Market- Based Regulation of Agricultural Nonpoint Source Externalities

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Providing Environmental Services from Agriculture in a Budget-Constrained Environment
ERS, Farm Foundation, RFF
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Topics

- Intro to water quality issues from row crop agriculture (pictures)
- How to get more for less?
  1. Be more willing to use models and proxies

     EBI without apology

  2. Reverse Property Rights

     Florida South Coast Agricultural Management District

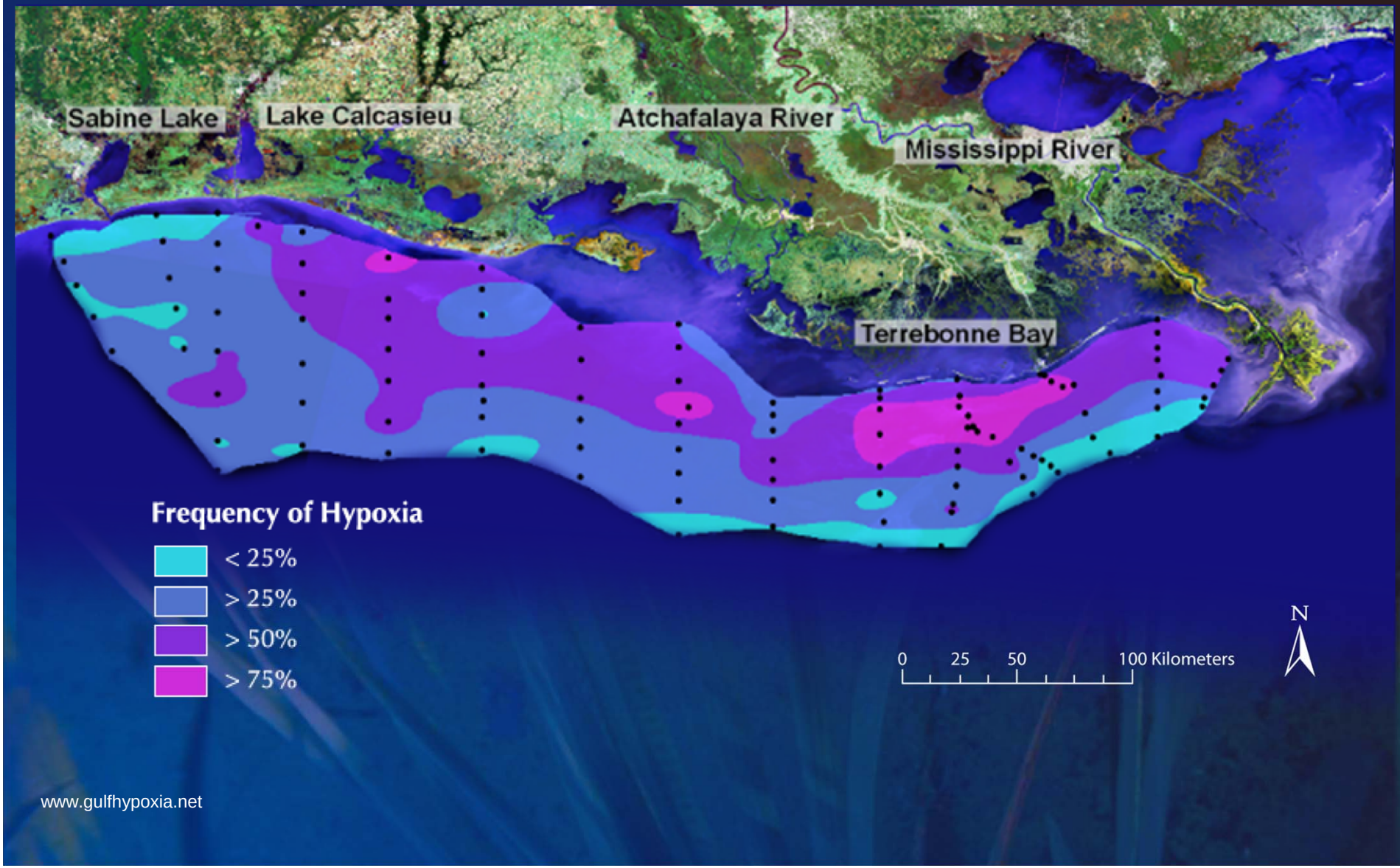
  3. Do income support separately

Water Quality: Rivers & Streams

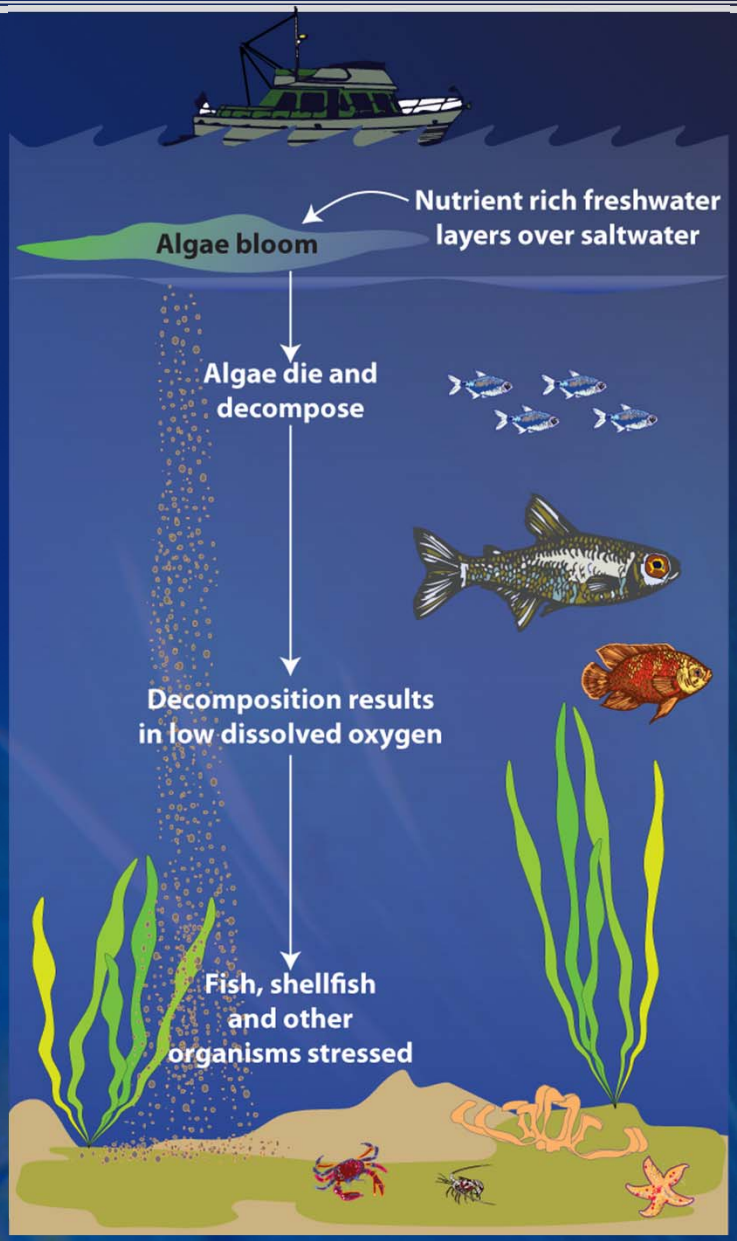
Photos courtesy Iowa DNR

- Rivers and Streams:
  - 26% assessed, 50% inadequate water quality to support designated uses
  - Nearly ½ million stream miles are "impaired"
  - Agriculture leading source of impairment (identified as cause of 22% unknown second highest)

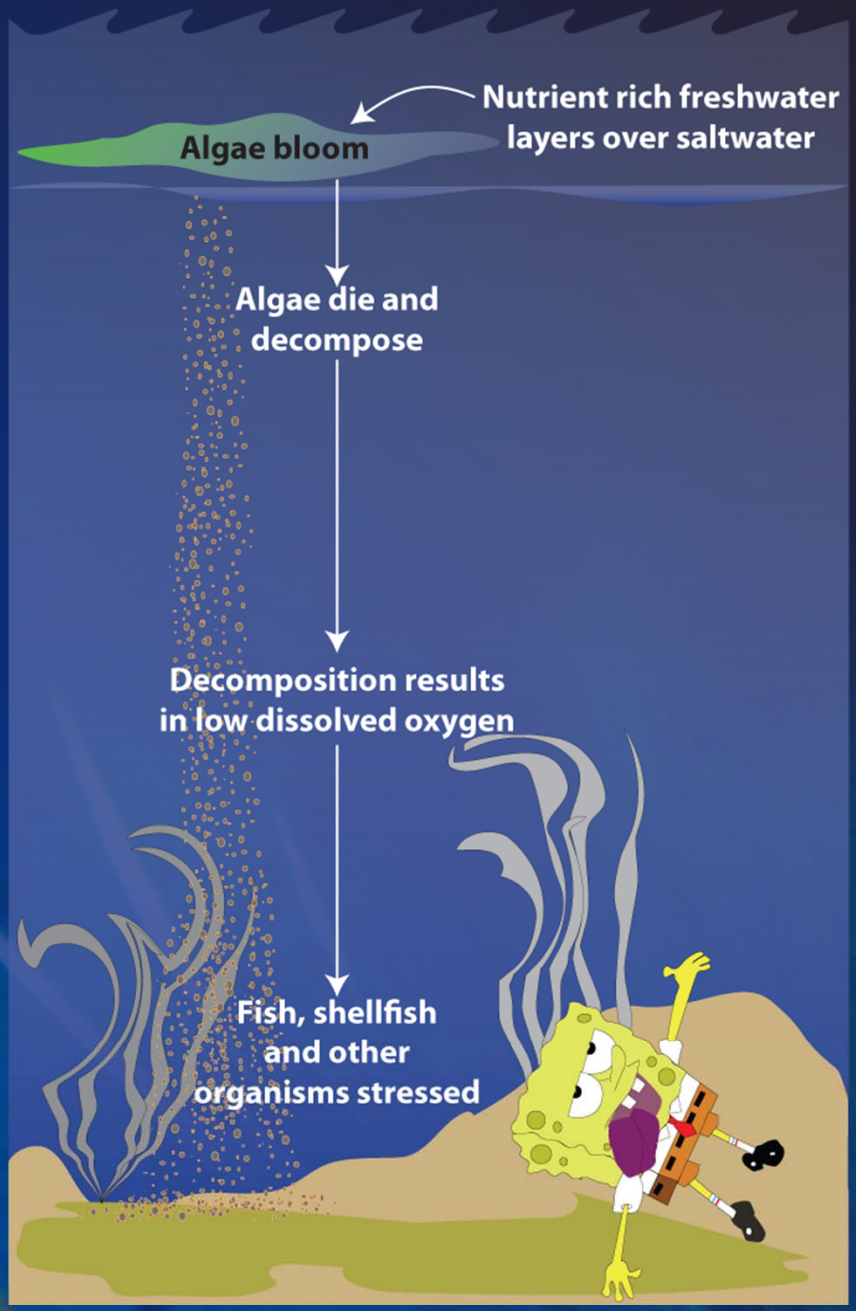
Frequency and Size: 1985-Present



Hypoxia = Dead Zone

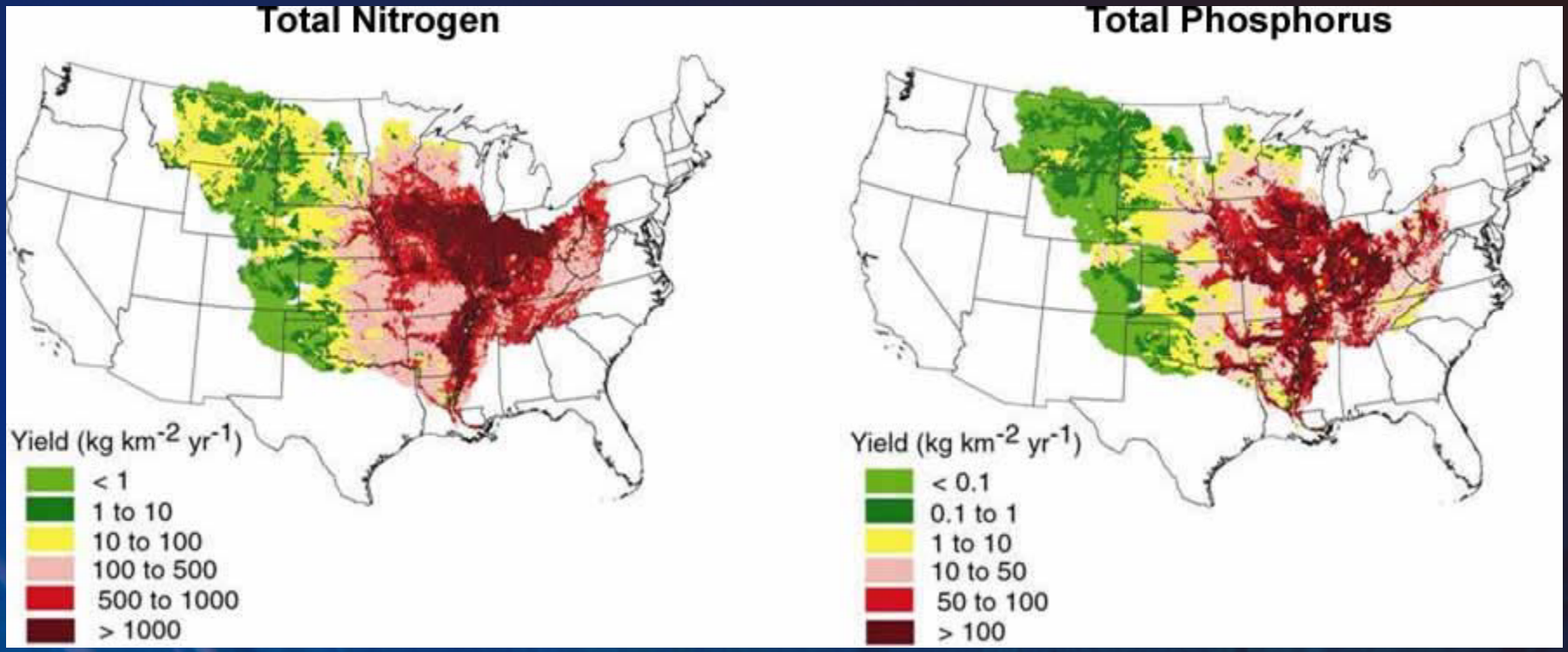


- Depleted oxygen creates zones incapable of supporting most life
- 400 worldwide
- Stressed marine and estuarine systems, mass mortality and dramatic changes in the structure of marine communities (Diaz and Rosenberg, 1995).
- In short….



Intelligent life
is threatened

Nutrient deliveries to the Gulf of Mexico
Source: USGS



- 52% of N from corn and soybean
- 40-50% reduction goal to address Gulf hypoxia

What abatement options exist?

- In field Management Practices
  - Reduced (no) tillage
  - Manure, fertilizer management/reduction
  - Cover crops, rotation changes
  - Land retirement

Panoramic view of gamma grass-big blue stem planting
http://www.fsa.usda.gov/Internet/FSA_Image/ia_767_15.jpg

What abatement options exist?

- Structural Practices
  - Buffers
  - Grassed Waterways
  - Denitrification, controlled drainage
  - Wetland restoration

Photo courtesy Missouri NRCS

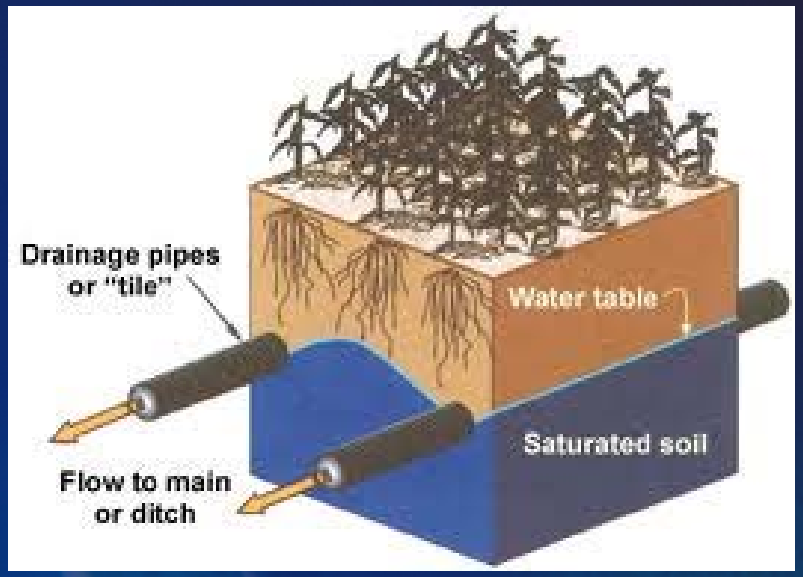
Sizing the drain pipe

(slides from Chris Hay, Extension Water Management Engineer, ABE, South Dakota State University

Photo: ARS

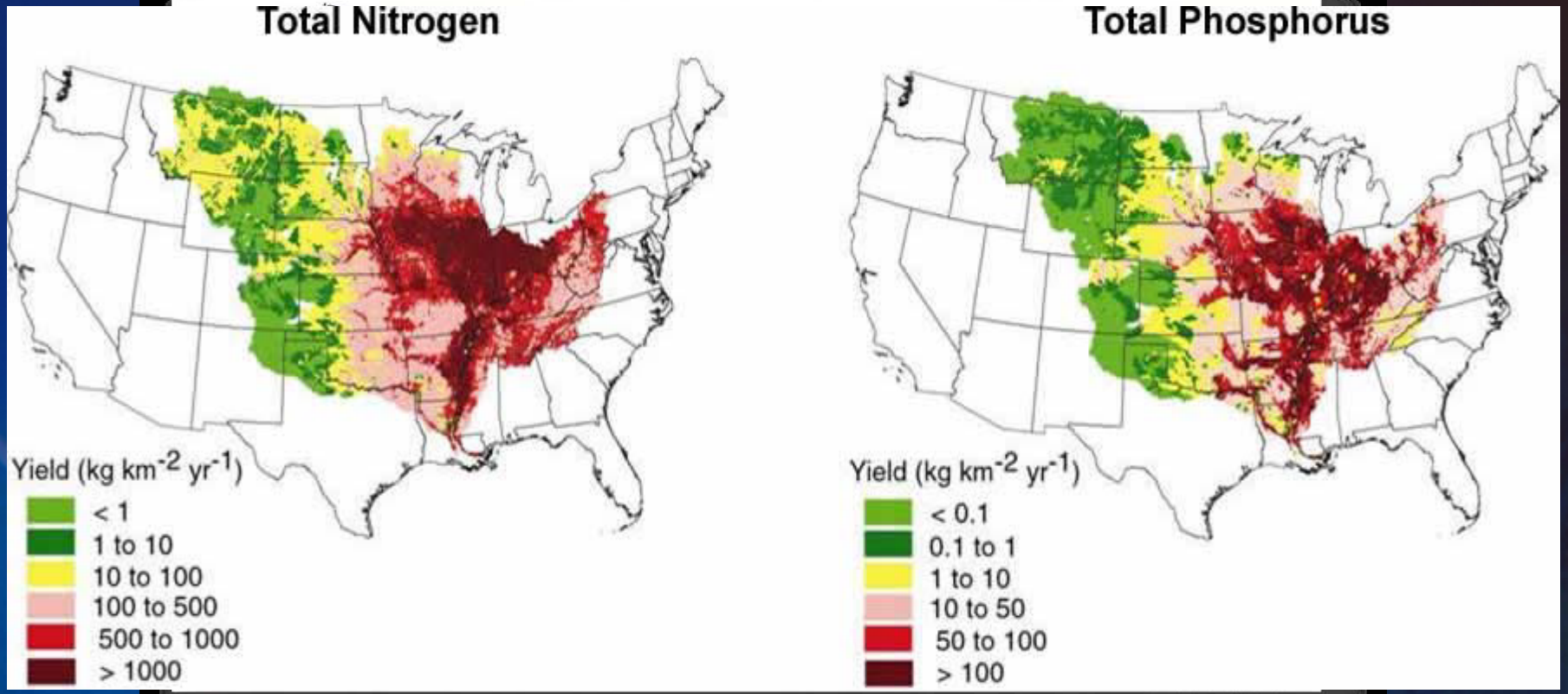
Photos: Matt Helmers

Nonpoint source or point source?



Lowell Busman and Gary Sands

About 25% of Cropland is Drained



Current policy, agricultural NPS water quality

- Voluntary, payment programs
- TMDLs, no enforceable standards
- Environmental quality goals, not met
- Iowa: ~30 million acres ag land
  - $25/acre cover crops? = $750 million/yr?
  - Are conservation budgets large enough?

EWG: ~800 million/yr corn, soybean subsidies 2010, +$250 million/yr CRP

An Alternative

- Reverse property rights
- Focus on practices (abatement actions)
  - Imperfect, but may still be welfare enhancing
  - Example: Abatement Action Permit System

An Abatement Action Permit System (AAPS) Based on Points

- Assign each practice/land use a point
- Set total points for watershed and allocate
- Allow trading
- Choose enforcement mechanism
- Adopt adaptive management
- Include innovation options

Features

- Addresses fairness – early adopters rewarded
- Could base on readily observable practices, could use in just most problematic areas
  - But seriously……

But!

1. Can't regulate when can't exactly measure each polluters contribution
   - We can pay them to set aside land and install practices even though we can't do so
   - We can tax estimates of the value of a house
2. Can't require practices when we're not sure what the ultimate environmental damage is:
   - Unless it's SO_2
   - Unless it's point source of water quality

But!

3. Transactions costs high, too many sources:
   - ~600,000 restaurants, calorie/health mandates
   - County extension offices, infrastructure!
   - We can pay them CRP, EQIP, WRP, conservation compliance … but not regulate?
4. Property rights are set in stone:
   - littering
   - smoking
5. If it were possible, it would have been done

BMPs: Everglades Agricultural Area

- 718,000 acres (40 acre fields)
- Everglades Regulatory Program
  - goal 25% P reduction overall
  - mandatory BMPs, 1995
  - Implemented via points
    - flexibility in BMPs, 25 points/farm
    - expert judgment set point values
    - must implement and monitor WQ

Wikipedia

EAA Regulatory Program

- Property Rights: with citizens
- First 3 years: 55% P load reduction (SFWMD, 1998)
- Unable to find information on costs
  - Direct cost of BMPs
  - Lost profit
  - Cost of monitoring
  - Cost of program implementation

Now you can yell at me

Use Tools Better

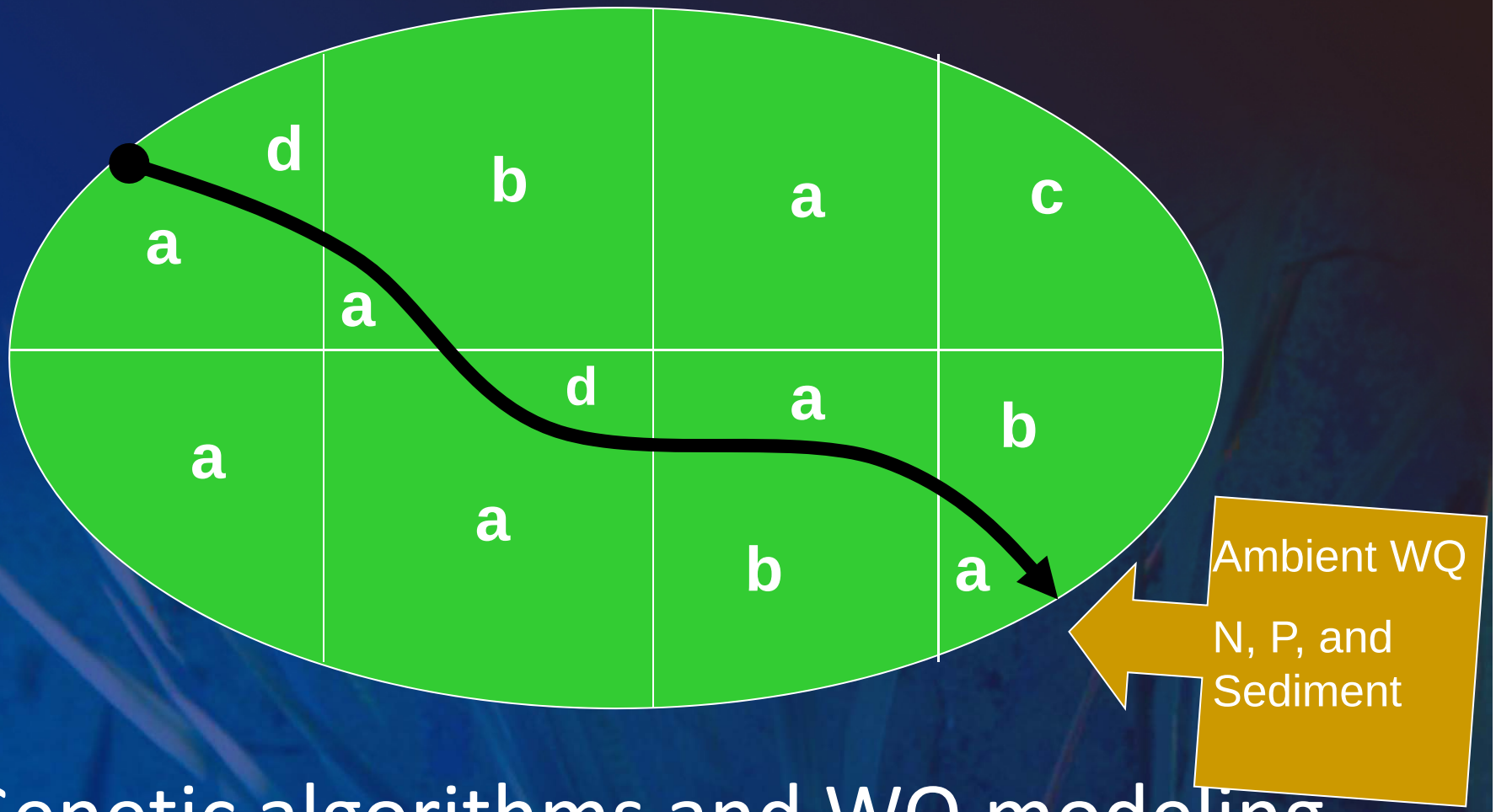
- Reverse Auctions
  - often implemented with simple ranking
  - erosion/cost of practice
  - Rank from highest to lowest and enroll
- Issues
  - Watershed models can better capture
  - Simple rankings ignore scale, land retirement may have lower benefit/cost ratio than reduced tillage, but can't achieve high benefit levels

“Optimal” reverse auctions

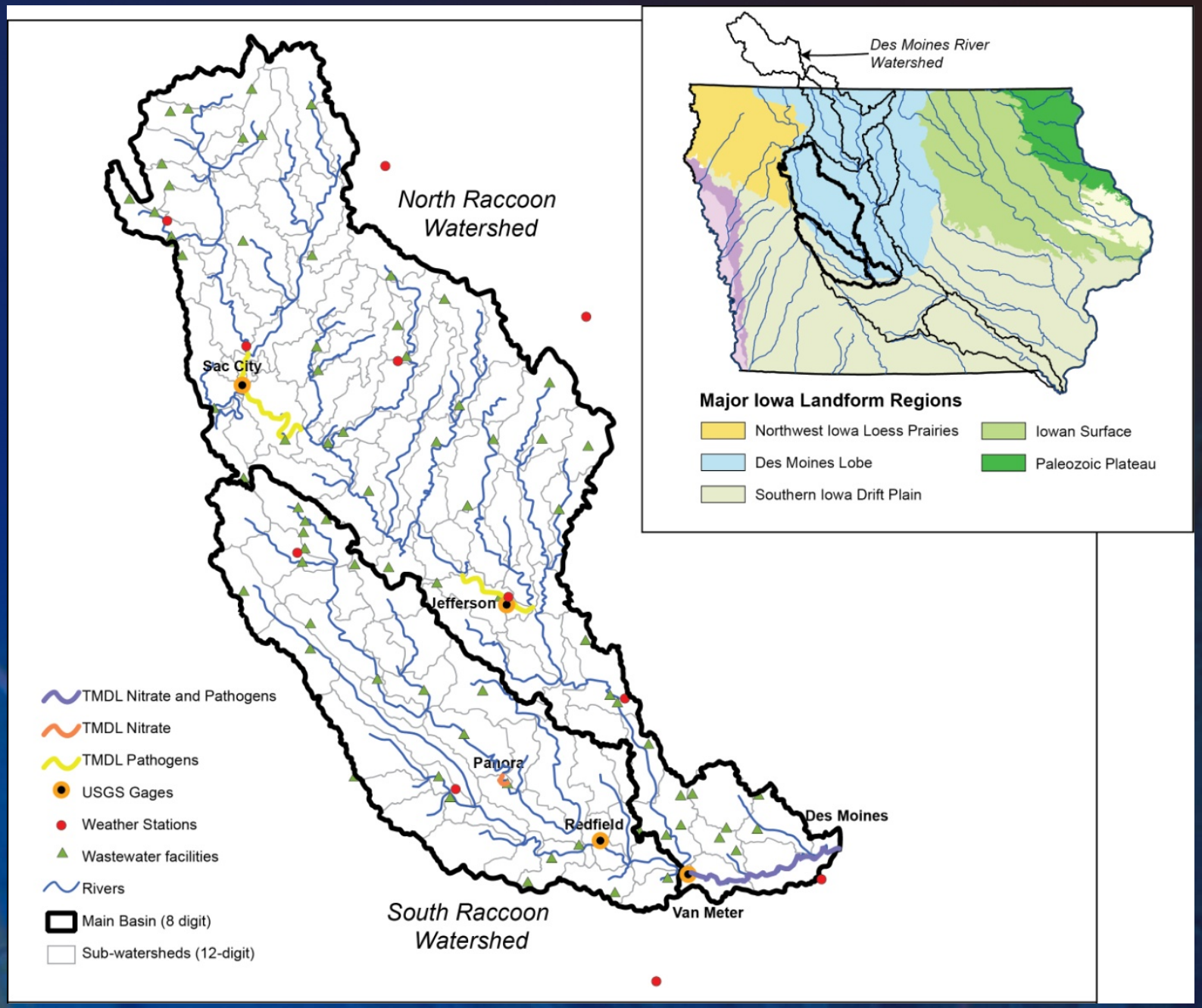
1. Agency announces potential set of practices that it will consider funding in an auction,
2. Elicit bids, multiple encouraged
3. Develop frontier of tradeoffs
4. Engage stakeholders, evaluate tradeoffs, discuss budget.
5. Choose the set of bids and conservation practices

Using a coupled simulation-optimization approach to design cost-effective reverse auctions for watershed nutrient reductions,“
S. Rabotyagov, A. Valcu T. Campbell, P.W. Gassman, M. Jha, and C.L. Kling

Watershed: 13 Fields, 4 options: a, b, c, d



Genetic algorithms and WQ modeling


North Raccoon Watershed
South Raccoon Watershed
Sac City
Jefferson
Panora
Redfield
Des Moines
Van Meter
TMDL Nitrate and Pathogens
TMDL Nitrate
TMDL Pathogens
USGS Gages
Weather Stations
Wastewater facilities
Rivers
Main Basin (8 digit)
Sub-watersheds (12-digit)
Des Moines River Watershed
Major Iowa Landform Regions
Northwest Iowa Loess Prairies
Des Moines Lobe
Southern Iowa Drift Plain
Iowan Surface
Paleozoic Plateau

Ranking vs. Pareto Optimal

Ranking method	Cost, $/yr	N gains (%)	P gains (%)	Pareto-dominated	cost savings and nutrient gains
USLE full enrollment	19.5 million	10.2	32.0	Yes/16	$2.8 mil, 1.4%N, 0.4%P
USLE partial enrollment	9.7 million	8.3	25.1	Yes/5	$1.4 mil, 0.2%N, 0.9%P
MUSLE full enrollment	15.6 million	9.8	31.5	No	--
MUSLE partial enrollment	7.8 million	8.0	25.6	No	--

Findings

1. Optimal auction outperformed USLE
2. MUSLE ranking was not dominated, BUT
3. Ranking by either method focusses on practices that have highest gain/cost ratio, followed blindly, cannot achieve high reductions

Thanks for your attention!