

Hutchins, Franya

FST Project and Report: Climate Change and Foodborne Illness (lecture powerpoints)

UCO 1200 Navigating the Food System (4 class periods of 75 minutes each)

10/26/2014

[Lecture 1: Climate Change and Agriculture Introduction]

Climate Change and Agriculture



CSPAN: June 18, 2014

Four former Republican Environmental Protection Agency administrators were among the witnesses at a hearing on efforts to address global climate change.

The former administrators, invited by Senator Sheldon Whitehouse (D-RI), supported efforts to address climate change.



William Reilly (Bush 1989-93)

Lee Thomas (Reagan 1985 - 89)

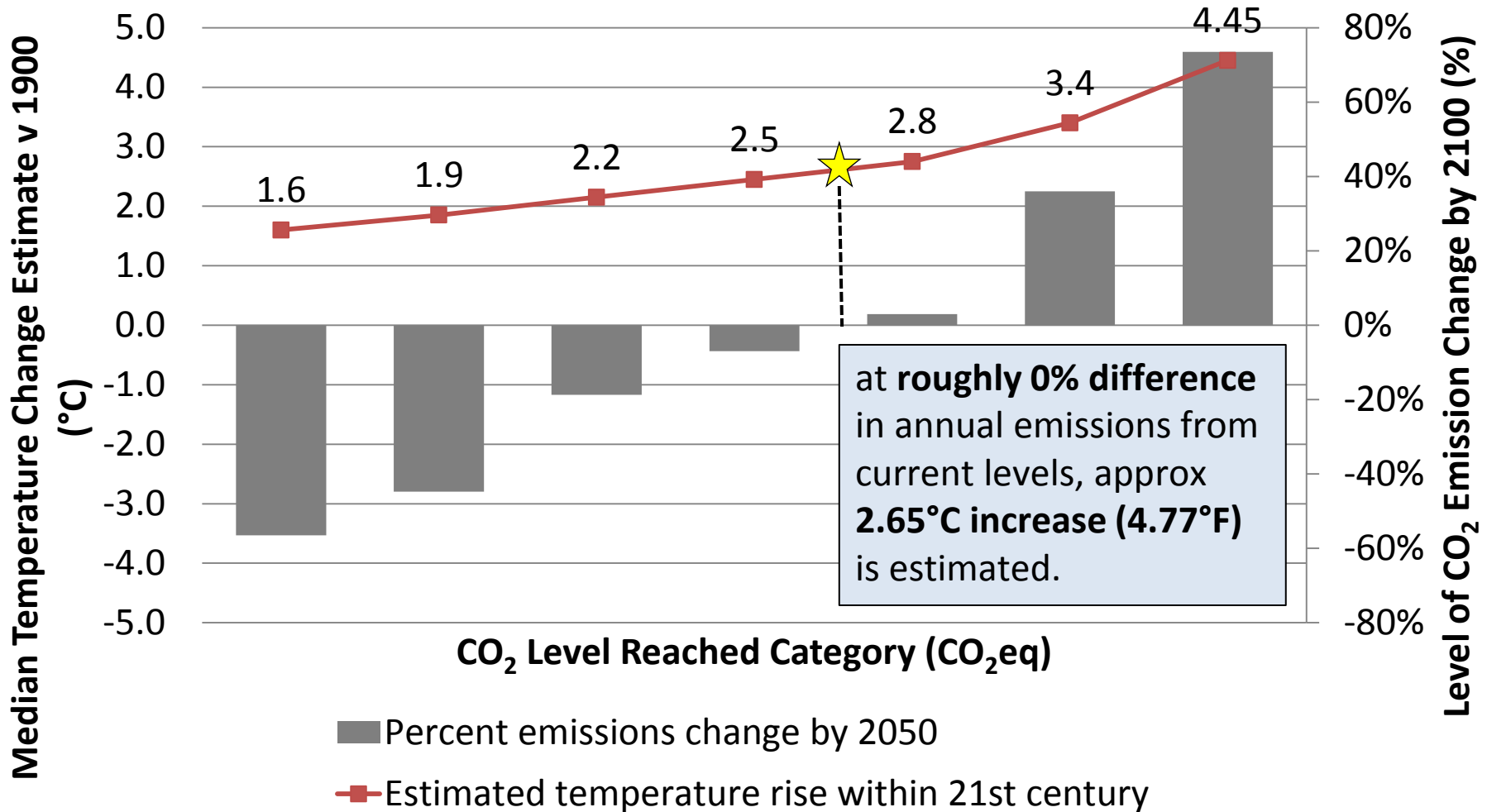
[Sen. Sheldon Whitehouse]

Christine Todd Whitman (Bush 2001-2003)



William Ruckelhaus (Nixon/Reagan)

CO₂ Emissions Change between 2010 - 2050 *versus* Estimated Global Temperature Rise During 21st Century



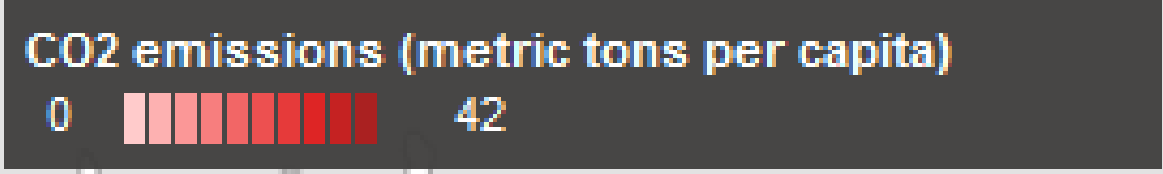
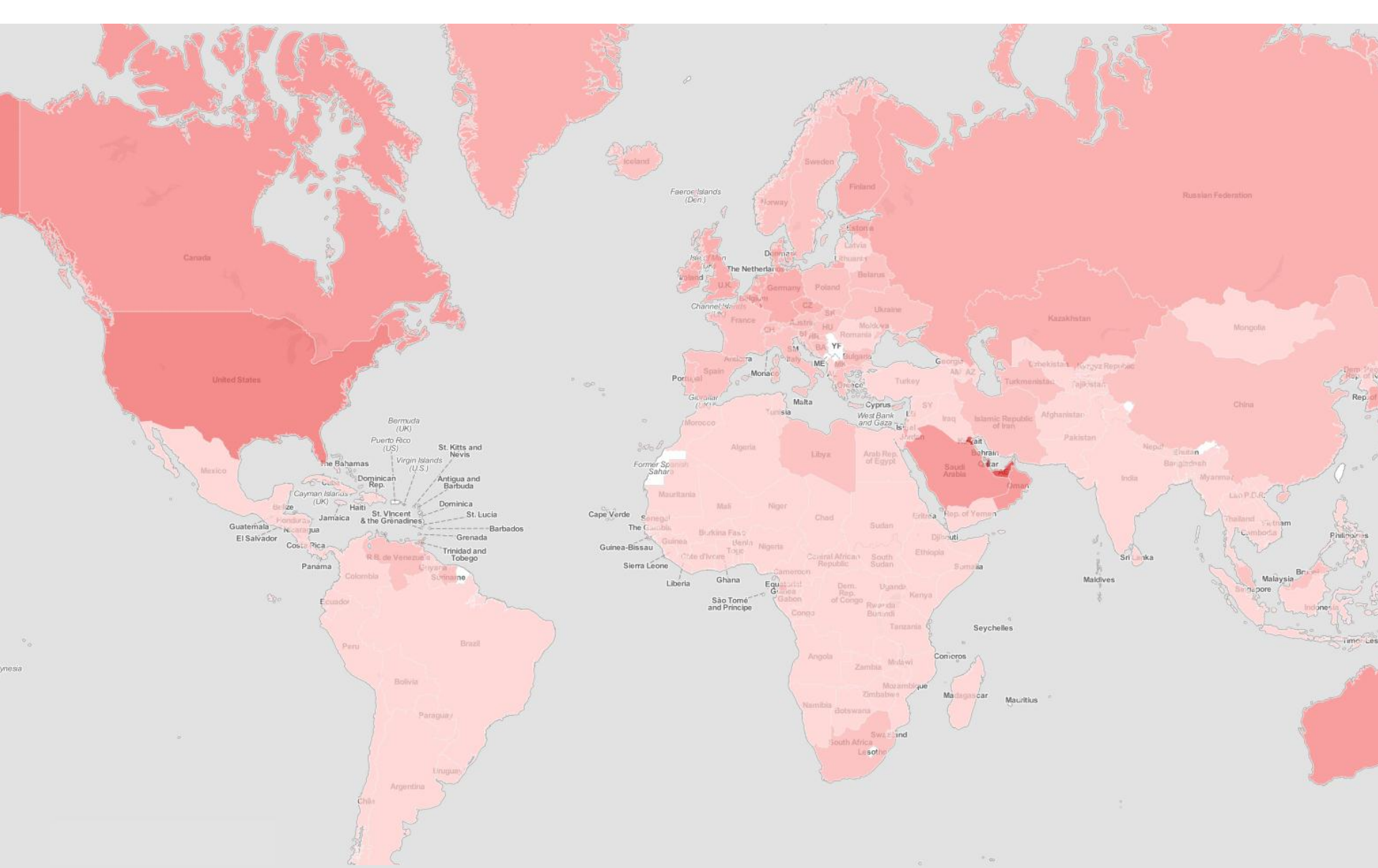
Citation: CO₂ Emissions Change between 2010 - 2050 *versus*
Estimated Global Temperature Rise During 21st Century

Adapted from:

Intergovernmental Panel on Climate Change, 2014: Summary for Policymakers, In: *Climate Change 2014, Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*

[Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)].

Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

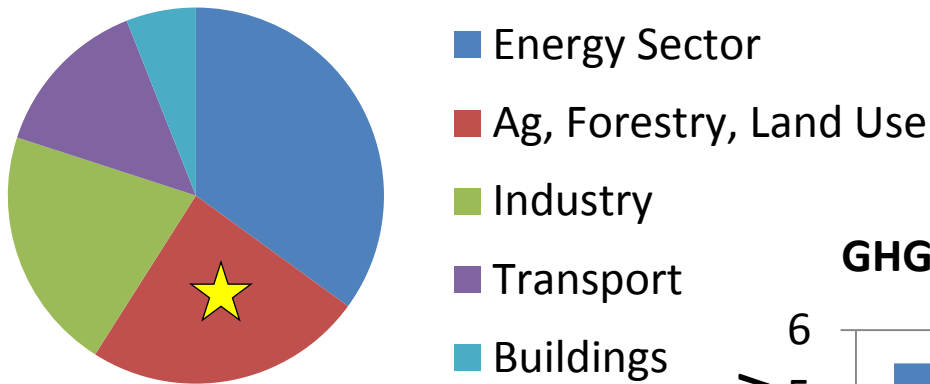


World Bank, 2014

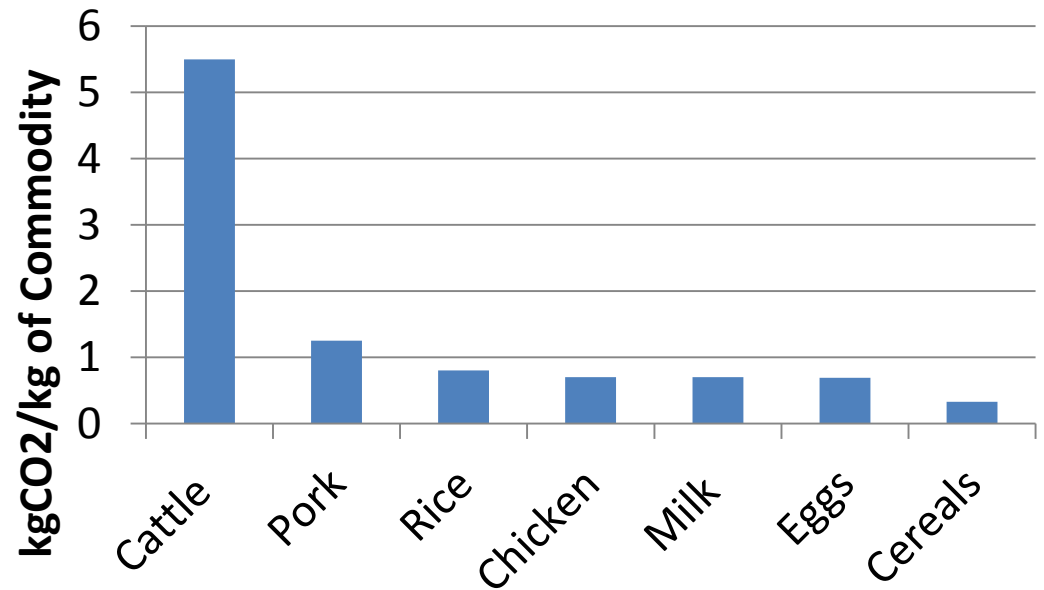
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How agriculture contributes

Percentage of Total GHG Emissions by Sector



GHG Emissions per kilogram of Product



Effects on Agriculture

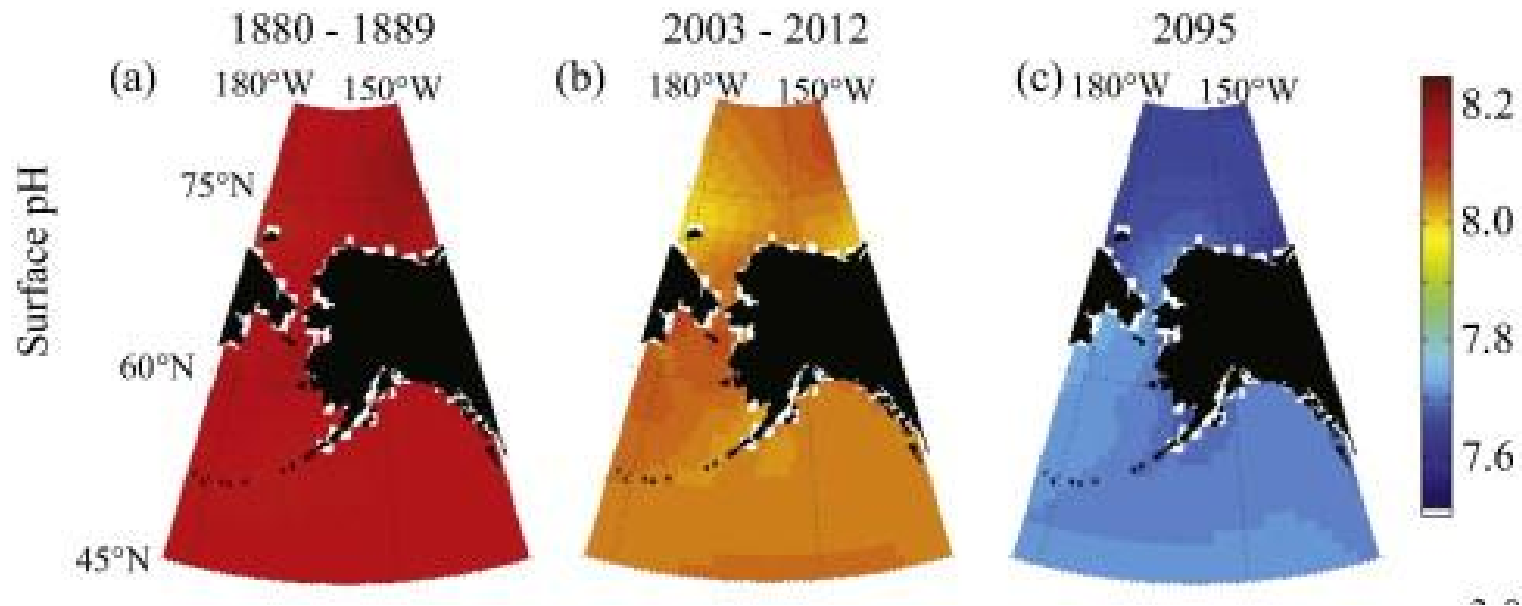


Droughts, flooding, seawater intake,
hail damage...



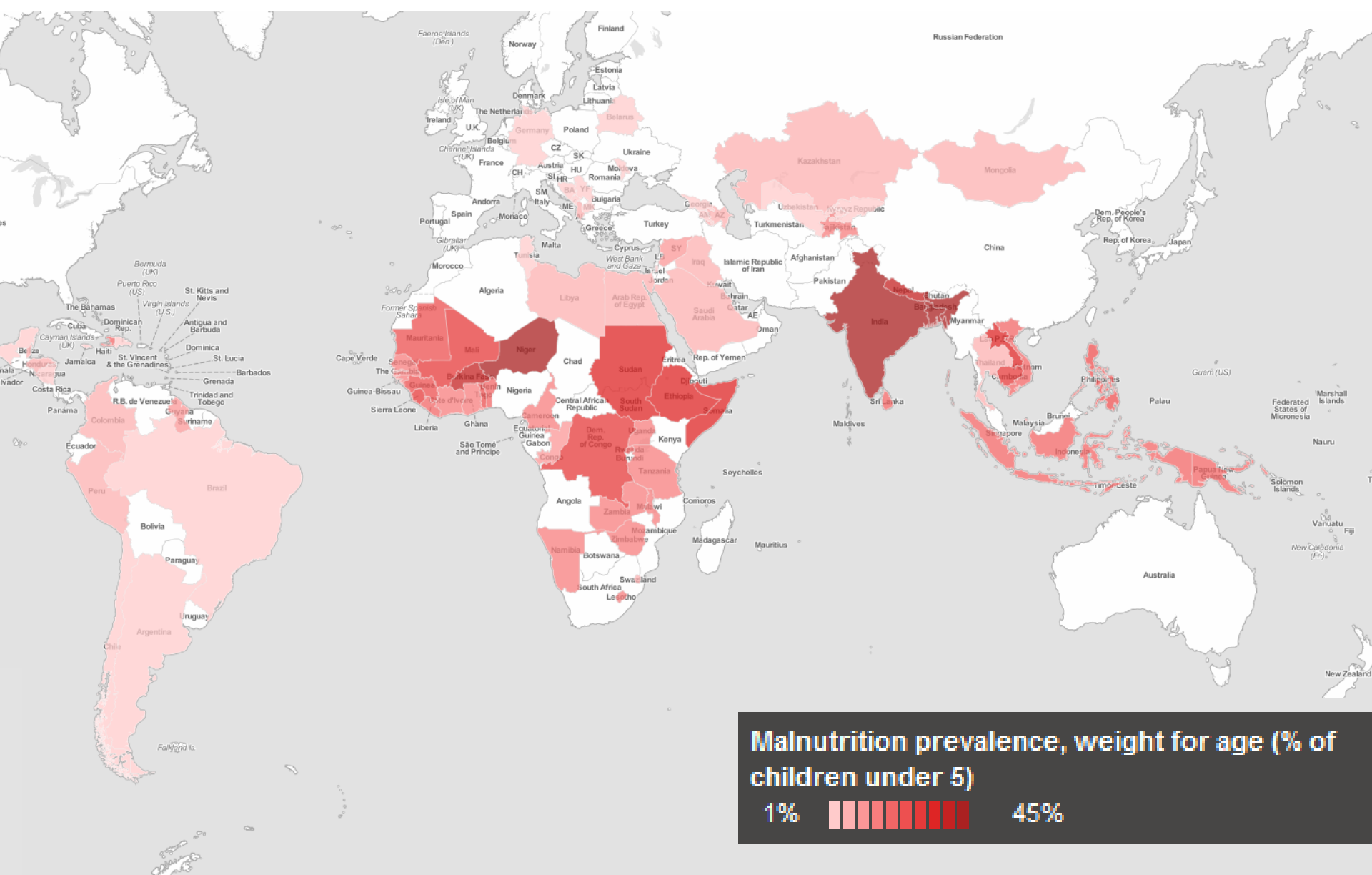
Ocean acidity level (Alaska) comparison of averages:

- 1880's to 2000's represents a drop of 0.10 to 0.14
- 2000's to 2095 estimated at an additional drop of 0.34 to 0.37



J.T. Mathis , S.R. Cooley , N. Lucey , S. Colt , J. Ekstrom , T. Hurst , C. Hauri , W. Evans , J.N. Cross , Ocean acidification risk assessment for Alaska's fishery sector. *Progress in Oceanography*, 2014.

[Lecture 2: Food Security]



Malnutrition prevalence, weight for age (% of children under 5)

1% 45%

World Bank, 2014

Components of Food Security

- Availability of natural resources
- Population density and increased demand
- Climate
- Global food price volatility and trade
- Socioeconomic barriers



Atmospheric Carbon Dioxide

- Effects on crop yield and weed competition is species specific
- Confounding factors include change in temperature, water availability, and extreme weather
- Ex/ Valerio et al. 2013, Ziska 2012



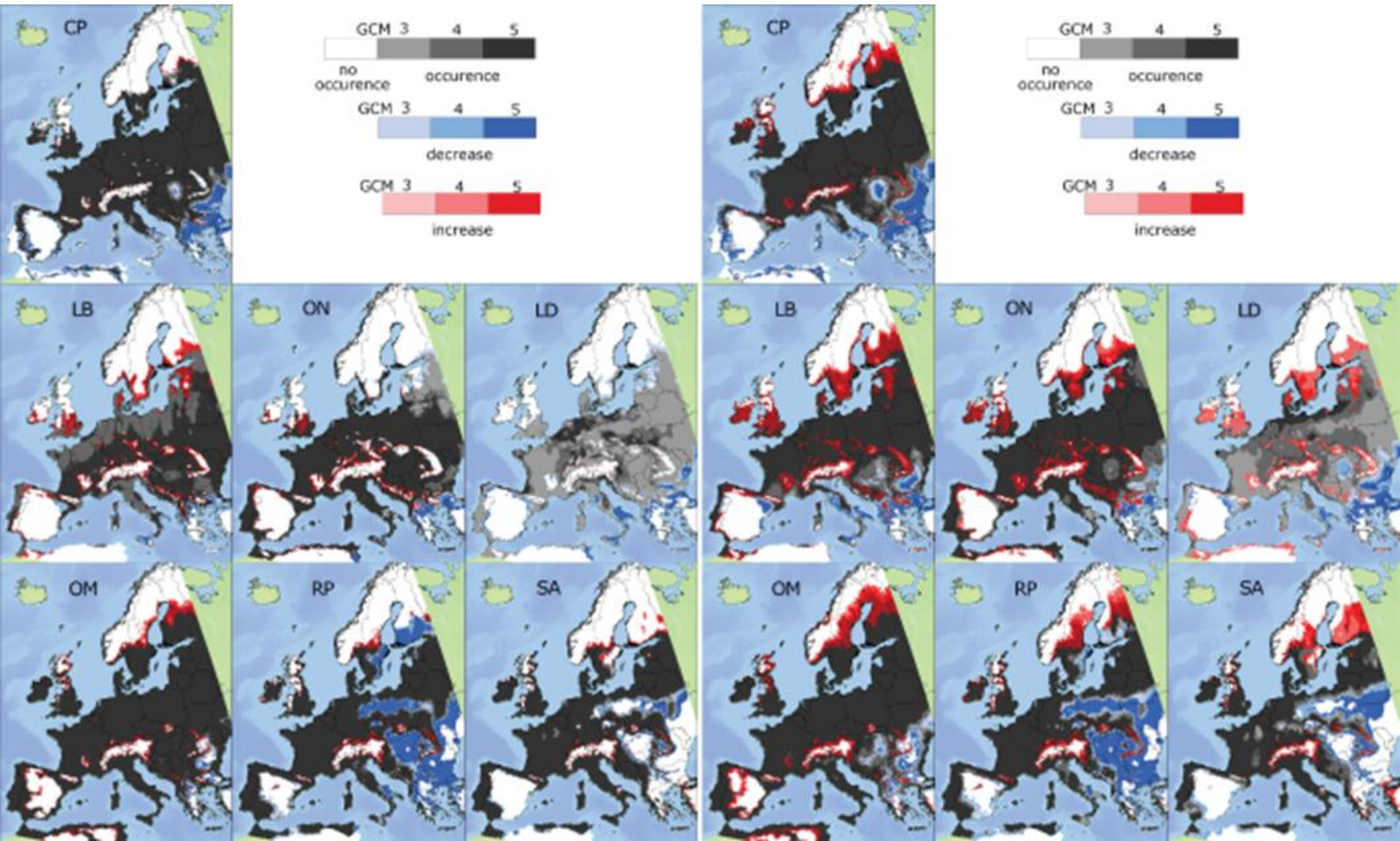
Heat

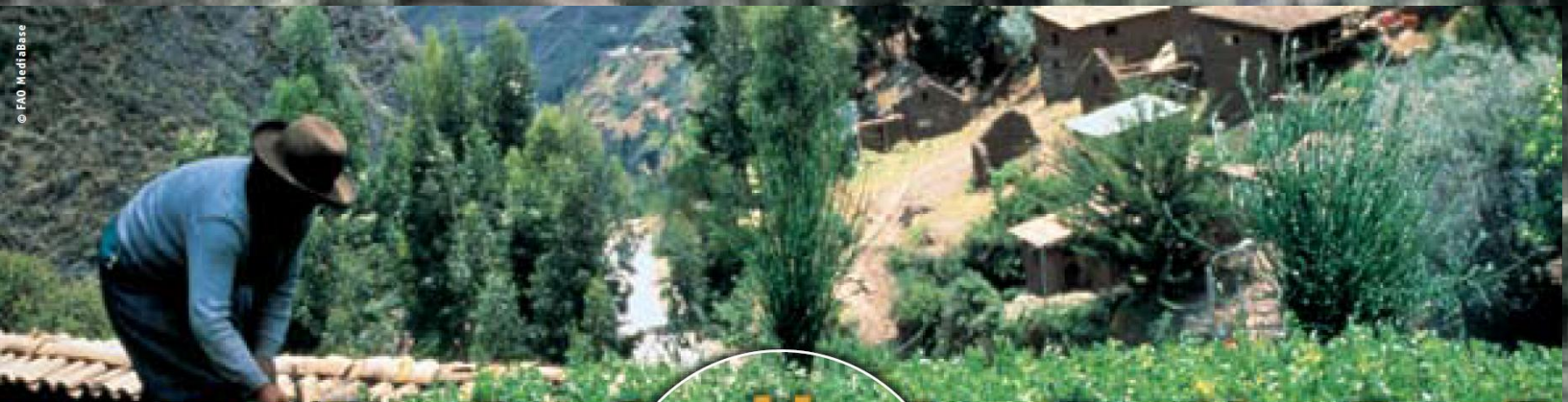
- Heat stress threaten livestock populations
- droughts (as well as seawater intake) can also reduce the amount of water available for irrigation
- “Frost-free days” per year across the US is anticipated to increase.
- Soil erosion

Pests and Pesticides

- Range expanding for some pest species as they can survive and overwinter in new (warmer) areas
- Has been connected with increases in pesticide use as well
- Ziska et al., 2014 evaluated the connection between temperature and pesticide use in the US
- Svobodová et al., 2014 mapped potential changes in climate suitability for various crop pests in Europe (next slide)

Determination of areas with the most significant shift in persistence of pests in Europe under climate change, Svobodová et al., 2014



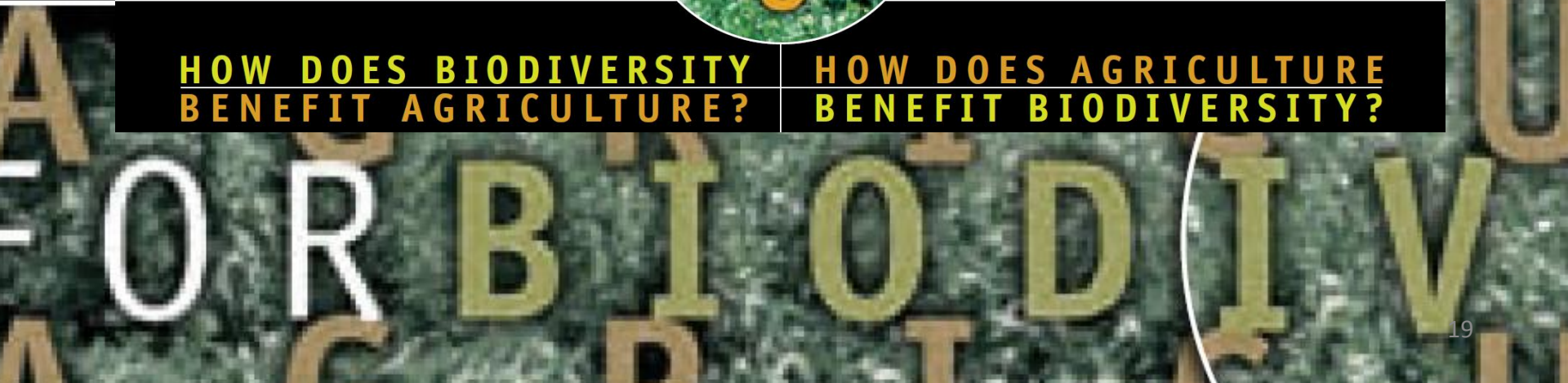


© FAO Mediatbase

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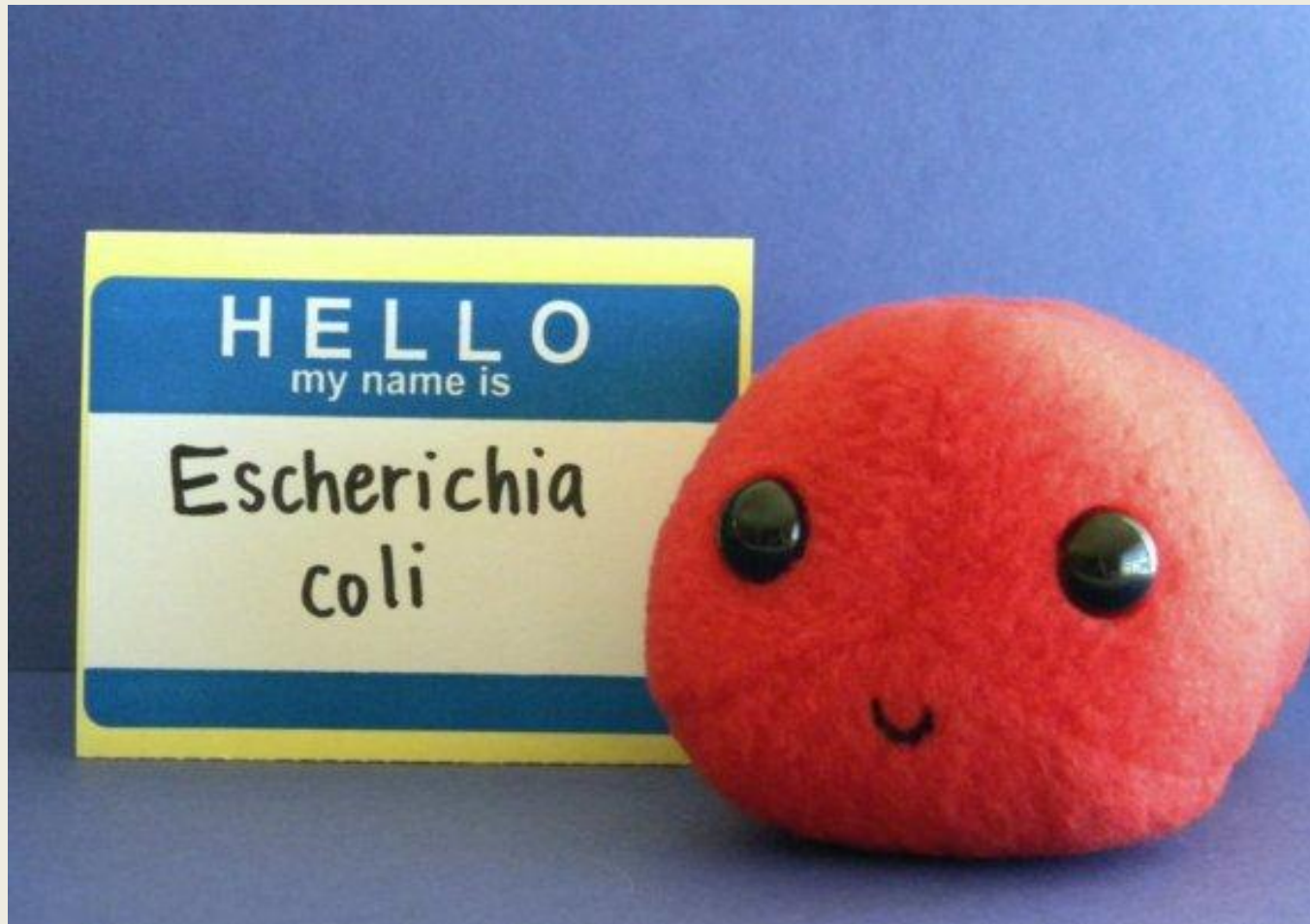
**HOW DOES BIODIVERSITY
BENEFIT AGRICULTURE?**

**HOW DOES AGRICULTURE
BENEFIT BIODIVERSITY?**



[Lecture 3: Food Safety]

Food Safety

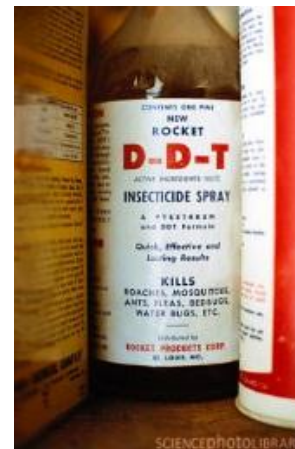
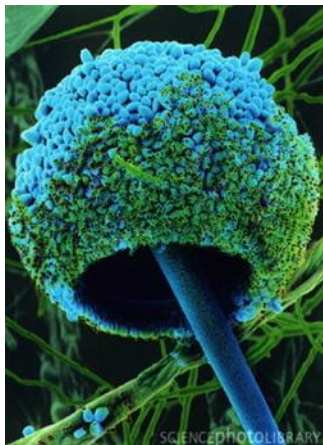


- **Food Security:**

“access by all people at all times to enough food for an active, healthy life.” (USDA)

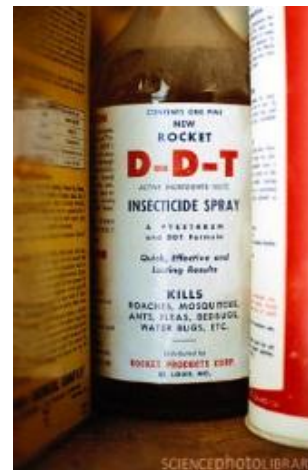
- **Food Safety:**

Manage pathogens, toxins, physical hazards (not necessarily the same as spoilage!)



Basics

- Hazards considered are:
 - Biological
 - Chemical
 - Physical
- Contamination all along the food system



Pathogens, toxins, other hazards

Biological

- Bacteria
- Viruses
- Parasites

Chemical

- Agricultural
- Mycotoxins
- Elements
- Additives

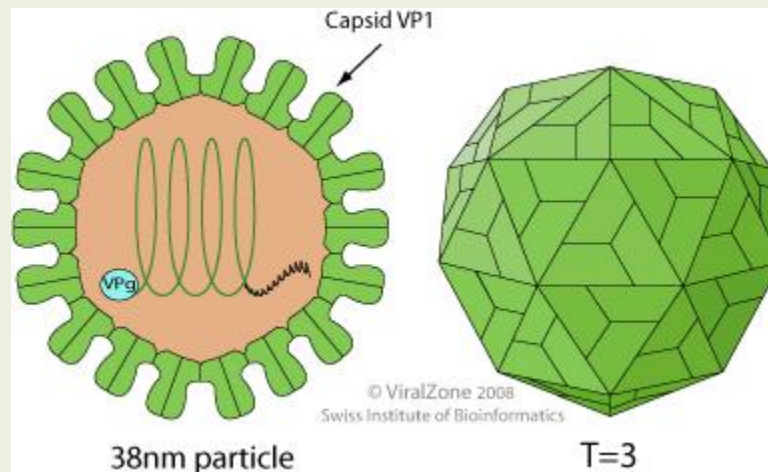
Physical

- Glass
- Wood
- Rocks
- Bugs (“Filth”)
- Etc!



Biological Hazards

- Living (pretty much)
- Have requirements for growth
- Food can be medium for growth (bacteria) or transmission (parasites and viruses)



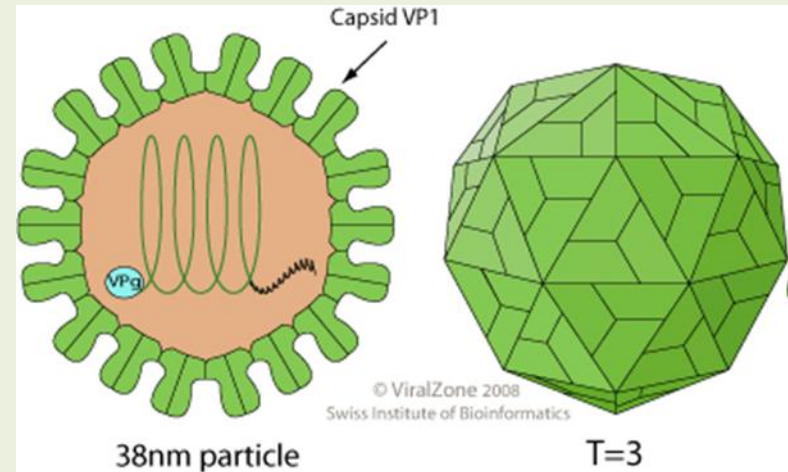
Biological Hazards: Bacteria



- Infection, Intoxication, or both
- Contamination possible from soil, water, animal contact, processing facility, human contact
- Ex/ *Escherichia coli* 0157:H7, *Listeria monocytogenes*

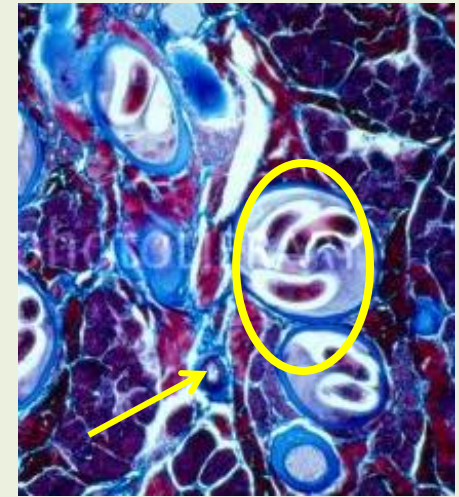
Biological Hazard: Viruses

- Ex/ Norwalk, Hepatitis A
- Do not grow without host (don't grow in food)
- Transmitted via food (yuk!) – typically from ill food handlers



Biological Hazard: Parasites

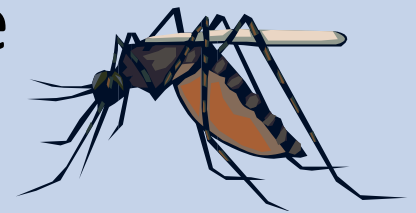
- Protozoa and worms
- Often due to water contamination or found in meat
- Ex/ *Trichinella spiralis*
 - Roundworm found in undercooked pork
 - Destroyed by cooking to 155°F
 - Larvae develop in human intestine, then burrow out (ah!)



*Larvae in
muscle*

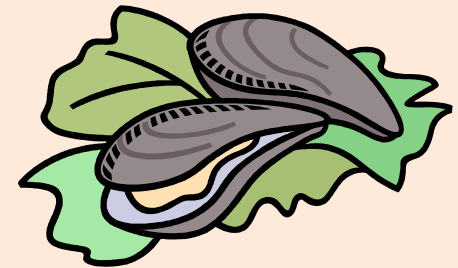
Climate and Biological Hazards

- Severe weather events
 - Incapacitation of infrastructure in natural disasters
 - Contamination of water and crops via flooding
- Change in disease range or incidence
- Vector-borne diseases
 - Vectors (blood-feeding arthropods) are cold blooded and therefore sensitive to climate
 - Ex/ Malaria, Yellow Fever, Dendue Fever, West Nile



Chemical Hazards

- Hazards:
 - General chemical contamination: pesticide residue, mercury, etc
 - Mushroom toxins
 - Mycotoxins
 - Seafood toxins
- Controls:
 - EPA guidelines for many chemicals
 - Careful food storage



Climate and Chemical Hazards

- Increased herbicide, pesticide, fungicide use
- Increased agricultural runoff due to heavy rains leading to nutrient pollution
- Increased incidence of natural toxins
- Increased animal stress and antibiotic use



Three-day water ban in Ohio lifted, BBC News



[Hungry FDA Official Orders Massive Pot Pie Recall](#) 2:11

The FDA is urging all Americans in possession of flaky, delicious pot pies to turn them in to FDA headquarters as soon as possible.