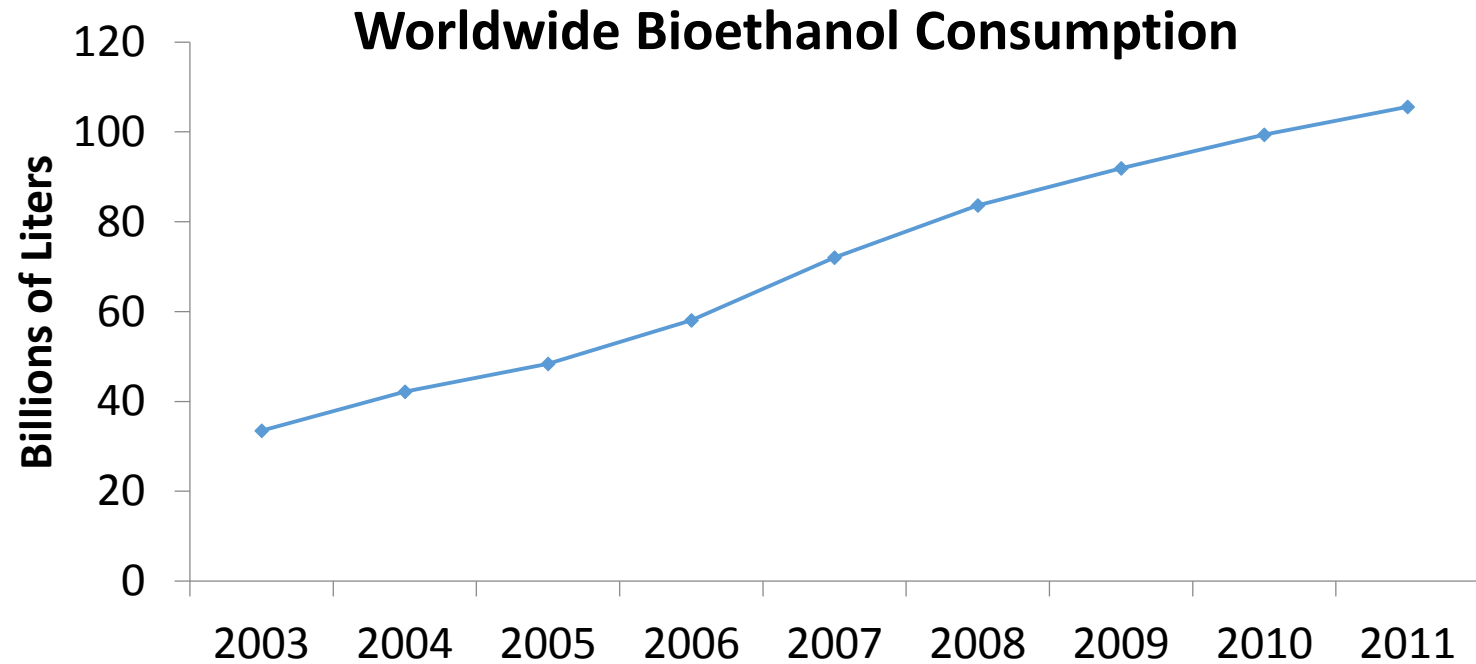


FAO, 2011





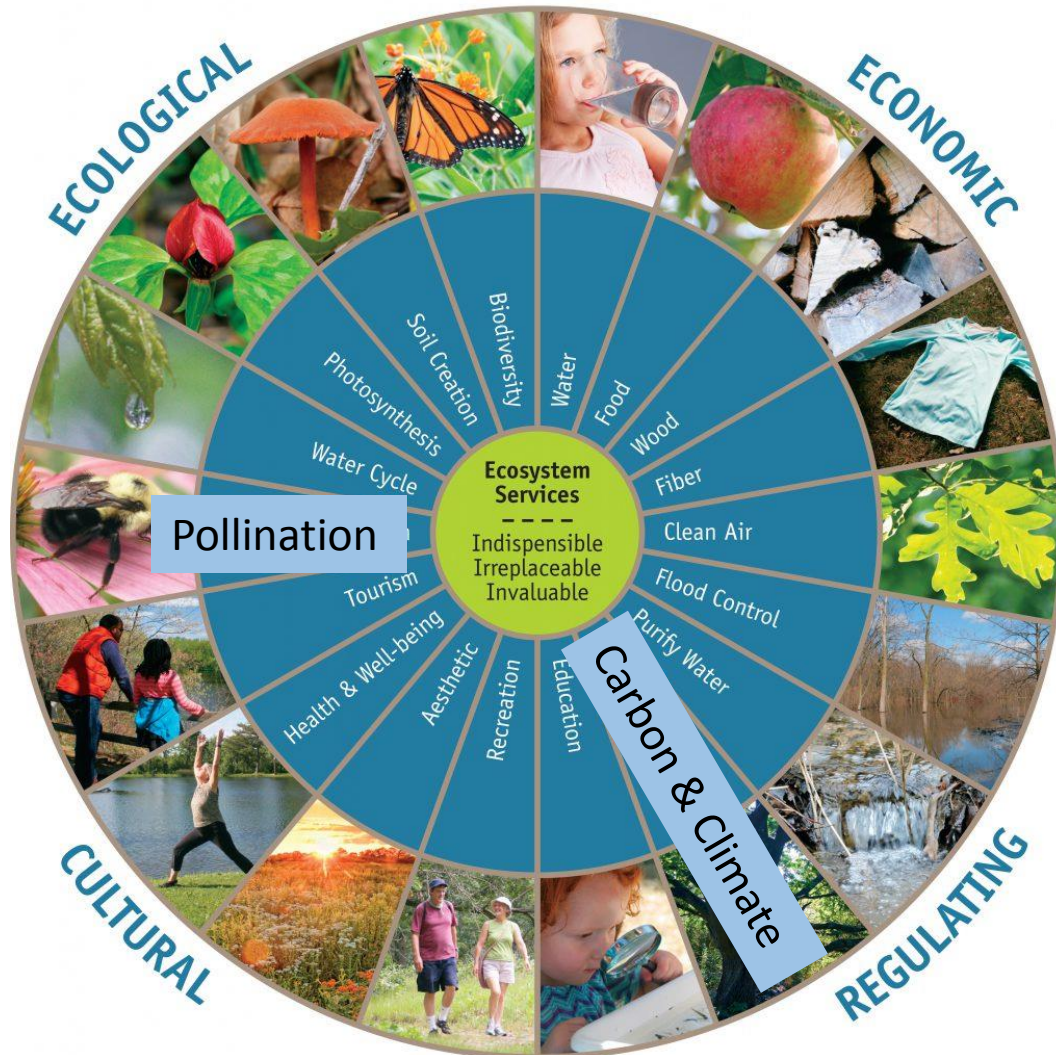
# Driver of Change: Policy e.g. Biofuels



OECD, 2012



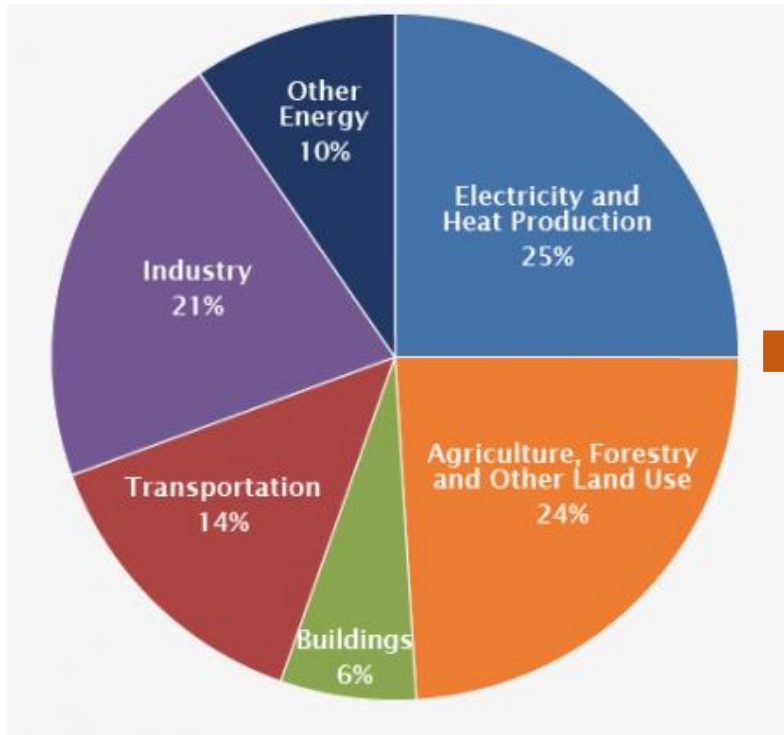
# Industrialized agriculture can disrupt ecosystem services





# Agriculture – Climate Change – Our Health

## Greenhouse Gas Emissions



IPCC 2014

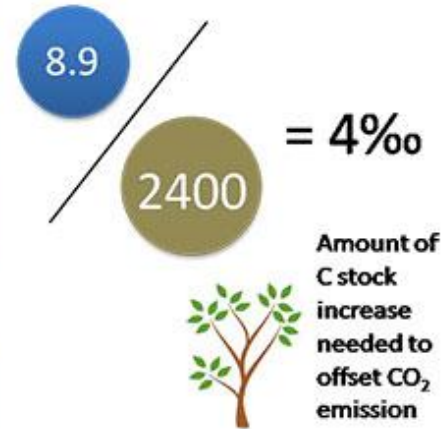
## Lead to Climate Change & Threaten Food Production



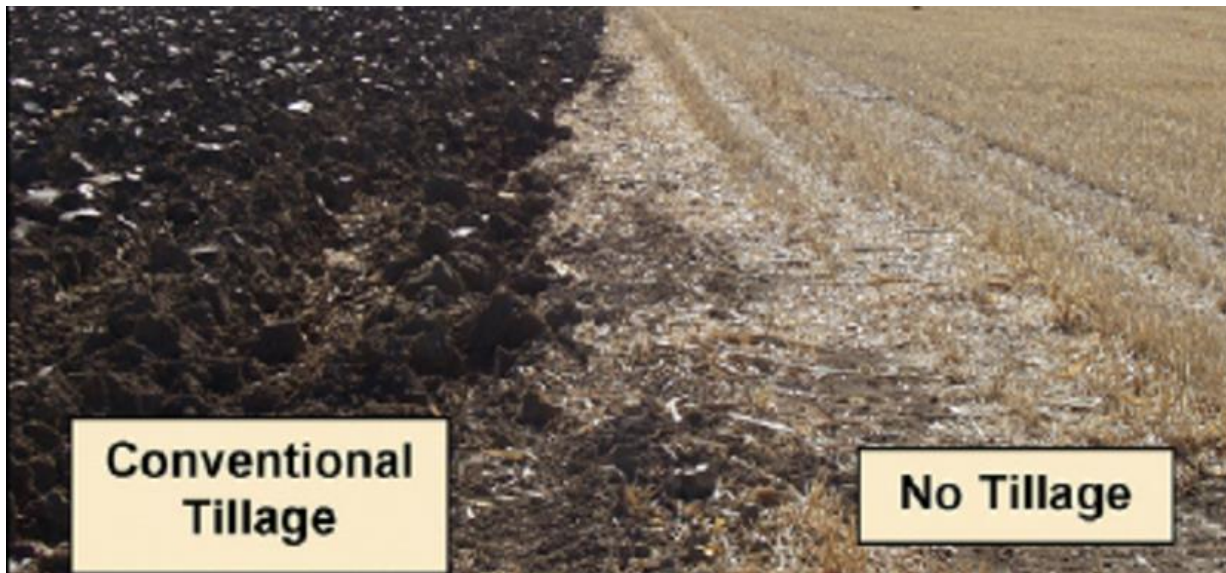
<https://climate.nasa.gov/effects/>

# Can no-till agriculture mitigate climate change?

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

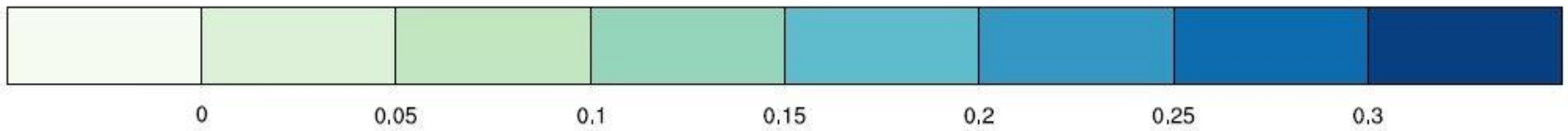
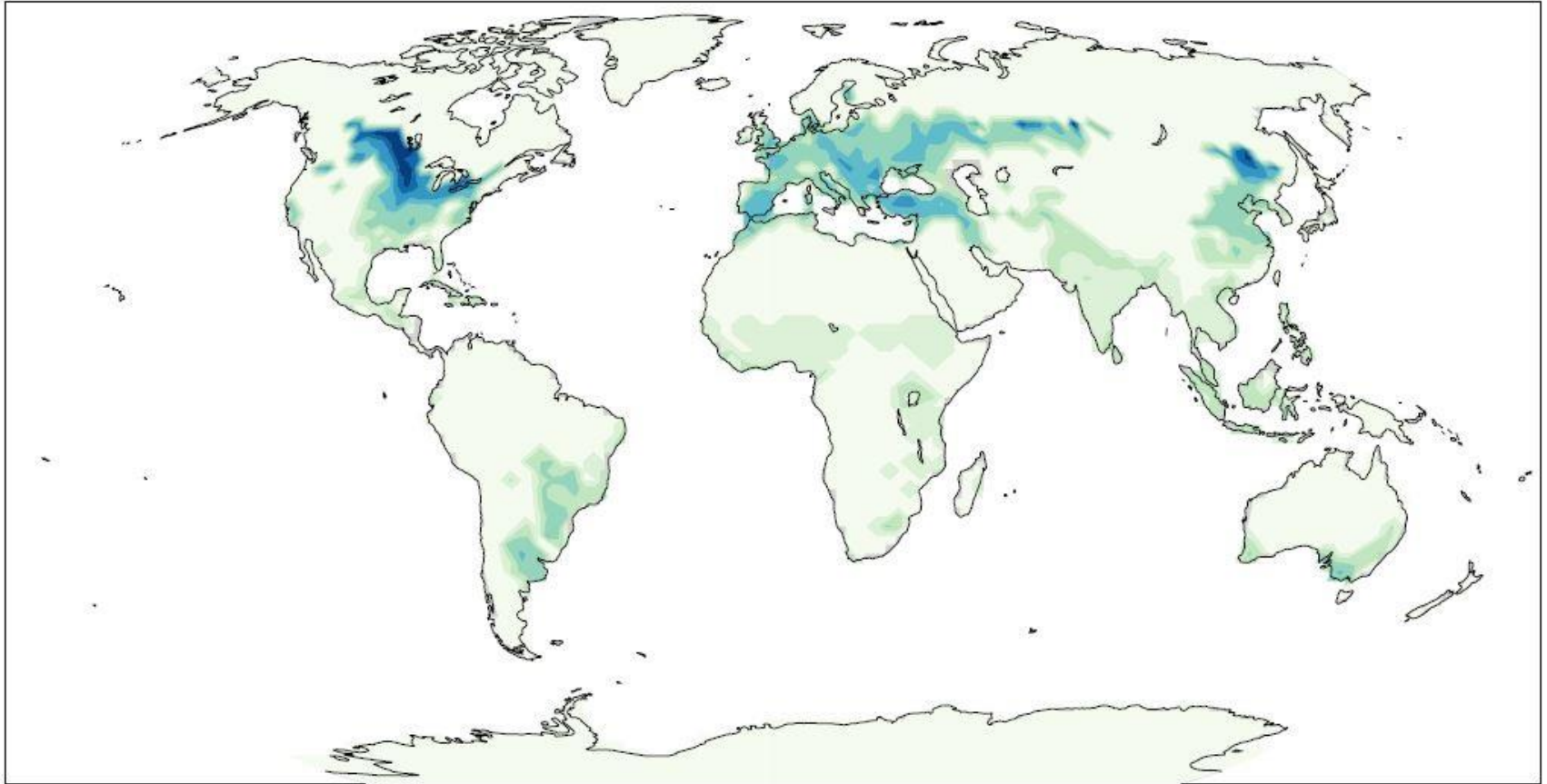


From Minasny et al., 2017



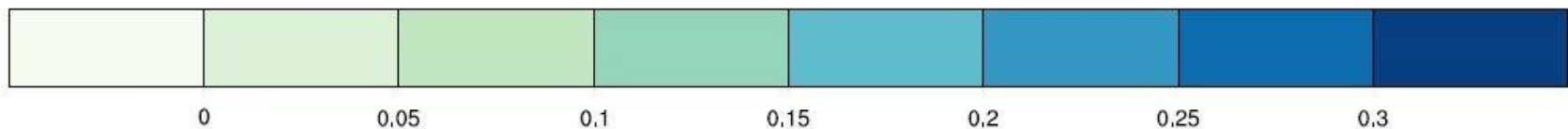
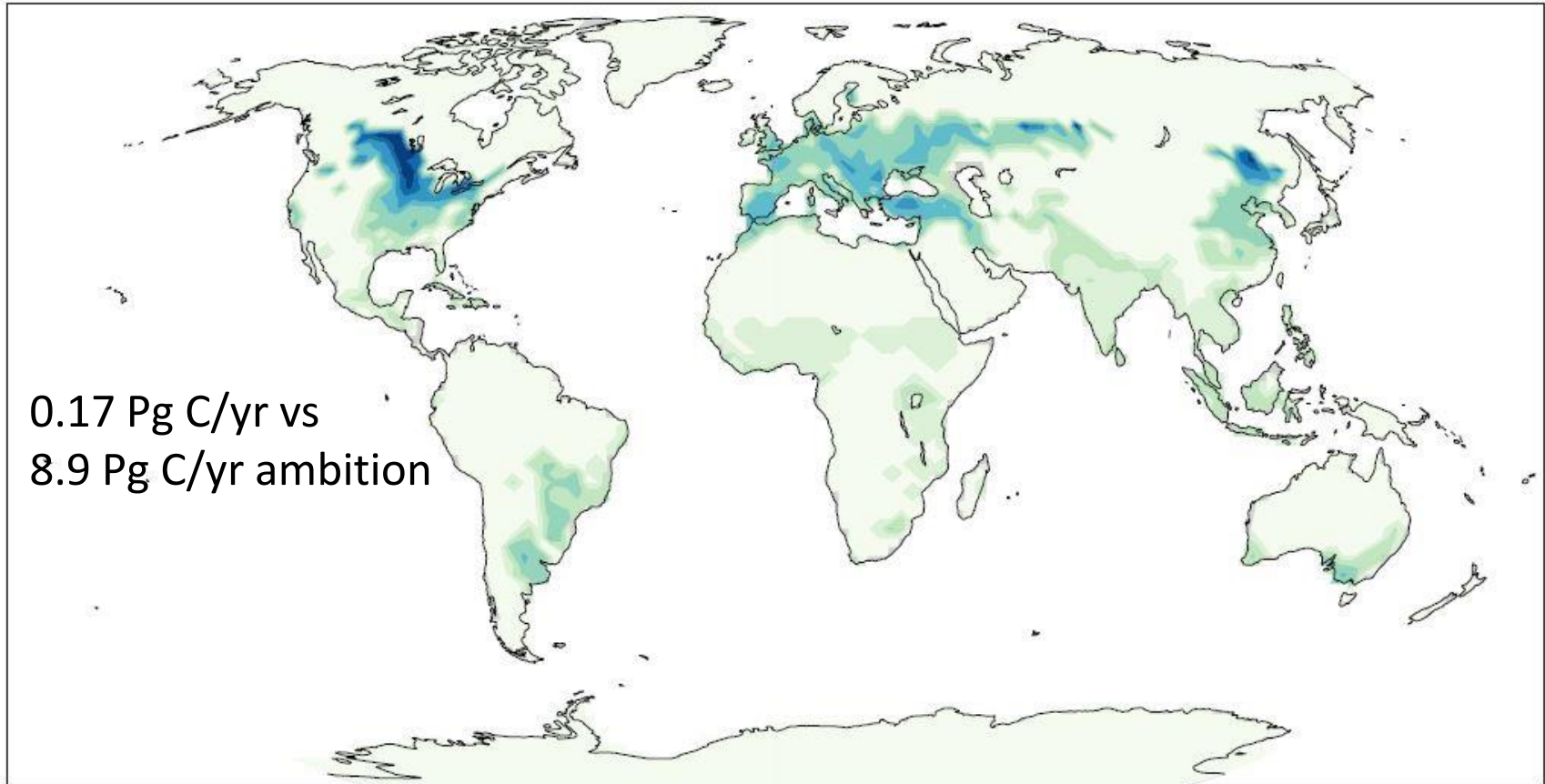
Strudley et al., 2008





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 CO<sub>2</sub> emissions



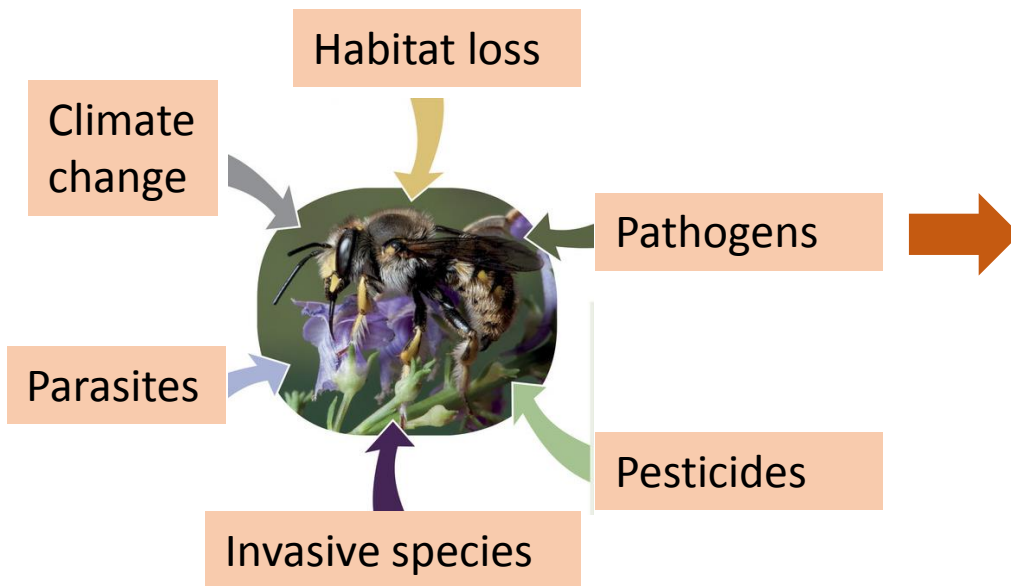
Average Annual Change in Total SOM Carbon per hectare of cropland ( $\text{Mg C ha}^{-1} \text{ yr}^{-1}$ )



# Agriculture – Pollination – Our Health

60% of pollinator species in decline

Threatens our most nutritious foods



Brown et al. Peer J., 2016

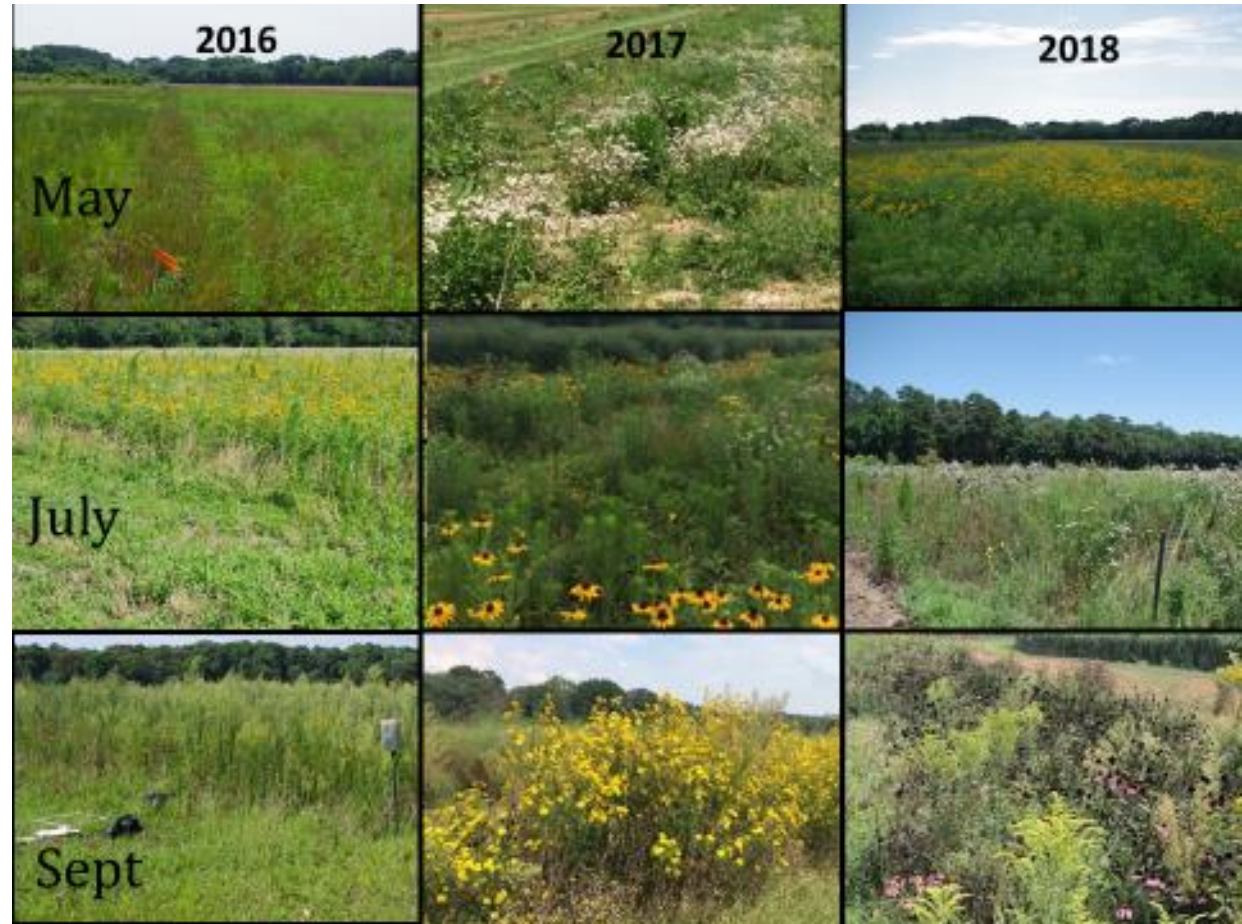


[Blog.blueapron.com/americas-tiny-farmers](http://Blog.blueapron.com/americas-tiny-farmers)

# Can restoring pollinator habitat preserve pollination?

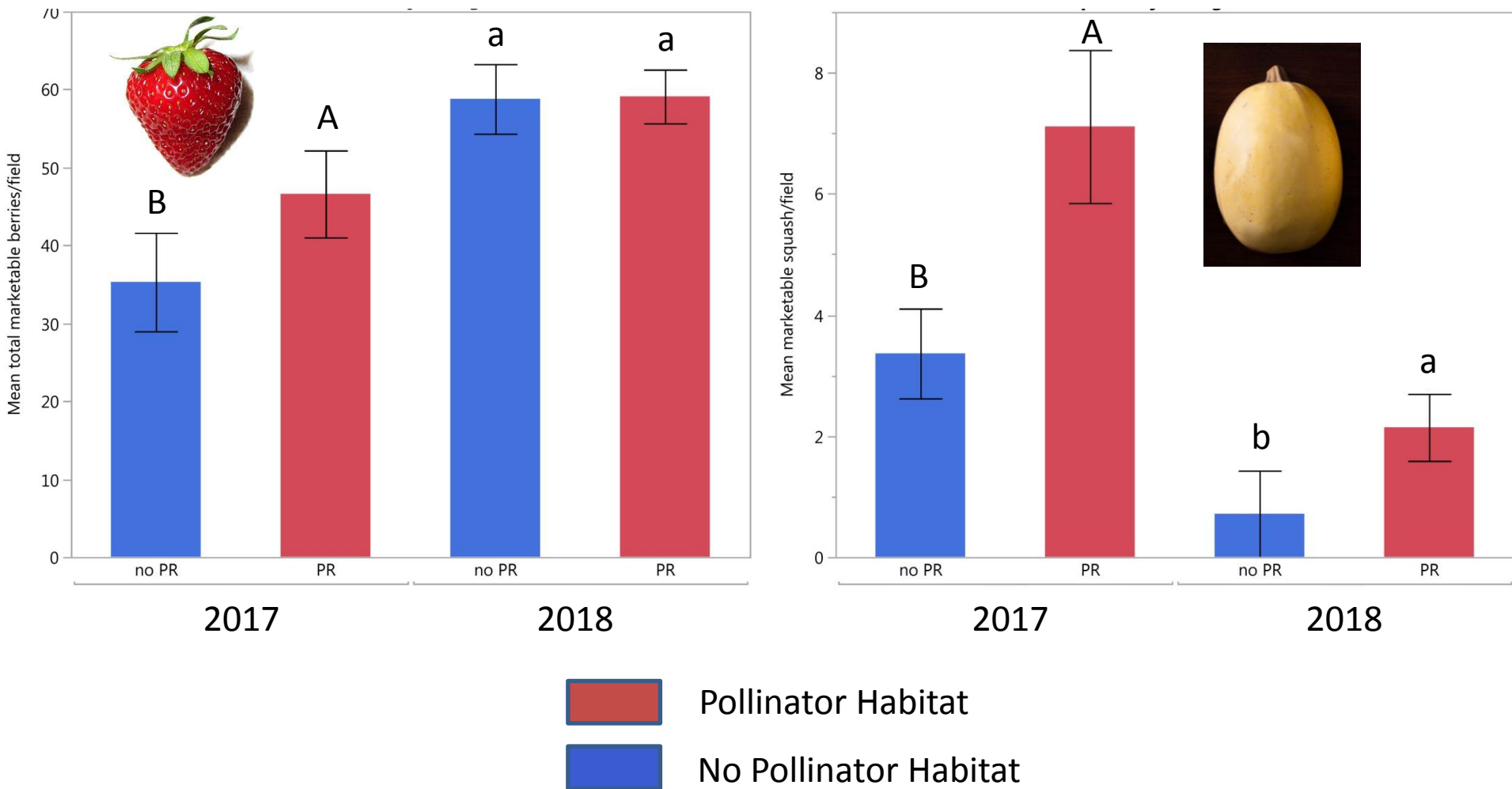
White House  
Pollinator  
Partnership Action  
Plan (2016)

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