Environmental Services of Agricultural Lands

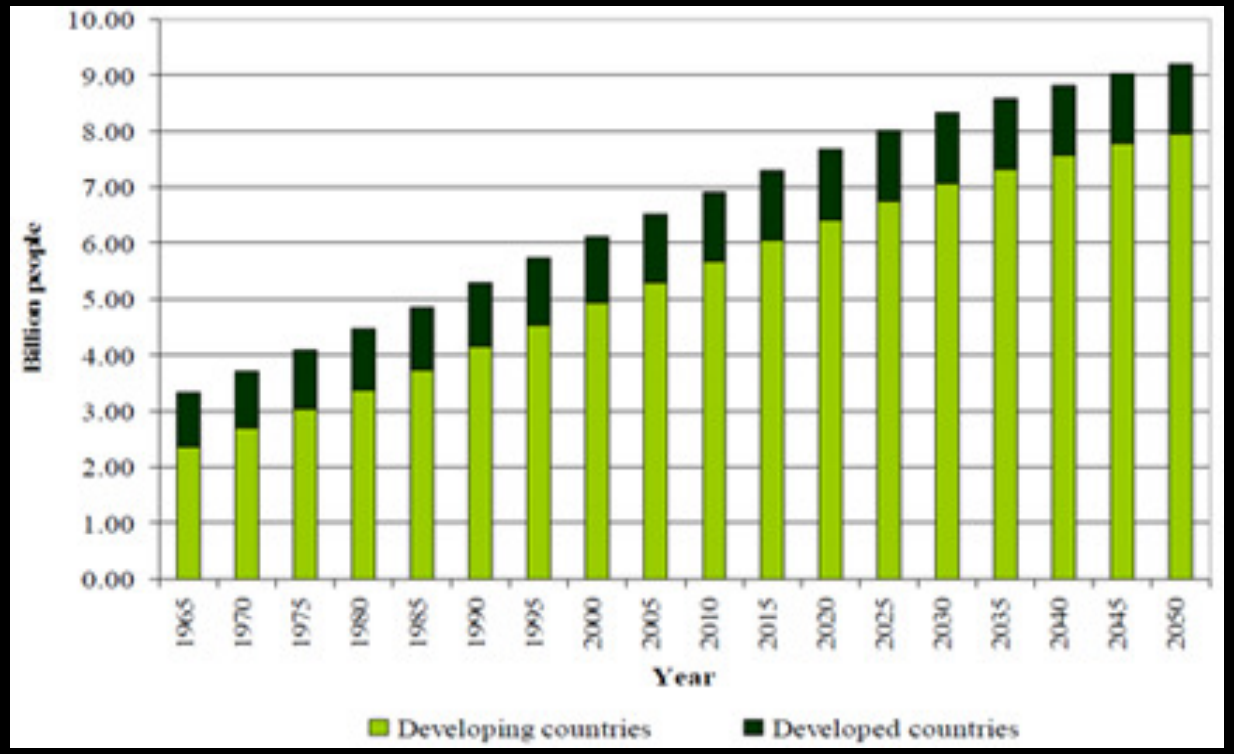
- 80+% of precipitation continental US on private lands
- Vast majority of biodiversity – particularly ESA
- Key opportunity to reduce GHG emission/sequester
- Not to mention food, fiber and fuel
- It’s where I recharge

Conservation Challenges of Last Century

Conservation Challenges Today

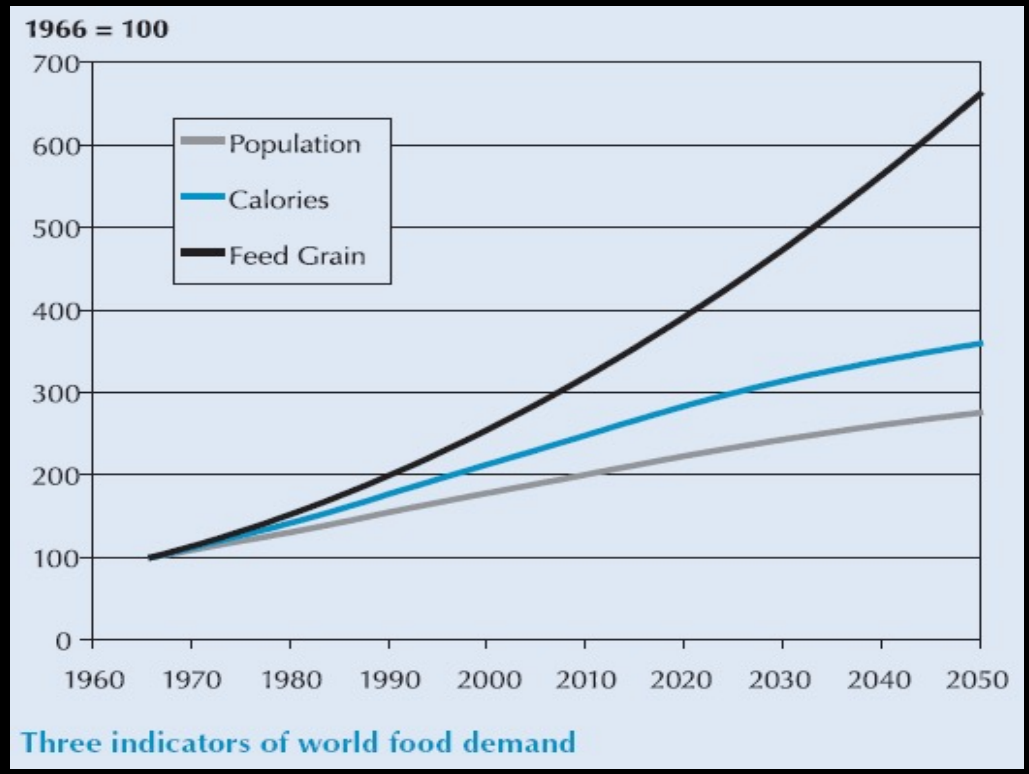
Drivers of Food Demand

World Population 1965 - 2050



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat 2017

Factors Contributing to Increased Food Demand

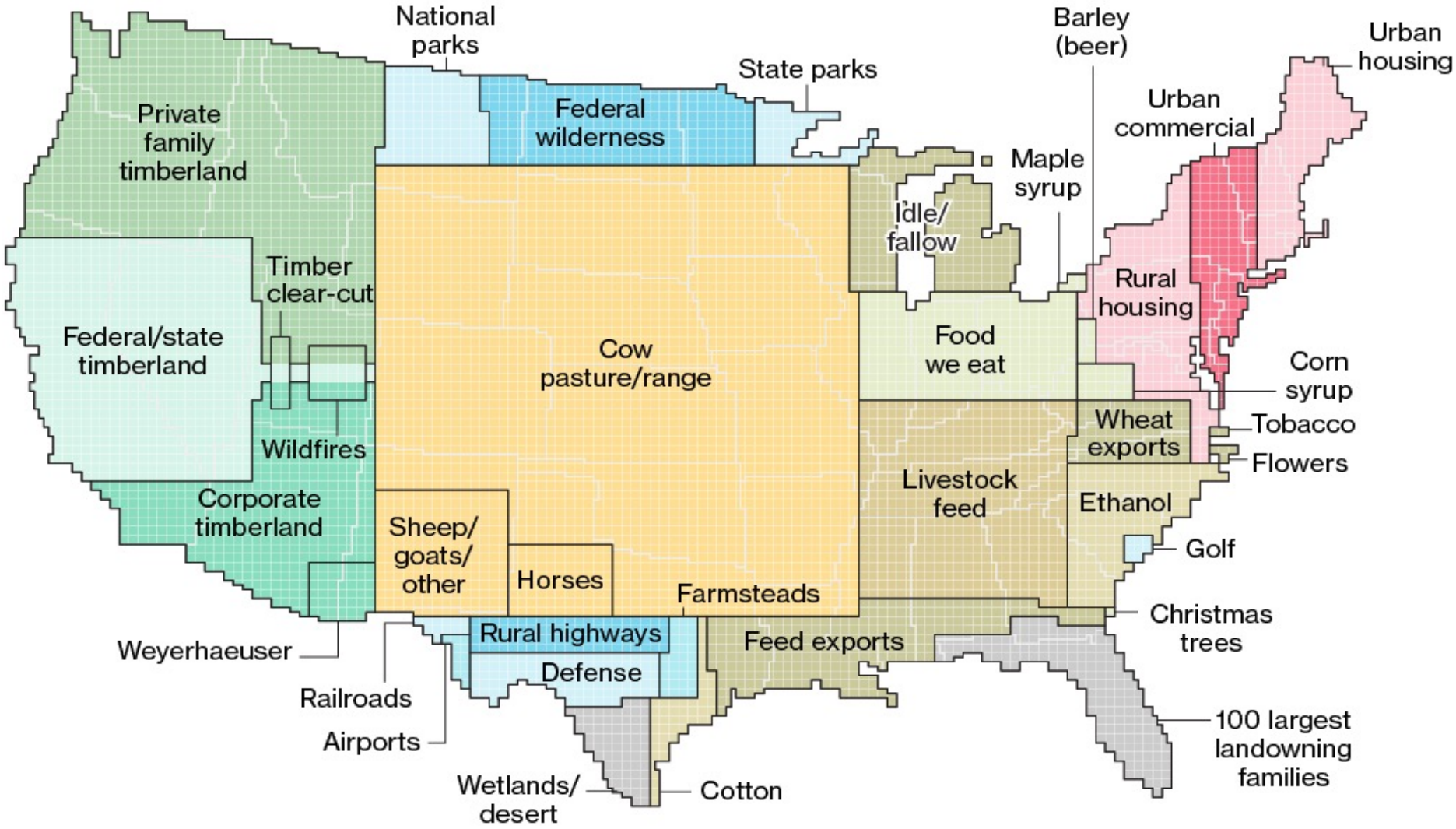


Source: Iowa State; Bruce A. Babcock

Threats to Agriculture

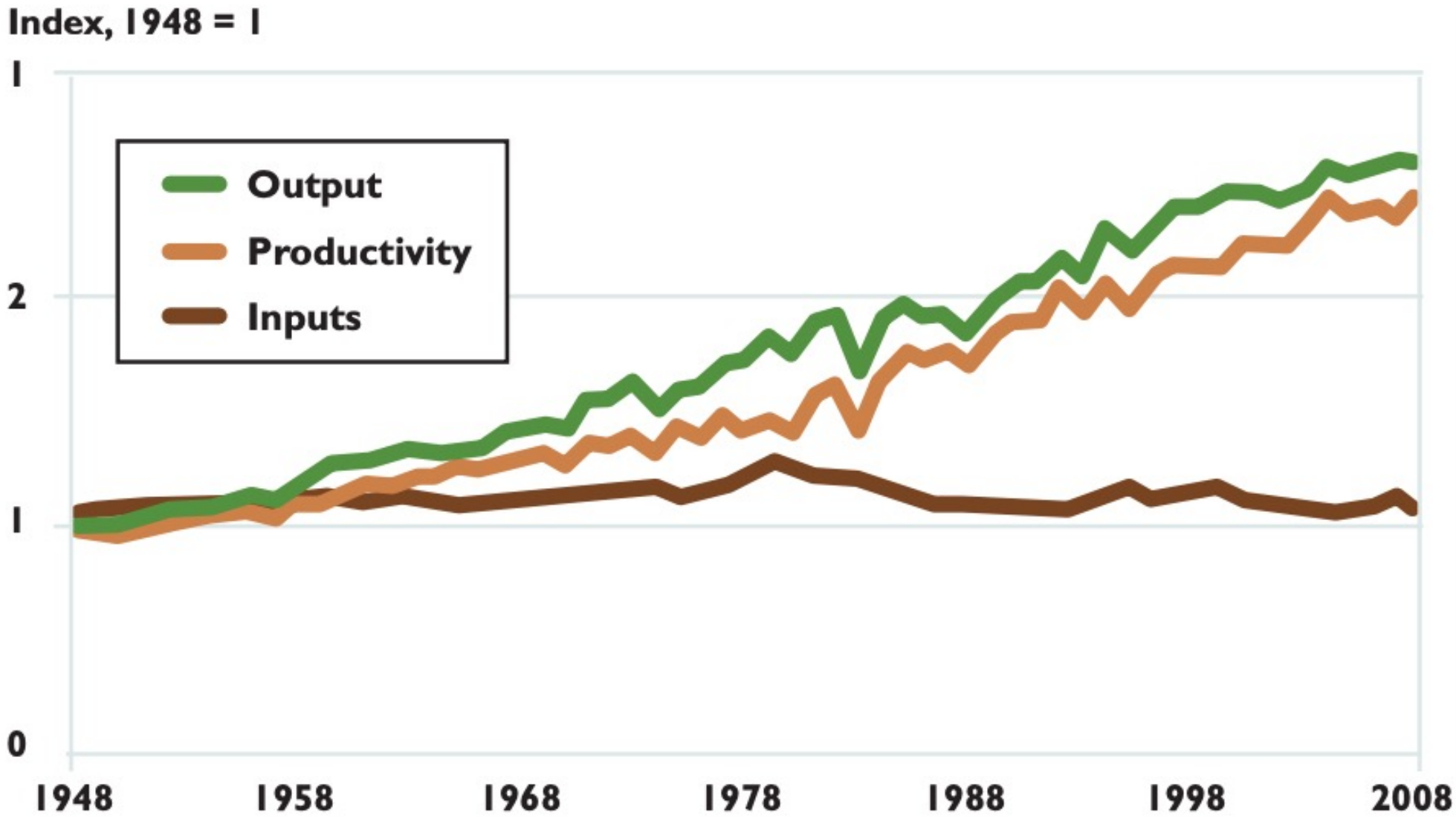
- Farmland Loss
  - Between 1992 and 2012, almost 31 million acres of agricultural lands were converted to non ag use
- Massive Intensification of Farmland
  - Millions of acres of new tile drainage added
  - Millions of acres of rangeland conversion
  - Landscape intensively managed
- Farm Economy in Trouble?
  - Commodity prices volatile
    - 3 years ago just above half of what they were 5 years before
    - Today near record highs
- Social Challenges
  - Farmer suicide rate exceeds (double?) that of Gulf War veterans
  - Age of farmers
  - Internet challenge

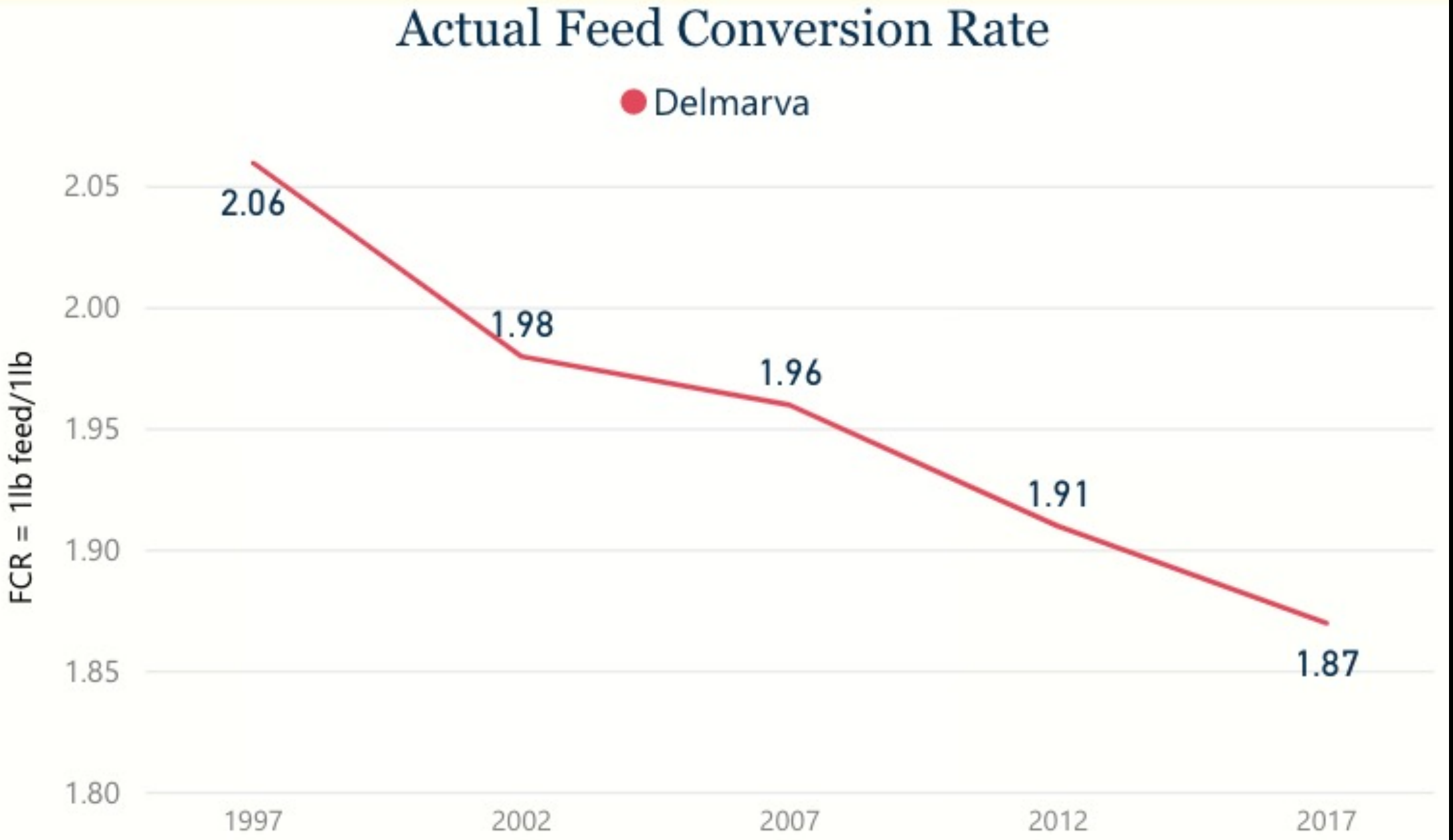
US Land Use



Source: www.bloomberg.com/graphics/2018-us-land-use/img/2018-us-land-use

U.S. Agricultural Output, Inputs, and Total Factor Productivity, 1948-2008





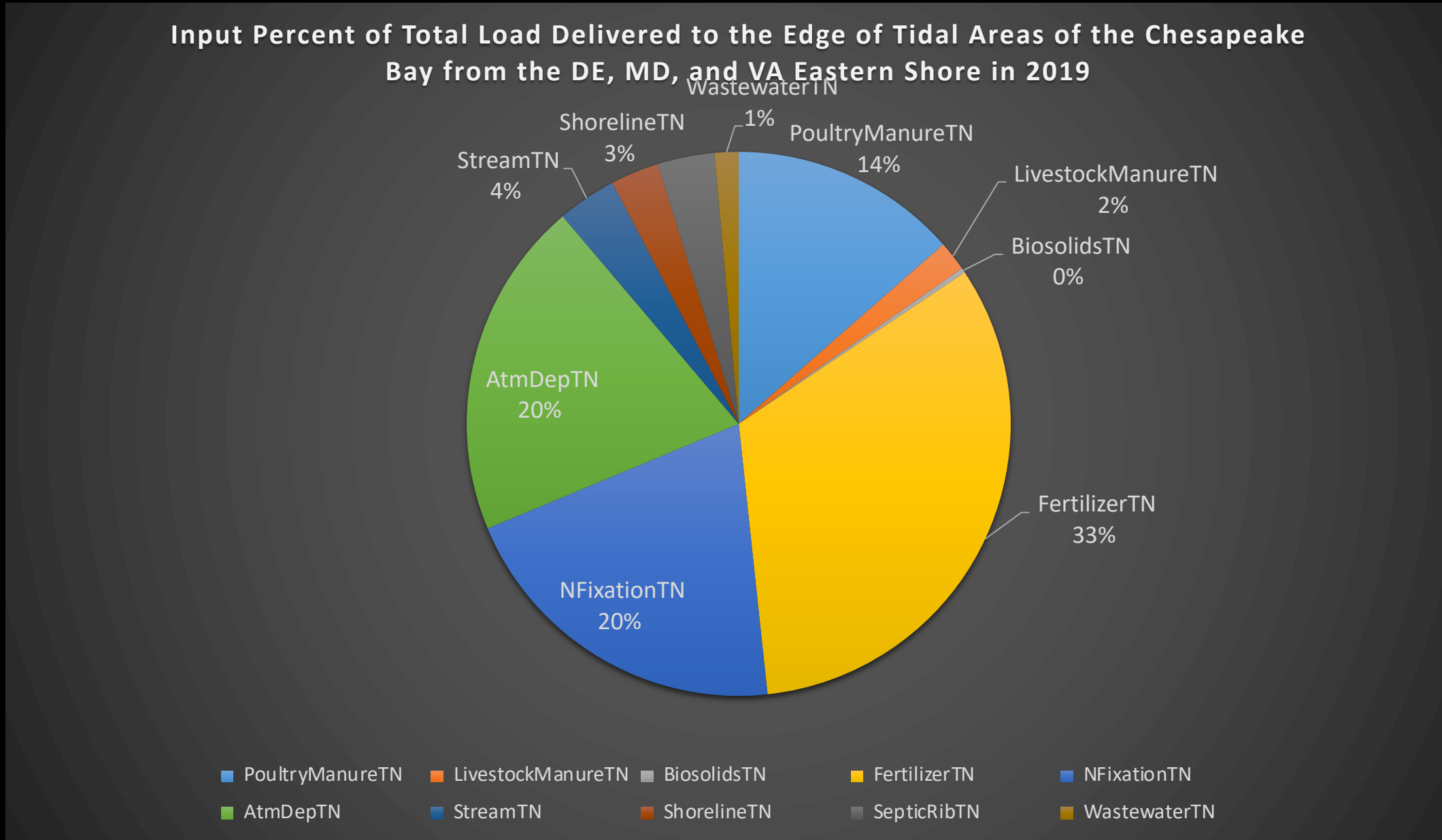
Source DLLC Poultry Explorer

Same Kind of Operation - Different Kind of Farmer

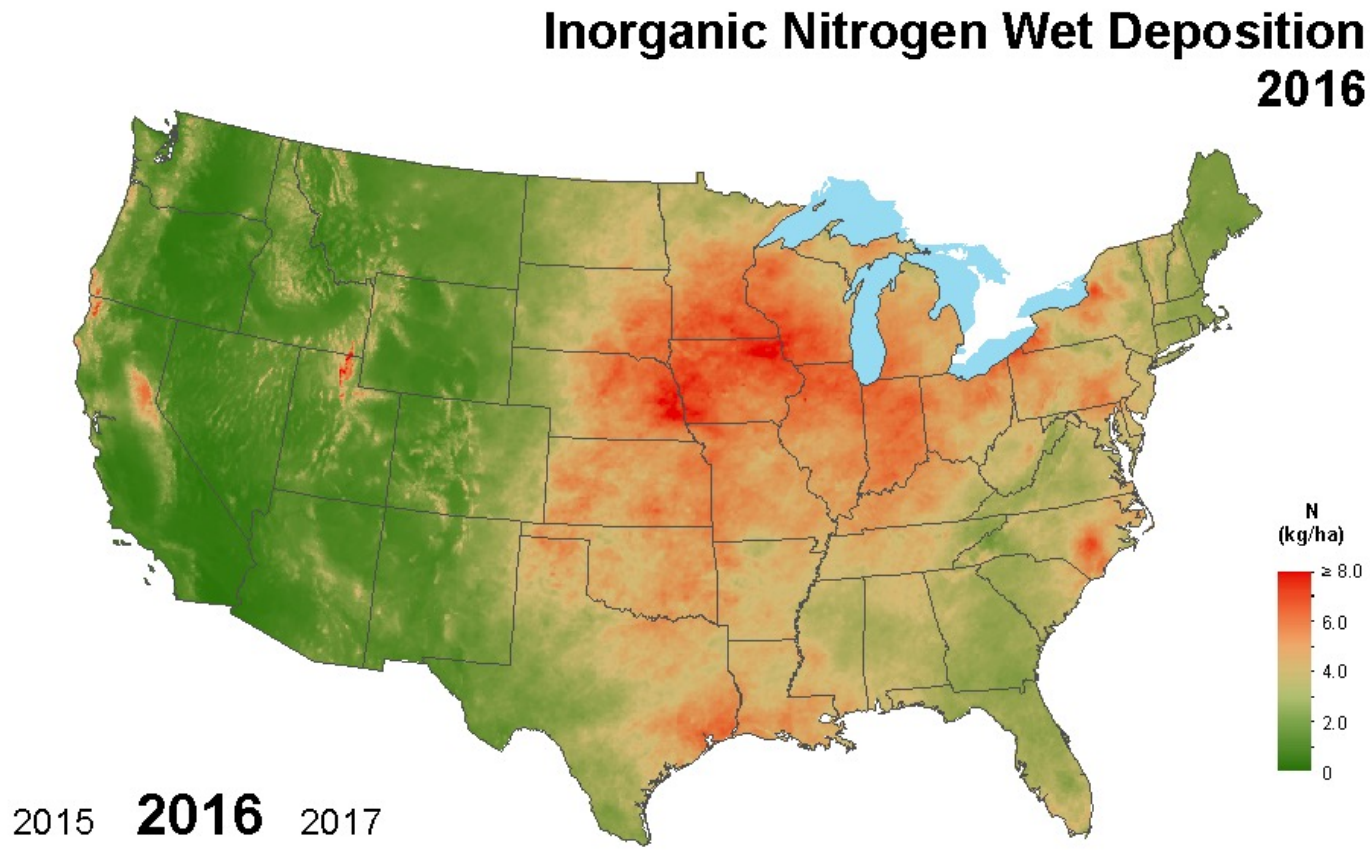
Organic

Conventional W AMP Grazing

We Need to Build Farmer Trust



We Need to Build Farmer Trust II



National Atmospheric Deposition Program/National Trends Network
http://nadp.slh.wisc.edu

How Do We Address These Challenges?

Shift to Performance Based Conservation

1. We spend billions of dollars a year in federal funds to invest in ag conservation
2. Those investments are principally driven by where farmers sign up not by conservation priorities
3. The incentives to farmers do not cover full costs. Typically not sufficient to sustain
   - Operating
   - Duration

Impediments to Overcome 1

We need **decision support system** to invest where we expect to get a higher environmental return on investment e-ROI

- ✓ At the farm level
- ✓ At the conservation investment scale
- ✓ At the national level
- ✓ At the market level

Impediments to Overcome 2

We need to better **align the incentives**:

- ✓ Farmers will finance "**on farm benefit**" – but what about off farm benefits for things like water quality?
- ✓ Do incentives cover the real costs of building & operating the conservation practice?
- ✓ Incentive needs to cover the term of the conservation practice

Impediments to Overcome 3

We need science to advance our understanding of costs and **environmental ROI (e-ROI)**

- ✓ We can not even tell you the environmental benefit of where we have spent billions – why do we think that free ride will continue?
- ✓ We can target areas where conservation is more effective.
- ✓ We need to track that implementation and outcomes in a way that protects farmer privacy but advances the public trust
- ✓ We are just starting to develop technologies to assess conservation and serve as planning tools

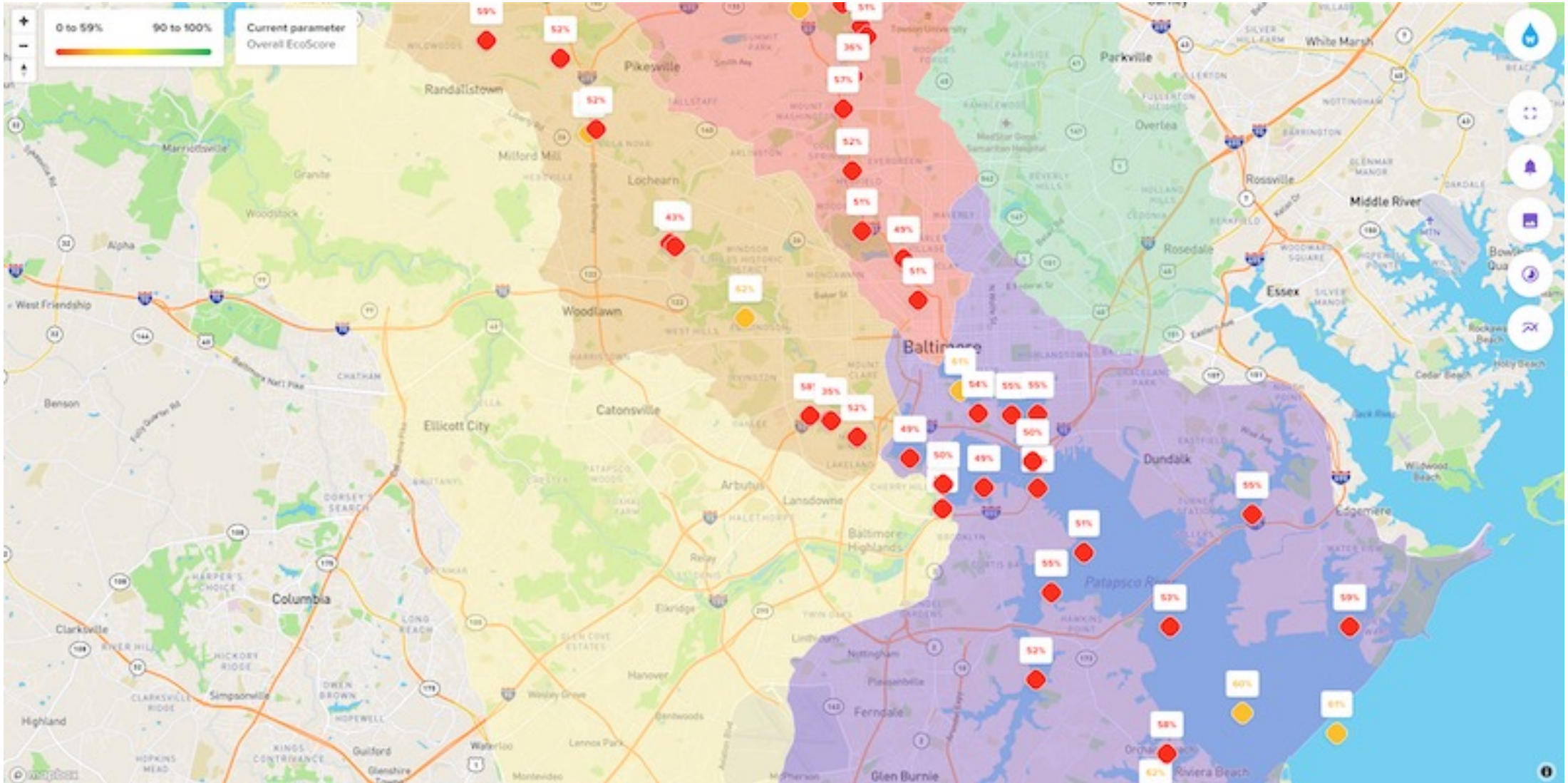
Conservation Practice Effectiveness and Cost

Practice	$ ha^{-1} y^{-1}		$ kg N^{-1} reduction		$ kg P^{-1} reduction	
	IA	IL	IA	IL	IA	IL
Constructed Wetlands	37.10	151	0.60	1.80	–	–
Buffers	571	726	0.90	0.70	6.40	5.40
Cover Crops	111 to 121	71.70	2.70	1.50 to 5.00	27.20 to 68.00	11.10 to 59.20
Land Retirement	474	–	4.10	–	54.40	–
Controlled Drainage	24.70	–	0.60	–	–	–
Bioreactor	24.70	42.00	0.40	1.00	–	–

Christianson et al: https://www.sciencedirect.com/science/article/pii/S0301479717311271

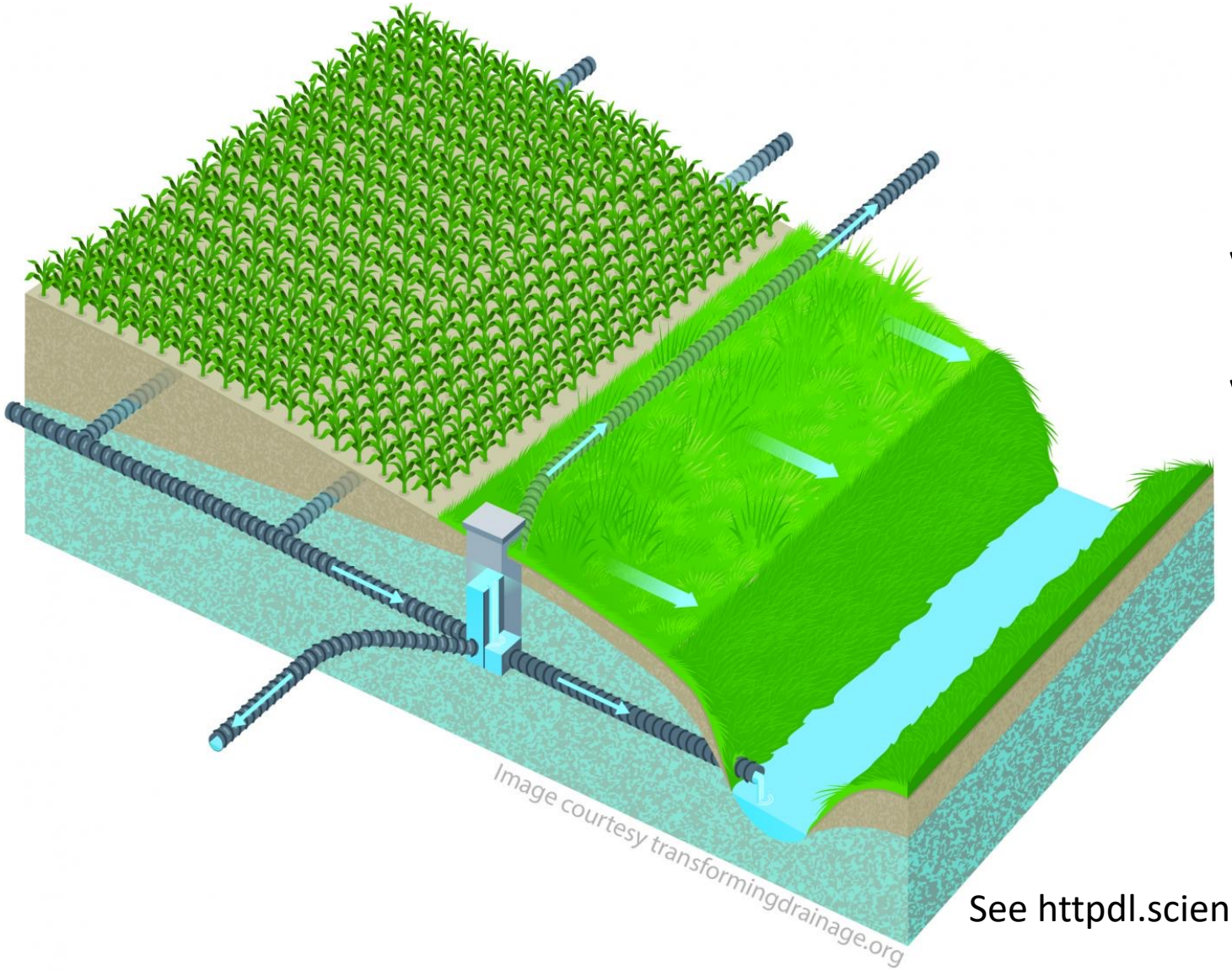
Getting Right Place, Practice, Investment

New Technologies like Field Doc



Example of New Research/Technology

Saturated Buffer



Highly Scalable

- Treat up to 9.5 million acres Midwest

Very Low Cost

- $3 - $4 K to install

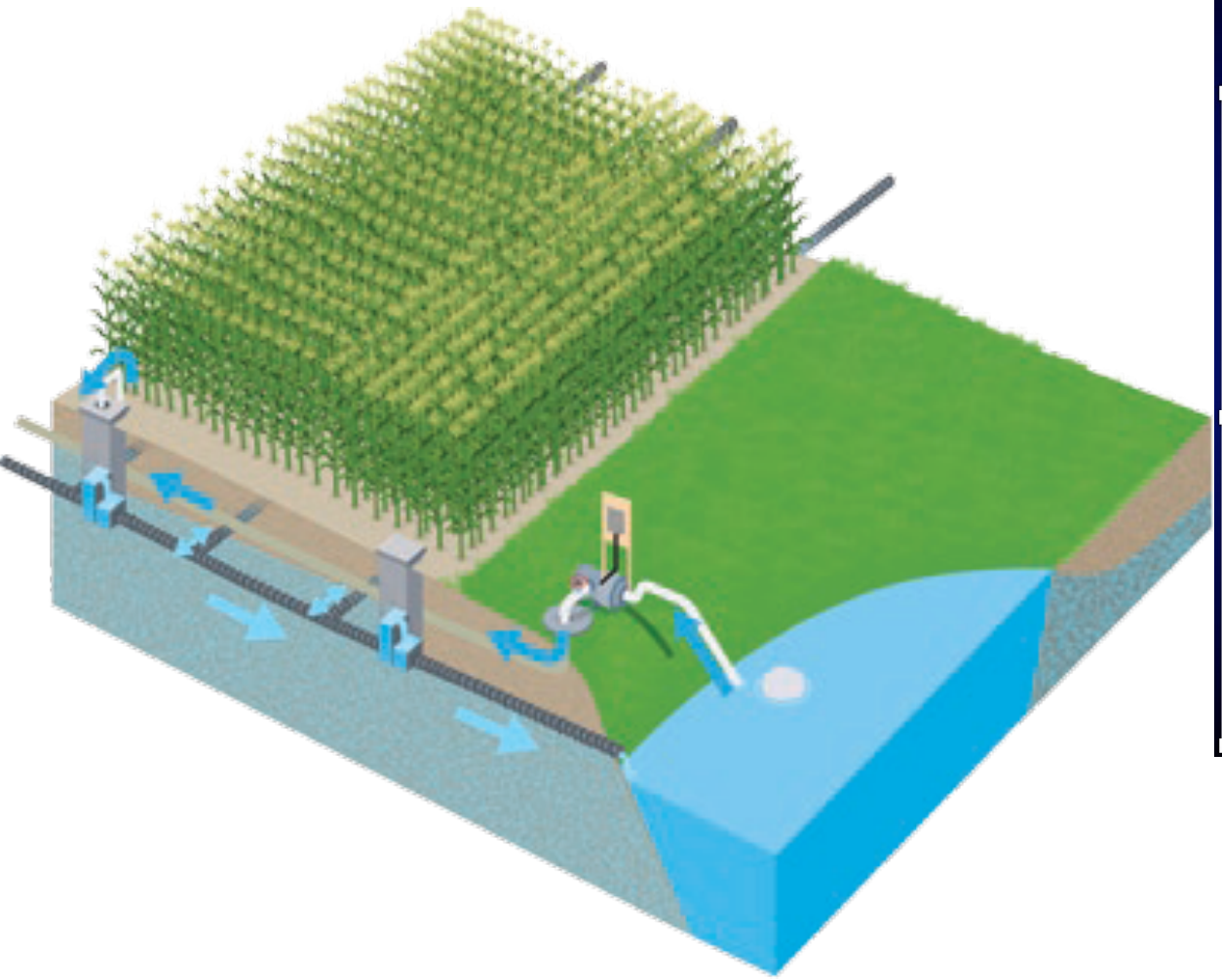
Very high e-ROI

- 80 acre field and operate for 20 years cost would be less than >$0.75/lb

- No on farm benefit other than Drainage Water Management

See httpdl.sciencesocieties.org/publications/ael/pdfs/4/1/180059

Coming Technology – Subirrigation and Reuse



Corn Response to Drainage (DO) and Subirrigation (DSI) (2002-16)

	Yield increase		Gross margin	
Year(s) and Environment	DO 20'	DSI 20'	DO 20'	DSI 20'
	---Bu/acre---		------- $/acre -----	
14: Dry-Wet	-4	-12	-16	-50
06,16: Dry-Moderate	15	33	66	238
02,05,12,13: Wet-Dry	14	70	236	1,180
03,07: Wet-Moderate	26	56	144	311
04,08-11,15: Wet-Wet	43	36	1,054	877
Average (bu/a) & Total ($)	26	50	$1,484	$2,556

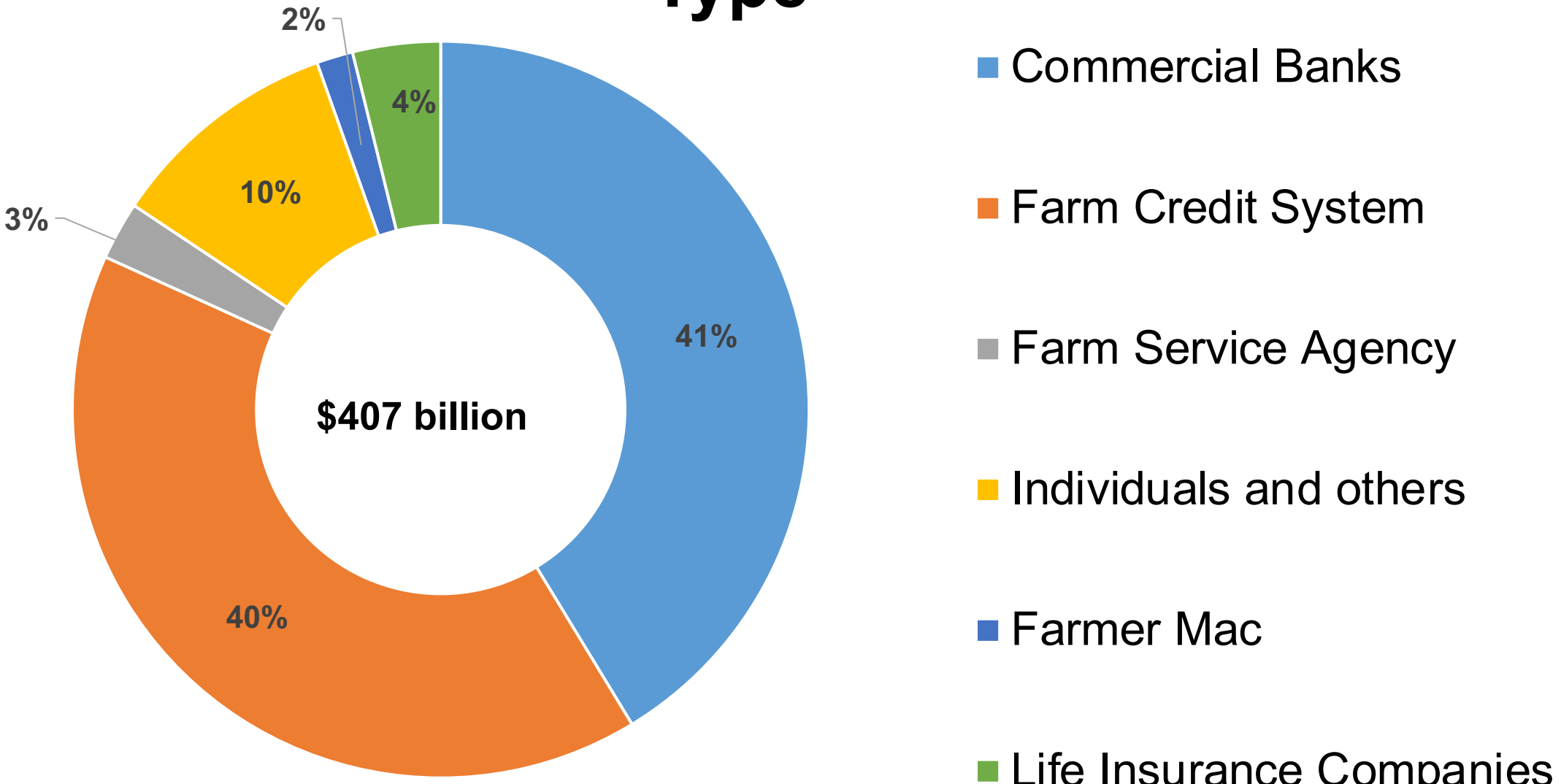
Kelly Nelson, Agronomy Professor, Division of Plant Sciences University of Missouri

We Need to Create New Funding Sources

We need to engage non traditional funding sources

- Markets
- Insurance
- Lenders – Public and Private
- Consumers
  - Organics getting premium
  - Why not sustainables?
- Point source
- MS4
- Flood Reduction

Distribution of Agricultural Debt by Lender Type



Source: USDA

Examples of Additional Funding Mechanisms

Ecosystem Service Markets

Water Quality Trading

Carbon monetization

Investment funds

Funds that invest in e-ROI on farms

Insurance opportunities

Regulation and policy

A non-starter with farmers as social and political reality

Can reduce costs to other sectors

Consumer Drivers

Need to understand and build market linkage

Key Impediments To Diversify Funding

1. Document environmental performance
   - We do a great job counting acres and linear feet
   - We fail to document effect on water quality
2. Get out of our silo
   - We are great talking to ourselves
   - We are not talking to FARMERS and their advisors
     - Input providers
     - Finance community
3. Align the incentives
   - Farmers will invest for on farm benefits
   - We need to finance off farm benefits – i.e. water quality

For too long the environment has been presented as at odds with opportunity
In fact the two should go hand in hand.

Alex Echols

When land does well for its owner,
and the owner does well by his land;
when both end up better by reason of
their partnership, we have conservation.

When one or the other grows poorer, we do not.

- Aldo Leopold
The Farmer as Conservationist 1939

Alex Echols

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