ESCOP
Experiment Station Committee on Organization and Policy

2013 ESS/SAES/ARD Meeting and Workshop
Hilton Columbus at Easton
3900 Chagrin Drive
Columbus OH 43210

Program

Tuesday, September 24, 2013		Room
1:00 PM	**Registration**	**Easton A & B**
3:00 – 3:15 PM 3:15-5:15 PM	**Welcome / Opening Remarks** (Moderator: Steve Slack) • **Michael Boehm,** Vice Provost for Academic Affairs, The Ohio State University • **Bruce McPheron,** Vice President for Agricultural Administration and Dean, The Ohio State University **North Central General Session "An Ohio Perspective on Water Quality Issues" / Q&A** Speakers: • **Jeff Reutter,** Director, Ohio Sea Grant, The Ohio State University "Lake Erie Algal Blooms: Framing the Water Quality Issue" • **Jack Fisher,** President, Ohio Farm Bureau Federation "We Don't Have to Choose Between Food Production and Water Quality" • **Karl Gebhardt,** Chief, Ohio Department of Natural Resources "Response of State Agencies to Water Quality Issues in Ohio" • **Libby Dayton,** Research Scientist, School of Environment and Natural Resources, The Ohio State University "Evaluation/Revision of the Ohio Phosphorus Risk Index Using Field-Scale, Edge-of-Field Monitoring Data" • **Richard Moore,** Professor, Executive Director, Environmental Sciences Network, The Ohio State University "A Nutrient Trading Model for Advancing Clean Water Initiatives" • **Lonnie Thompson,** Distinguished University Professor, Department of Earth Sciences, The Ohio State University "Global Climate Change: Glaciers, Water and People"	**Easton A & B**
6:00 – 8:00 PM	**Opening Reception – Comments at 7:00 PM**	**Easton C, D & E**
Wednesday, September 25, 2013		**Room**
7:00 AM	**Registration**	
6:30 – 7:45 AM	**Breakfast**	**Easton B**
8:00 – 10:00 AM	Regional Meetings • ARD • NCRA • NERA • SAAESD • WAAESD	**Easton C, D & E** **Magnolia and Lilac**
10:00 – 10:30 AM	**Break**	
11:00 – 12:00 PM	**ESS Business Meeting**	**Easton A**

12:00 – 1:30 PM	**Luncheon with Speaker - Cathy Woteki,** Under Secretary for USDA's Research, Education, and Economics (REE)	**Easton B**
1:30 – 3:00 PM	**ESS Business Meeting (continued)**	**Easton A**
3:00 – 3:30 PM	**Break**	
3:30 – 5:00 PM	**Discussion Session I: "Industry Employment Needs for the Future" –** **John Sherwood,** Department Head, Department of Plant Pathology, The University of Georgia **Josef M. Broder,** Associate Dean for Academic Affairs, The University of Georgia "Industry Employment Needs (Broder presentation)" (Moderator: Mike Harrington)	**Easton A**
6:00 – 8:30 PM	**Banquet with Speaker – Joseph Alutto,** Interim President, The Ohio State University	**Easton B**
Thursday, September 26, 2013		**Room**
7:00 – 8:15 AM	**Breakfast**	**Easton B**
8:30 – 10:00 AM	**Discussion Session II: "Board on Natural Resources Roadmap" –** **Doug Parker,** Director, California Water Resources Research Institute, University of California System **John Hayes,** Dean for Research, University of Florida **Wendy Fink,** Associate Director, APLU (Moderator: Eric Young)	**Easton A**
10:00 – 10:30 AM	**Break**	
10:30 – 12:00 PM	**Discussion Session III: "New Budget/Management Strategies for Dealing with Austerity" –** **Terry Snoddy,** Business Manager, Ohio Agricultural Research and Development Center, The Ohio State University **William Randle,** Dean/Director of Agriculture, North Carolina A&T State University (Moderators: Arlen Leholm, Carolyn Brooks)	**Easton A**
12:00 – 12:30 PM	**Boxed Lunches**	
12:30 – 2:00 PM	**Discussion Session IV: "IR-4 50th Anniversary and Update" –** **Jerry Baron,** Executive Director, IR-4 (Moderator: Dan Rossi)	**Easton A**
2:00 PM	**Adjourn**	

Lake Erie Algal Blooms: Framing the Water Quality Issue

Dr. Jeffrey M. Reutter

Director, Ohio Sea Grant College Program

Southernmost

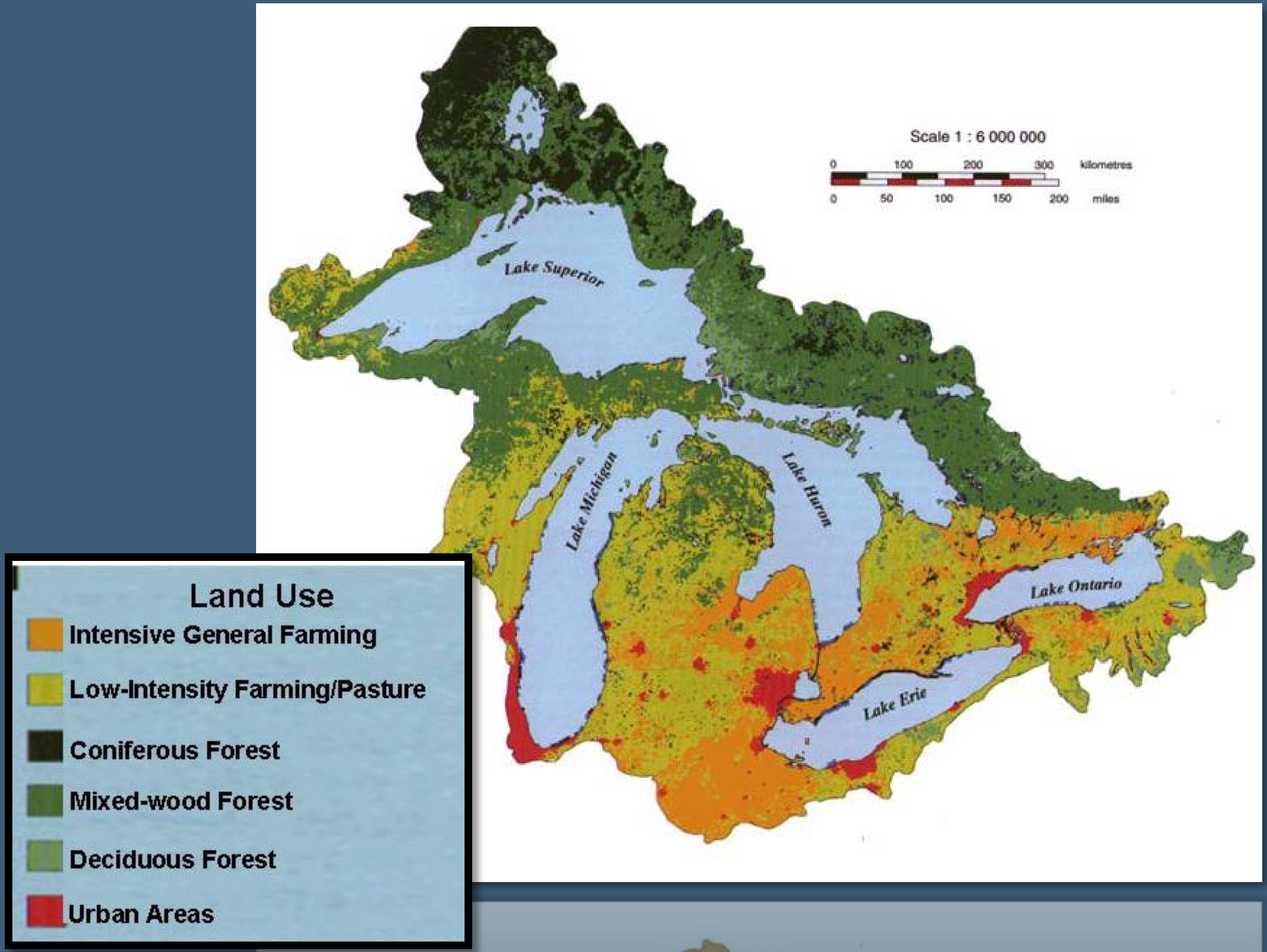
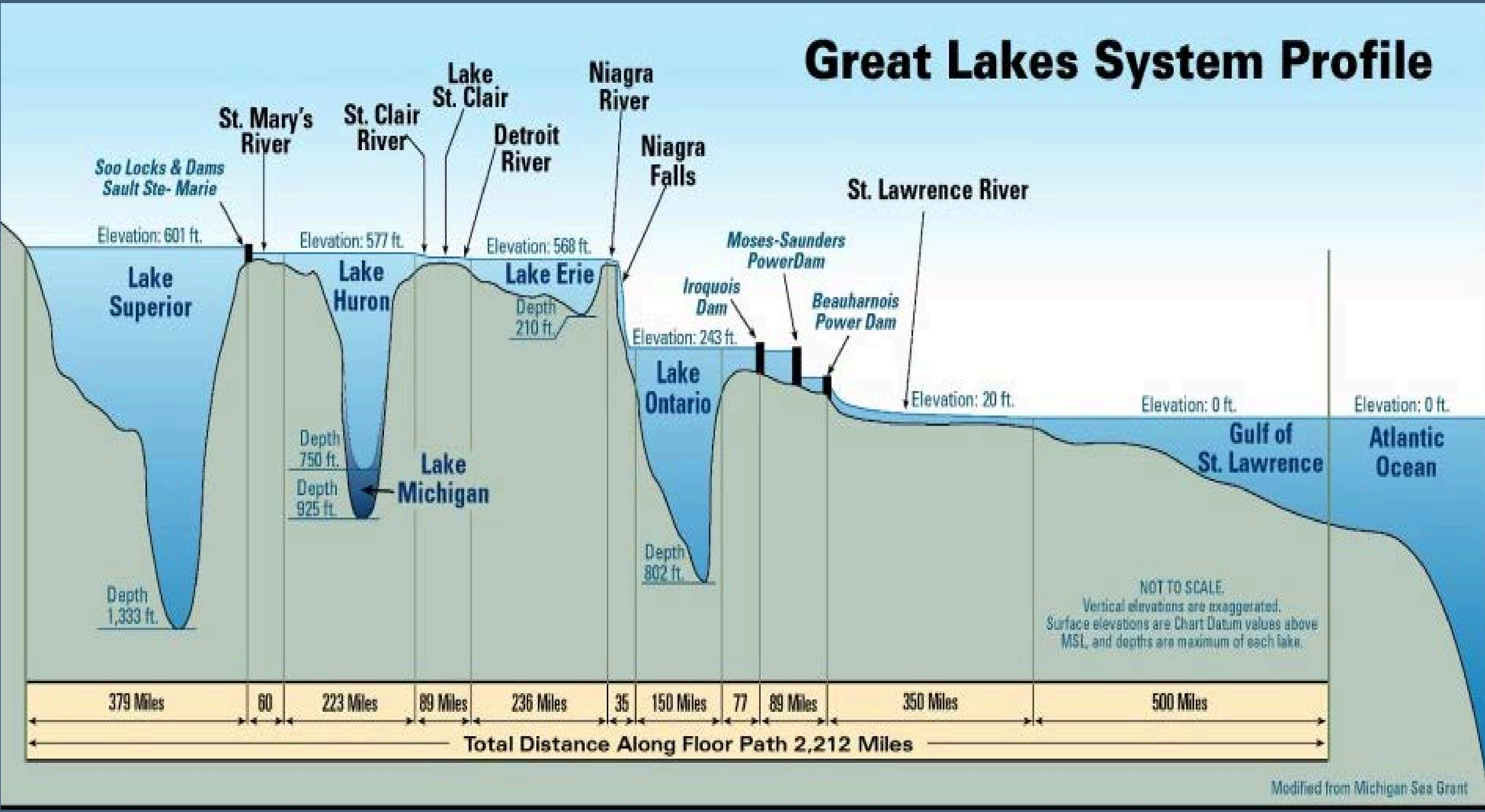


Image: Ohio Sea Grant



Great Lakes System Profile
Soo Locks & Dams
Sault Ste- Marie
St. Mary's River
St. Clair River
Lake St. Clair
Detroit River
Niagra River
Niagra Falls
St. Lawrence River
Elevation: 601 ft.
Lake Superior
Depth 1,333 ft.
Elevation: 577 ft.
Lake Huron
Depth 750 ft.
Depth 925 ft.
Lake Michigan
Elevation: 568 ft.
Lake Erie
Depth 210 ft.
Moses-Saunders PowerDam
Iroquois Dam
Beauharnois Power Dam
Elevation: 243 ft.
Lake Ontario
Depth 802 ft.
Elevation: 20 ft.
Elevation: 0 ft.
Gulf of St. Lawrence
Elevation: 0 ft.
Atlantic Ocean
NOT TO SCALE.
Vertical elevations are exaggerated.
Surface elevations are Chart Datum values above MSL, and depths are maximum of each lake.
379 Miles
60
223 Miles
89 Miles
236 Miles
35
150 Miles
77
89 Miles
350 Miles
500 Miles
Total Distance Along Floor Path 2,212 Miles
Modified from Michigan Sea Grant

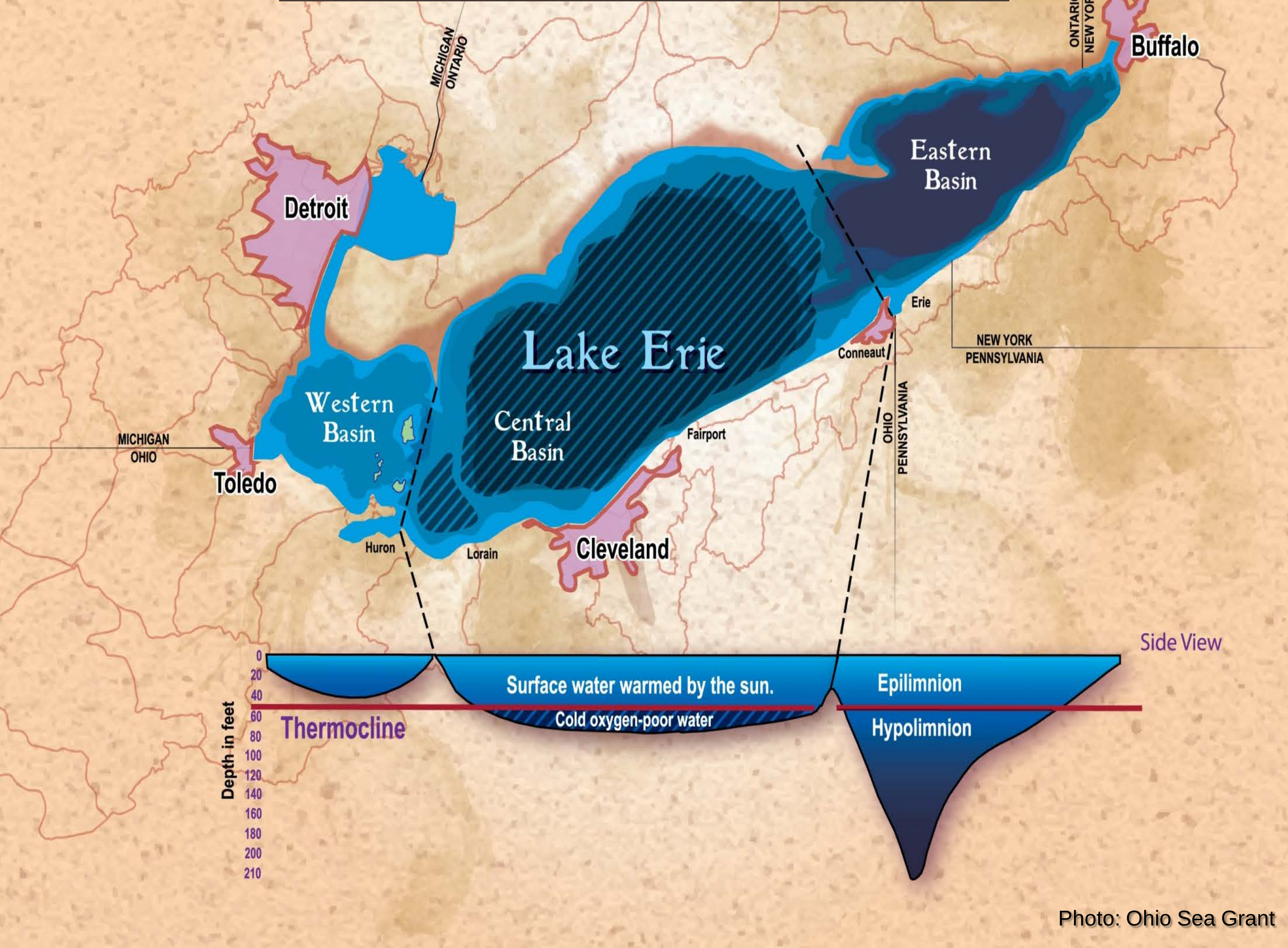
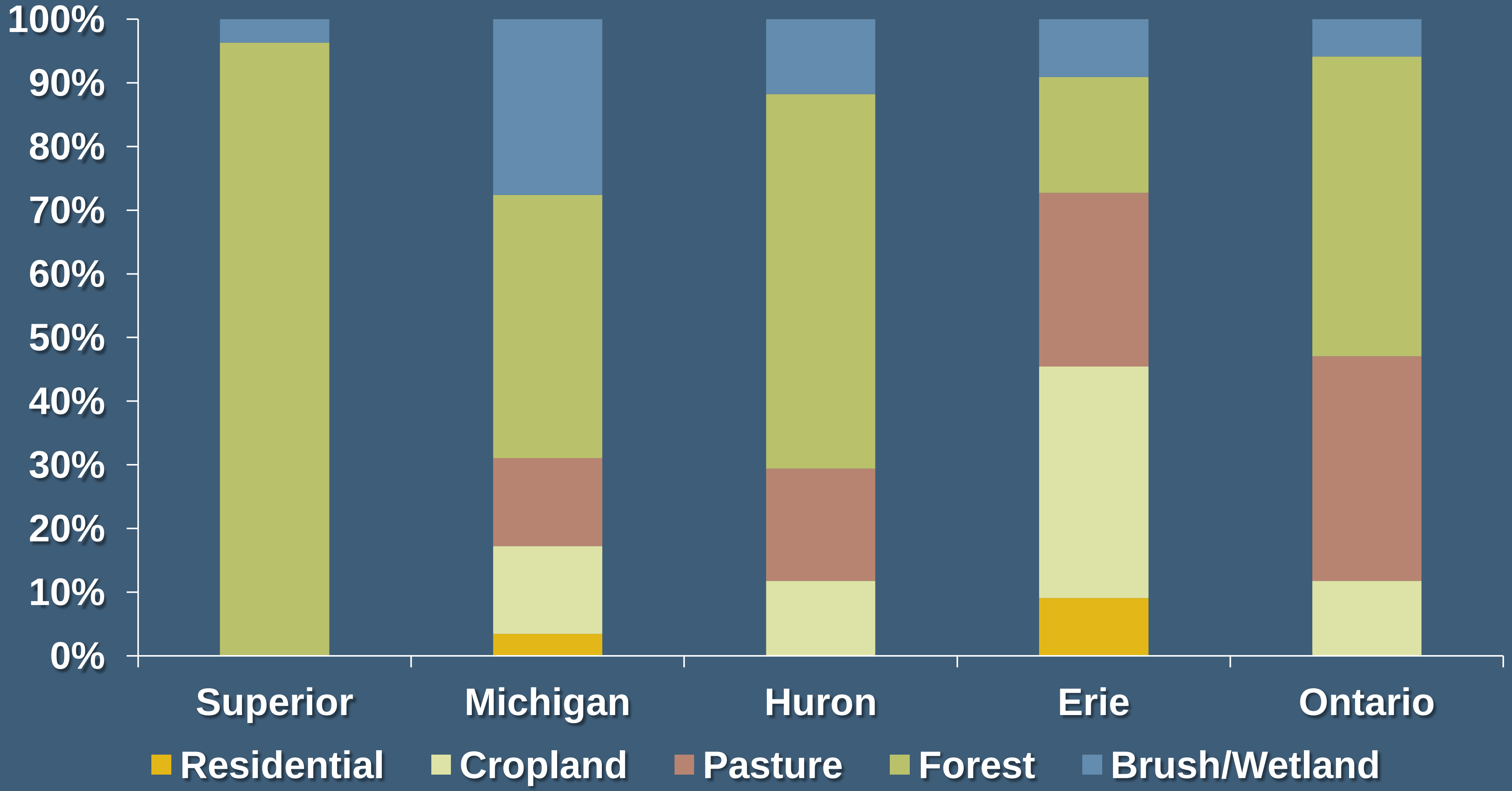


Photo: Ohio Sea Grant

Major Land Uses in The Great Lakes

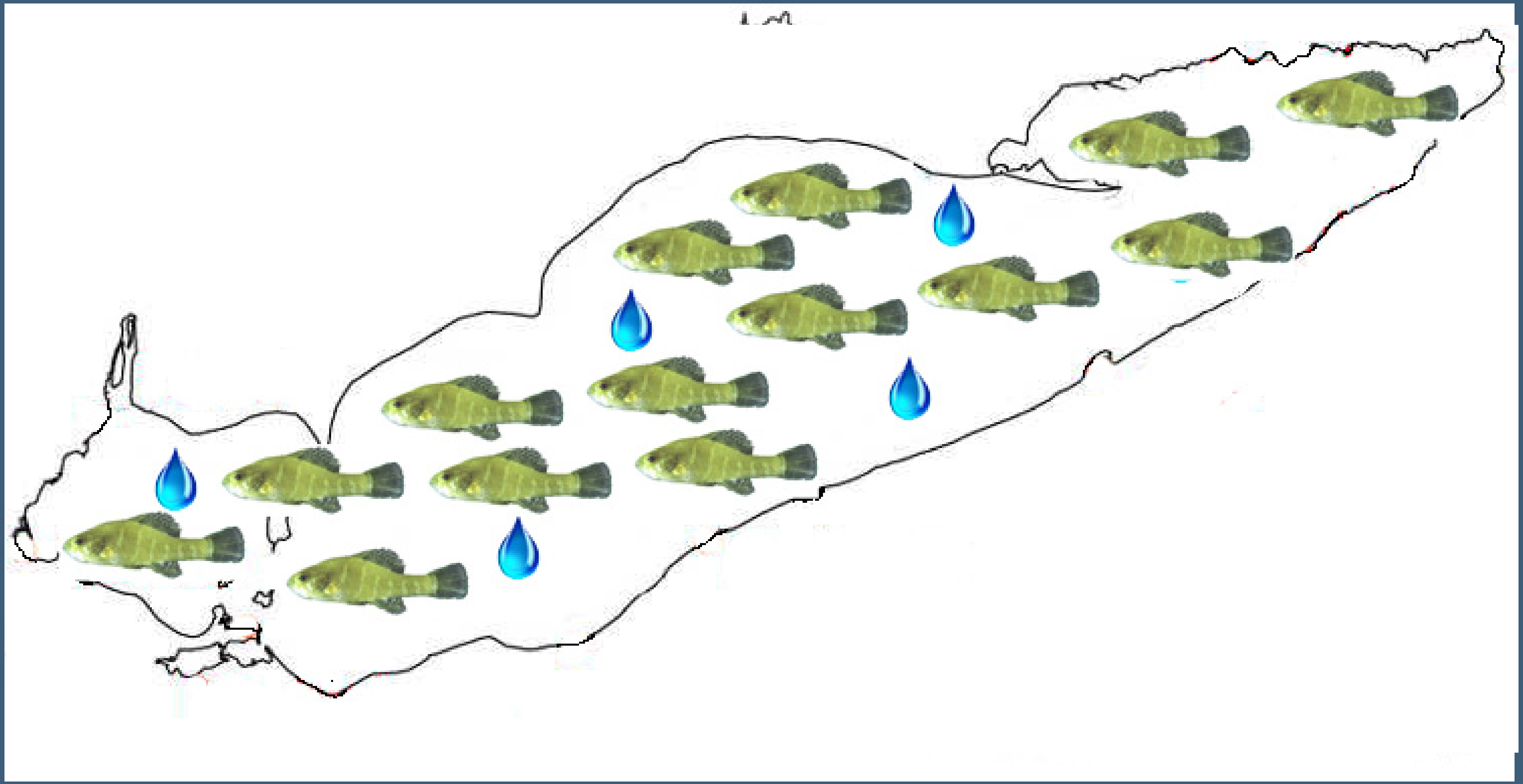


Because of Land Use, Lake Erie Gets:

- More sediment
- More nutrients (fertilizers and sewage)
- More pesticides
- (The above 3 items are exacerbated by storms, which will be more frequent and severe due to climate change.)
- <u>And Lake Erie is still biologically the most productive of the Great Lakes—And always will be!!</u>

50:2 Rule

(Not exact, but instructive)



Lake Erie:

2% of the water and **50%** of the fish

Lake Superior:

50% of the water and **2%** of the fish

80:10:10 Rule

- 80% of water from upper lakes
- 10% direct precipitation
- 10% from Lake Erie tributaries
  - Maumee
    - Largest tributary to Great Lakes
      - Drains 4.5 million acres of ag land
    - 3% of flow into Lake Erie

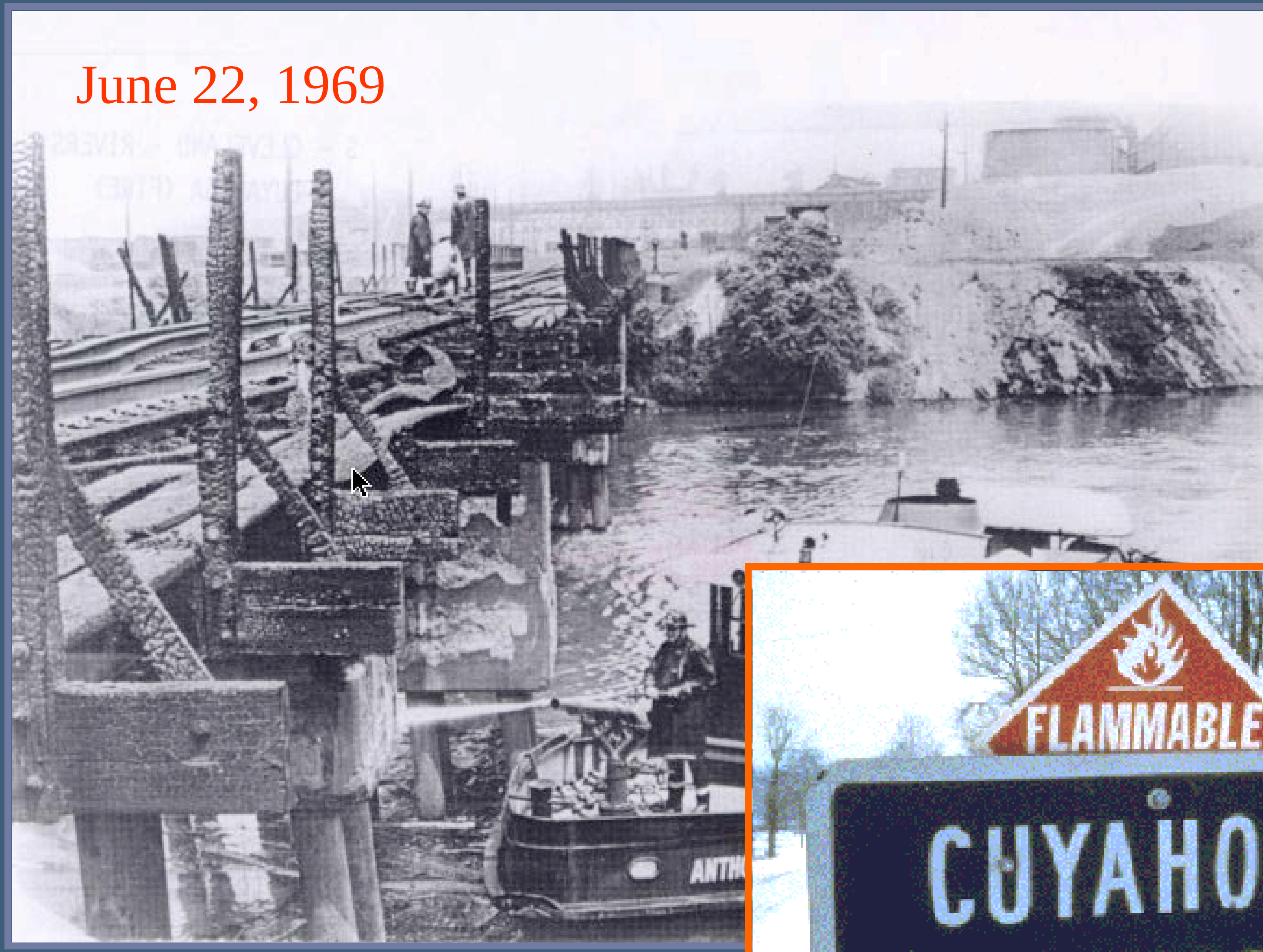
Lake Erie: One of the Most Important Lakes in the World

- Dead lake image of 60s and 70s.
- Poster child for pollution problems in this country.
- But, most heavily utilized of any of the Great Lakes.
- Shared by 5 states, a province, and 2 countries.
- Best example of ecosystem recovery in world.

Lake Erie Stats

- Drinking water for 11 million people
- Over 20 power plants
- Power production is greatest water use
- 300 marinas in Ohio alone
- Walleye Capital of the World
- 40% of all Great Lakes charter boats
- Ohio’s charter boat industry is one of the largest in North America
- $1.5 billion sport fishery
- One of top 10 sport fishing locations in the world
- Most valuable freshwater commercial fishery in the world
- Coastal county tourism value is over $11.5 billion and 119,000 jobs

June 22, 1969



Impact of Ecosystem Recovery (rebirth)

- Ohio walleye harvest 112,000 in 1976 to over 5 million by mid-80s
- 34 charter fishing businesses in 1975 to over 1200 by mid-80s and almost 675 today
- 207 coastal businesses to over 425 today

What brought about the rebirth (dead lake to Walleye Capital)?

- Phosphorus reductions from point sources (29,000 metric tons to 11,000).

Why did we target phosphorus?

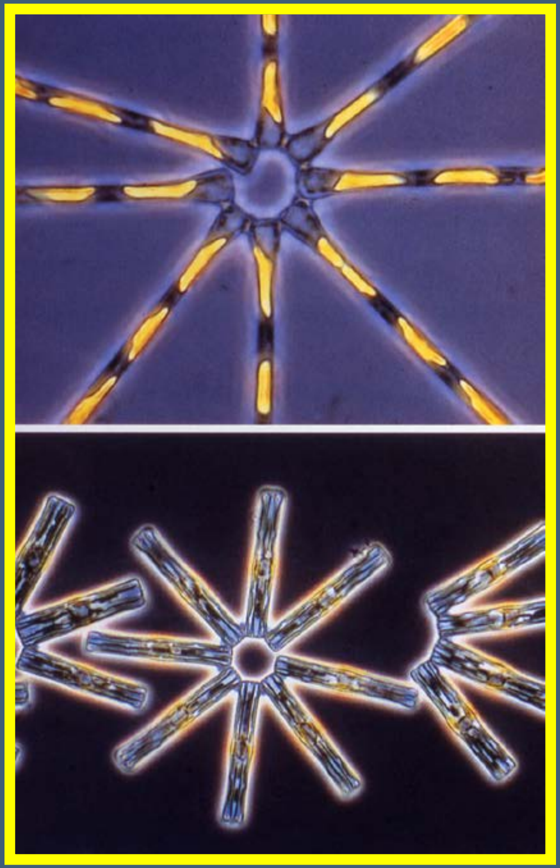
- Normally limiting nutrient in freshwater systems
- P reduction is best strategy ecologically and economically
- Reducing both P and N would help

Algae are tiny plant-like organisms that live in water

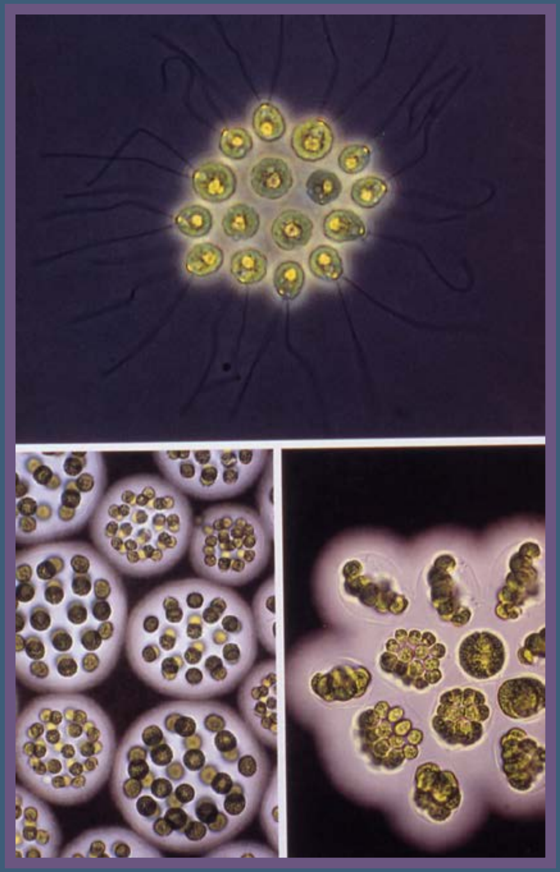
There are hundreds of species of algae in Lake Erie. Most are beneficial.

- Source: Tom Bridgeman, UT

Major groups/kinds in Lake Erie



Diatoms



Greens

Blue-greens
(Cyanobacteria)

- Source: Tom Bridgeman, UT

Impacts of Increased Phosphorus Concentrations

- HABs—If P concentrations are high (regardless of the source, Ag, sewage, etc.) and water is warm, we will have a HAB (nitrogen concentration will likely determine which of the 7-10 species bloom)
- Nuisance Algae Blooms
  - Cladophora—Whole lake problem. An attached form.
  - Winter algal blooms
- Dead Zone in Central Basin

Are HABs only a Lake Erie and Ohio Problem?

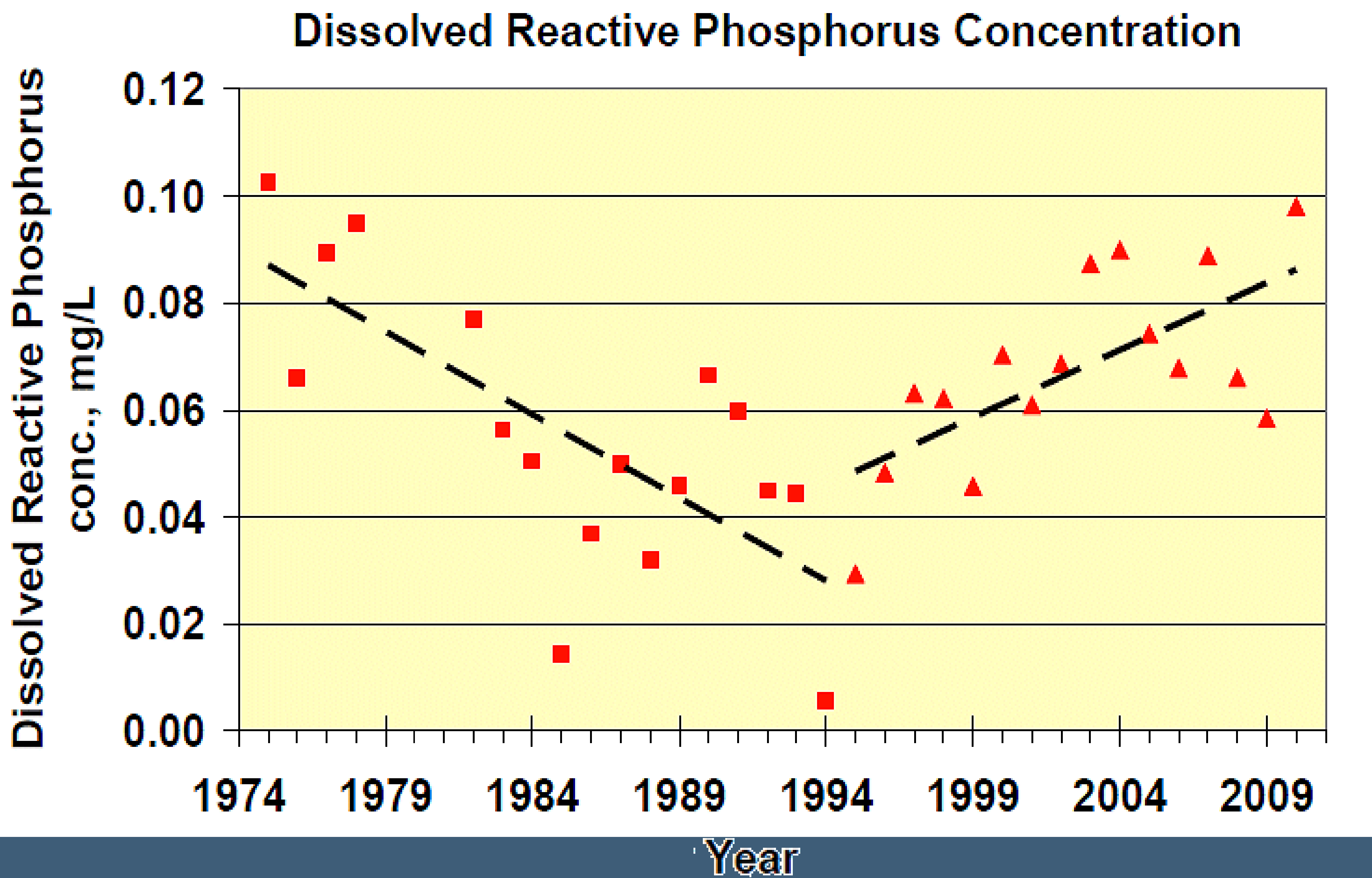
- Serious problem in US and Canada
- Global problem
- Common species in Lake Erie is *Microcystis sp*.
- Dominant form in Grand Lake St. Marys in 2010 was *Aphanizomenon* sp., the same species that bloomed in Lake Erie in the 60s and 70s

Blue-green Algae Bloom circa 1971, Lake Erie

Photo: Forsythe and Reutter

Microcystis, Stone Lab, 8/10/10

Photos: Jeff Reutter

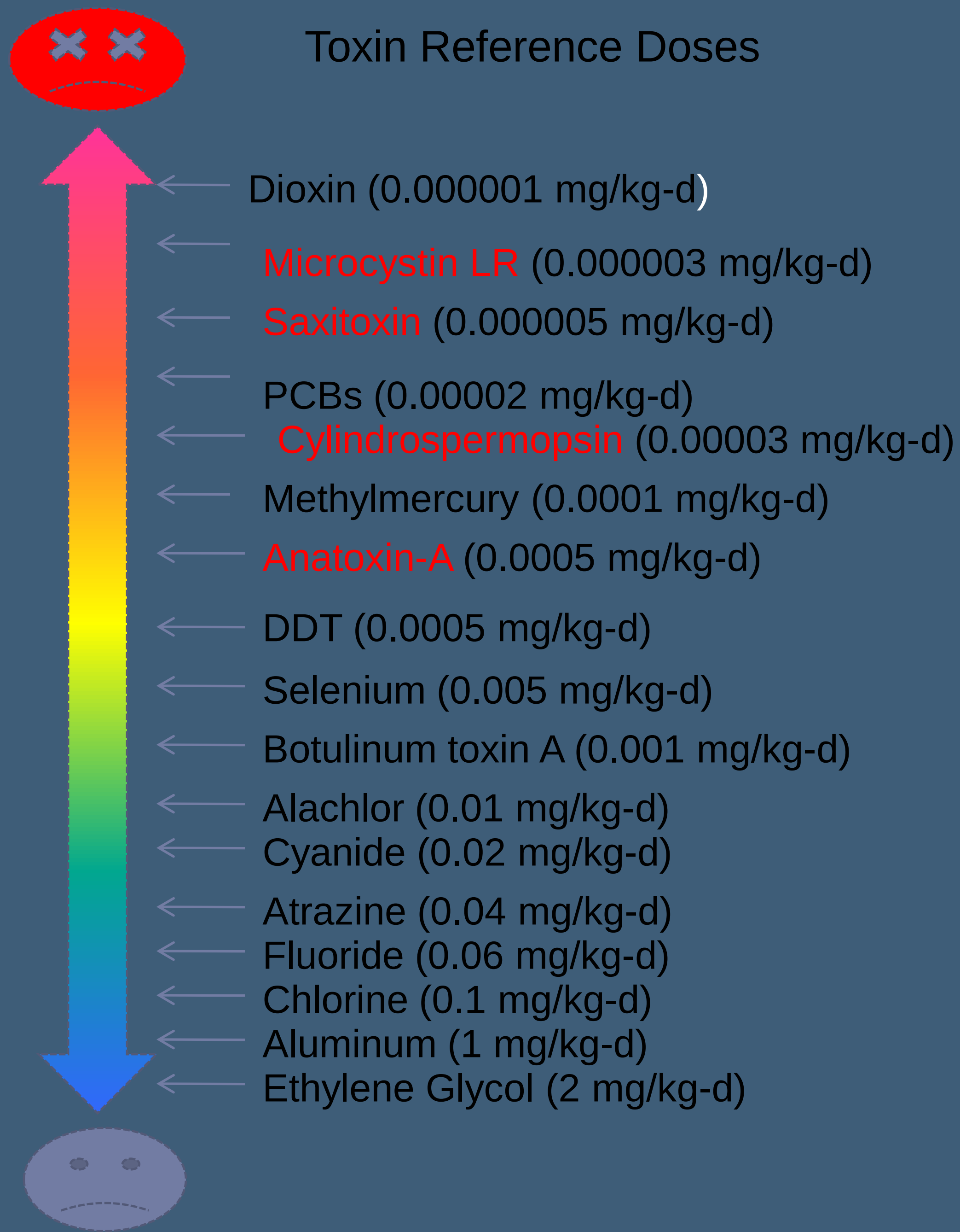

Dissolved Reactive Phosphorus Concentration
Dissolved Reactive Phosphorus conc., mg/L
0.12
0.10
0.08
0.06
0.04
0.02
0.00
1974
1979
1984
1989
1994
1999
2004
2009
Year

Microcystin Concentrations

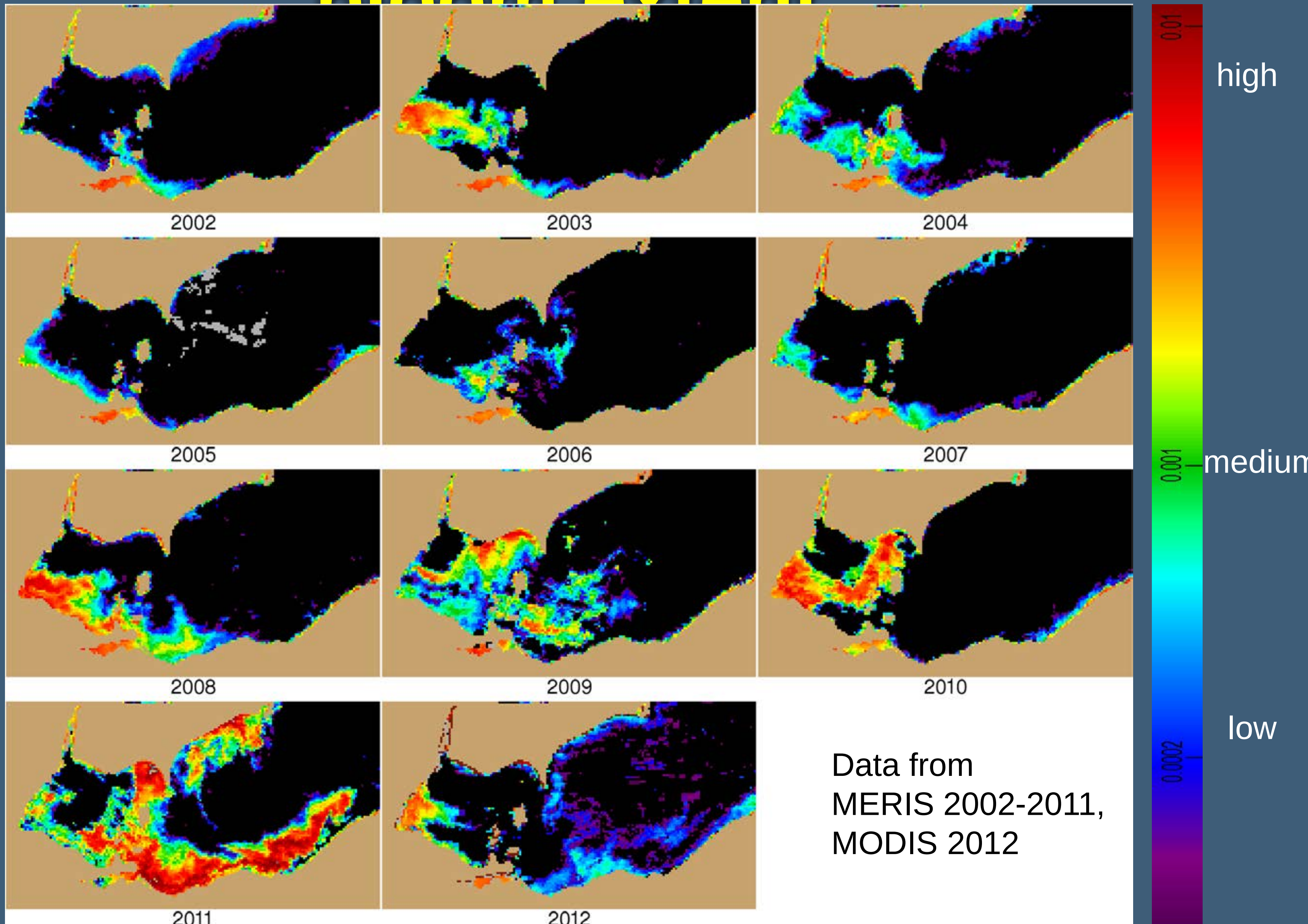
- 1 ppb WHO drinking water limit
- 20 ppb WHO swimming limit
- 60 ppb highest level for Lake Erie till 2011
- 84 ppb highest level for Grand Lake St. Marys till 2010
- 2000+ Grand Lake St. Marys 2010
- 1200 Lake Erie Maumee Bay area 2011
- Carroll Water System, west of Davis-Besse, 4&5 Sept 2013, 1.4 and 3.5 ppb

Toxicity of Algal Toxins Relative to Other Toxic Compounds found in Water

- Reference Dose = amount that can be ingested orally by a person, above which a toxic effect may occur, on a milligram per kilogram body weight per day basis.

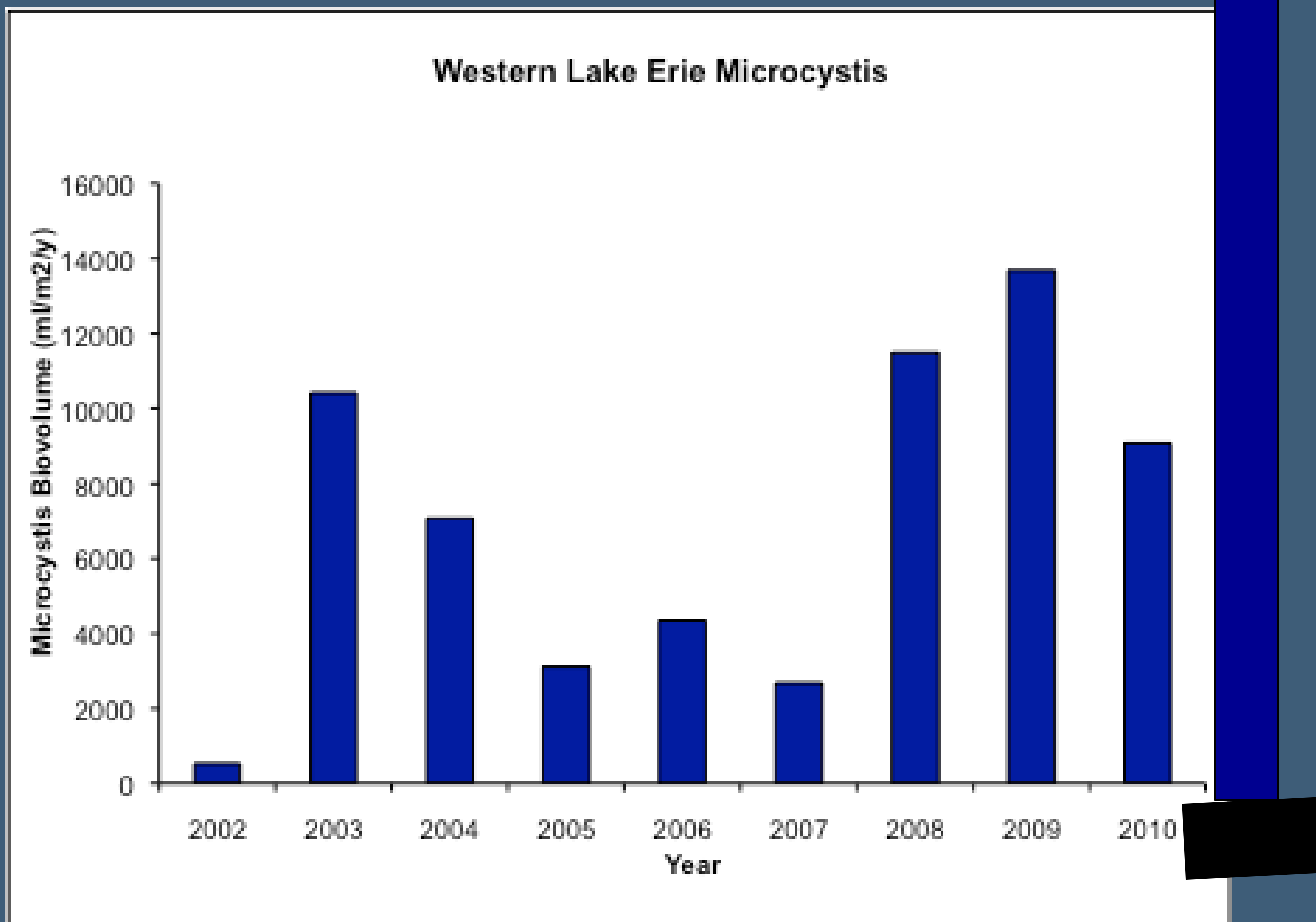


11 years of satellite data provide bloom extent



Microcystis in Lake Erie

- The *Microcystis*-***Anabaena*** bloom of 2009 was the largest in recent years in our sampling region
  - …until 2011 Source: Tom Bridgeman, UT



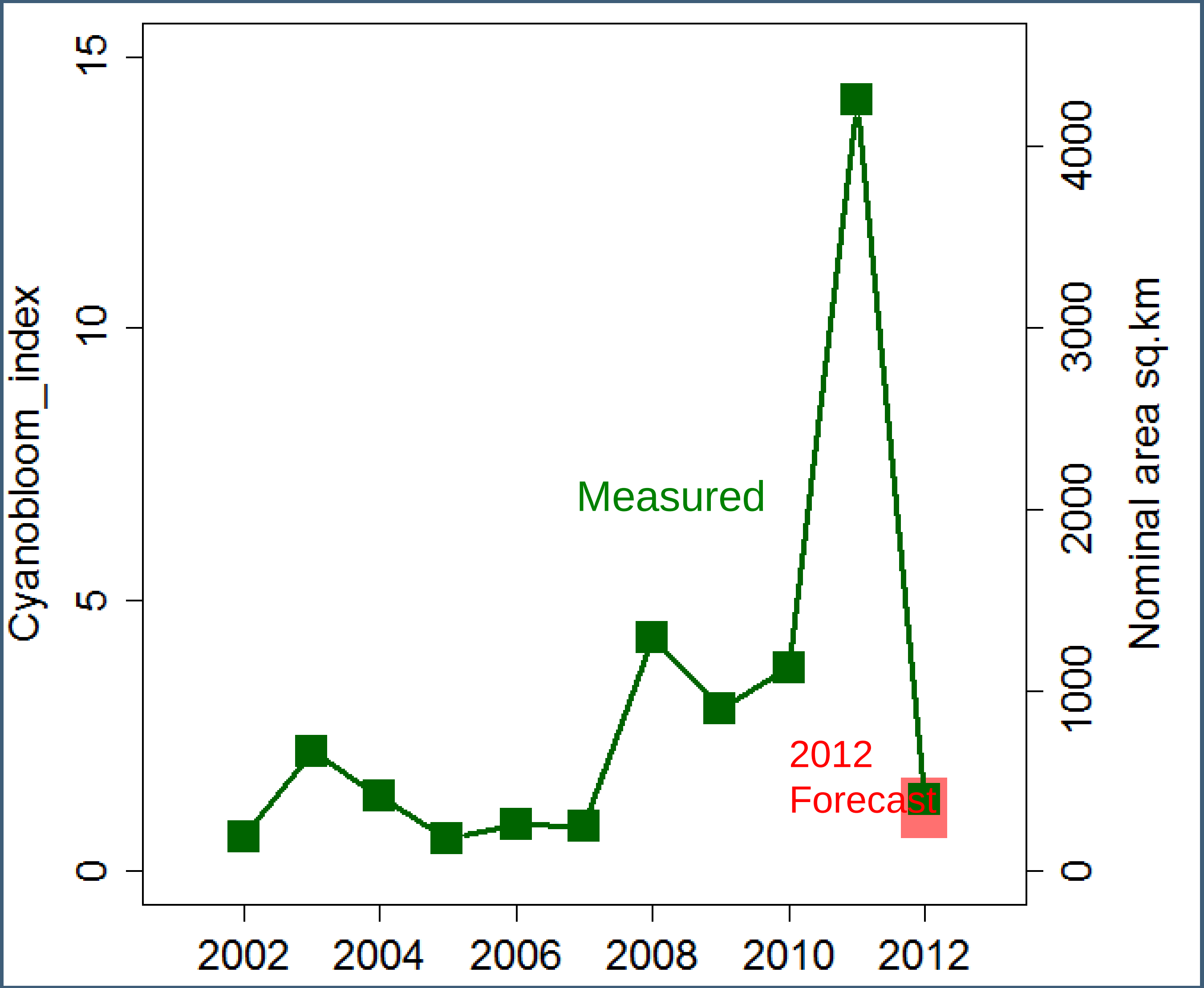

October 9, 2011
Photo: NOAA Satellite Image

Microcystis near Marblehead

HABs in 2012 & 2013

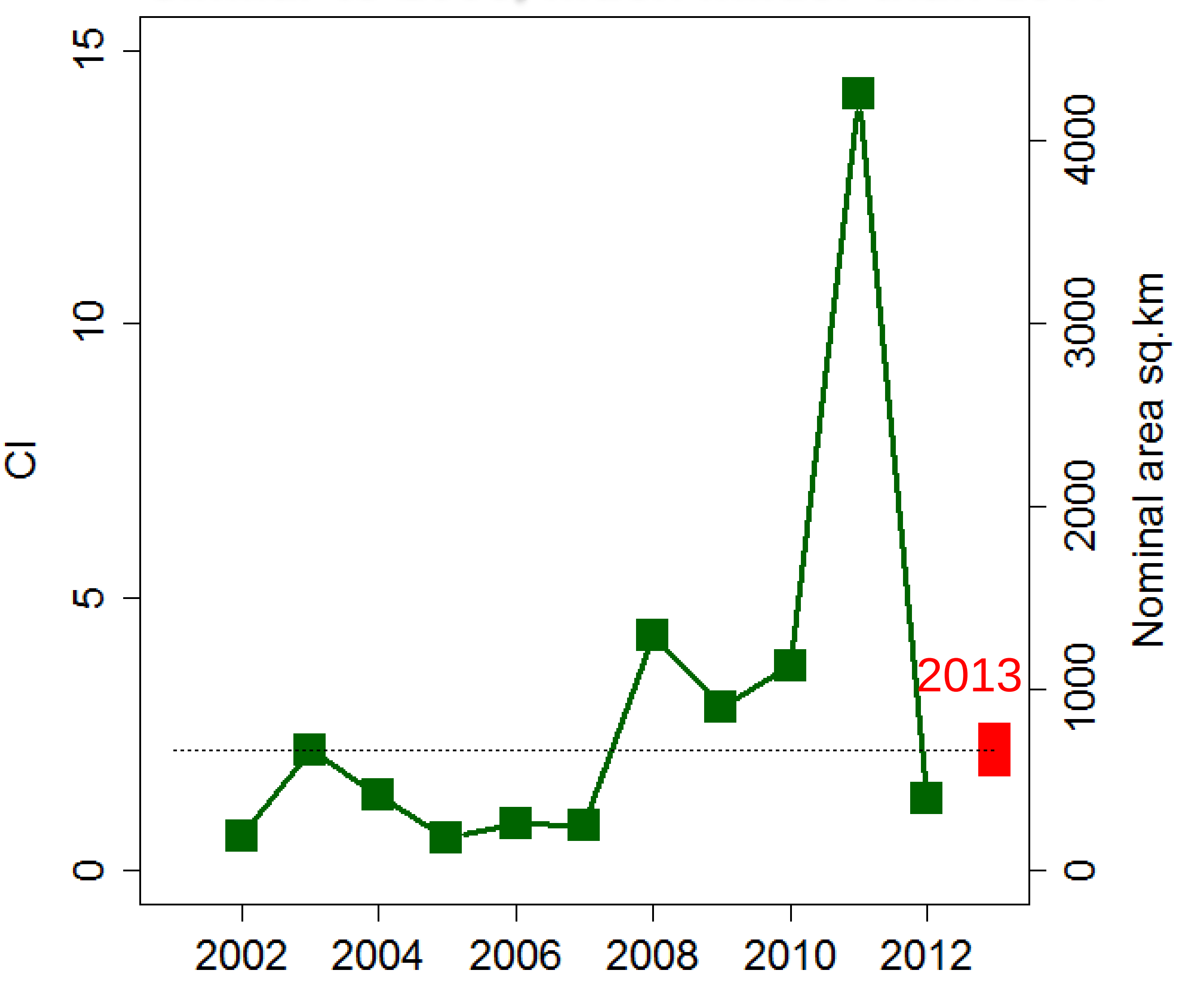
- **NOAA forecast (Dr. Rick Stumpf) in partnership with OSU Sea Grant and Stone Lab, Heidelberg U, and U of Toledo**
- **Based on the total phosphorus load from the Maumee River 1 March to 30 June**
- **Issued at Stone Lab press conferences on 5 July 2012 and 2 July 2013**

NOAA issued the first forecast in 2012.
2012 Forecast (mild bloom) and observed.



2013 Forecast: Significant bloom.

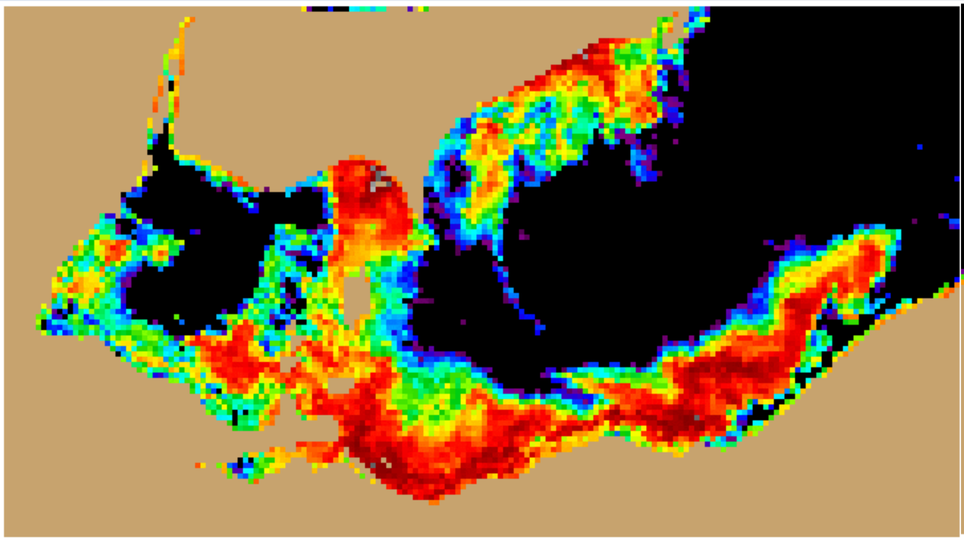
similar to 2003, much milder than 2011



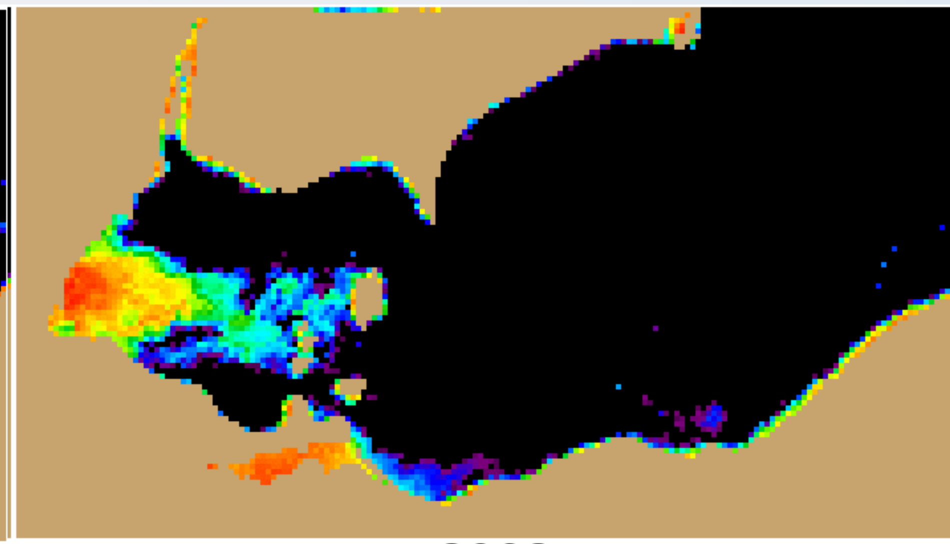
2013 prediction for western Lake Erie: similar to 2003, <1/5 of 2011, 2X 2012

2011 for comparison

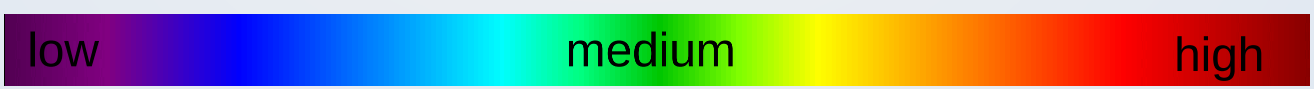
2013 may resemble 2003



2011

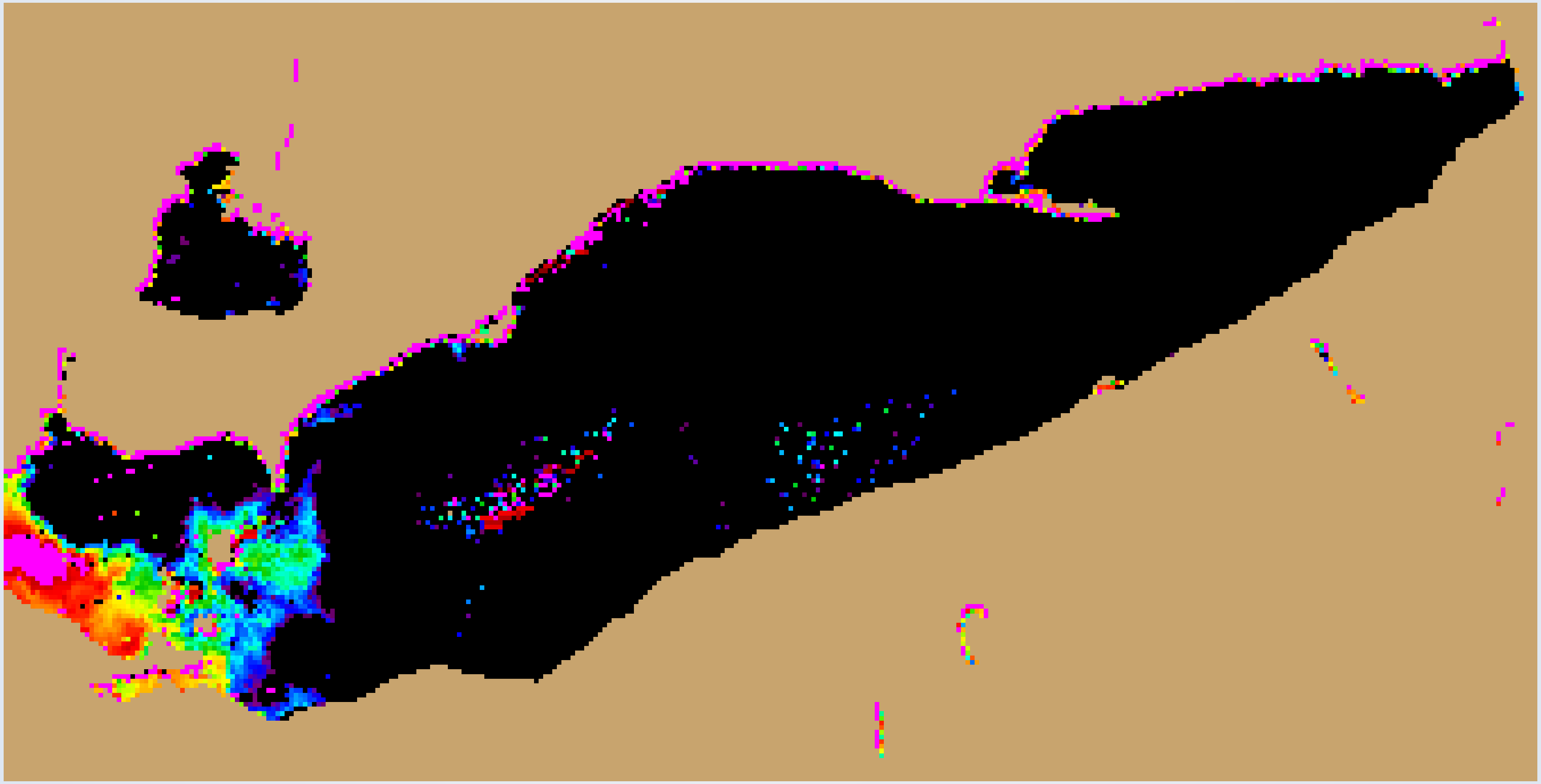


2003



concentration

9/14/13



Target Loads to Solve HABs Problem

- **Leading subcommittee of the Ohio Phosphorus Task Force and Nutrient Annex of Great Lakes Water Quality Agreement to identify both spring and annual target loads of both total P and DRP to prevent or greatly reduce HABs**
- **<u>Target is 40% reduction</u>**
- **<u>Target is 56-78% reduction to solve dead zone issue in Central Basin</u>**

Expect Rapid Recovery in Lake Erie

- Due to rapid flush out rate
  - Lake Erie = 2.7 years
  - Western Basin = 20-50 days
- Other Great Lakes could be over 200 years

Nutrient Loading: Expect improvement

- Scotts P removal from over the counter fertilizer bags
- CSO’s moving in right direction (too slow?)
- Detroit sewage—hopefully in compliance—but bankrupt
- Frequency of severe storms continues to go up
- Ag—expect improvement
  - Farm Bureau is supporting efforts to reduce P
  - Majority of farmers now accept responsibility
  - Certification programs being developed
  - 4R Program
  - Recommendations
    - Don’t apply more fertilizer than needed
    - Don’t apply on frozen or snow covered ground
    - Don’t broadcast, incorporate into soil
    - Don’t apply before when rain in immediate forecast
    - Address load from drain tiles

For more information: Dr. Jeff Reutter, Director

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1314 Kinnear Rd.
Col, OH 43212
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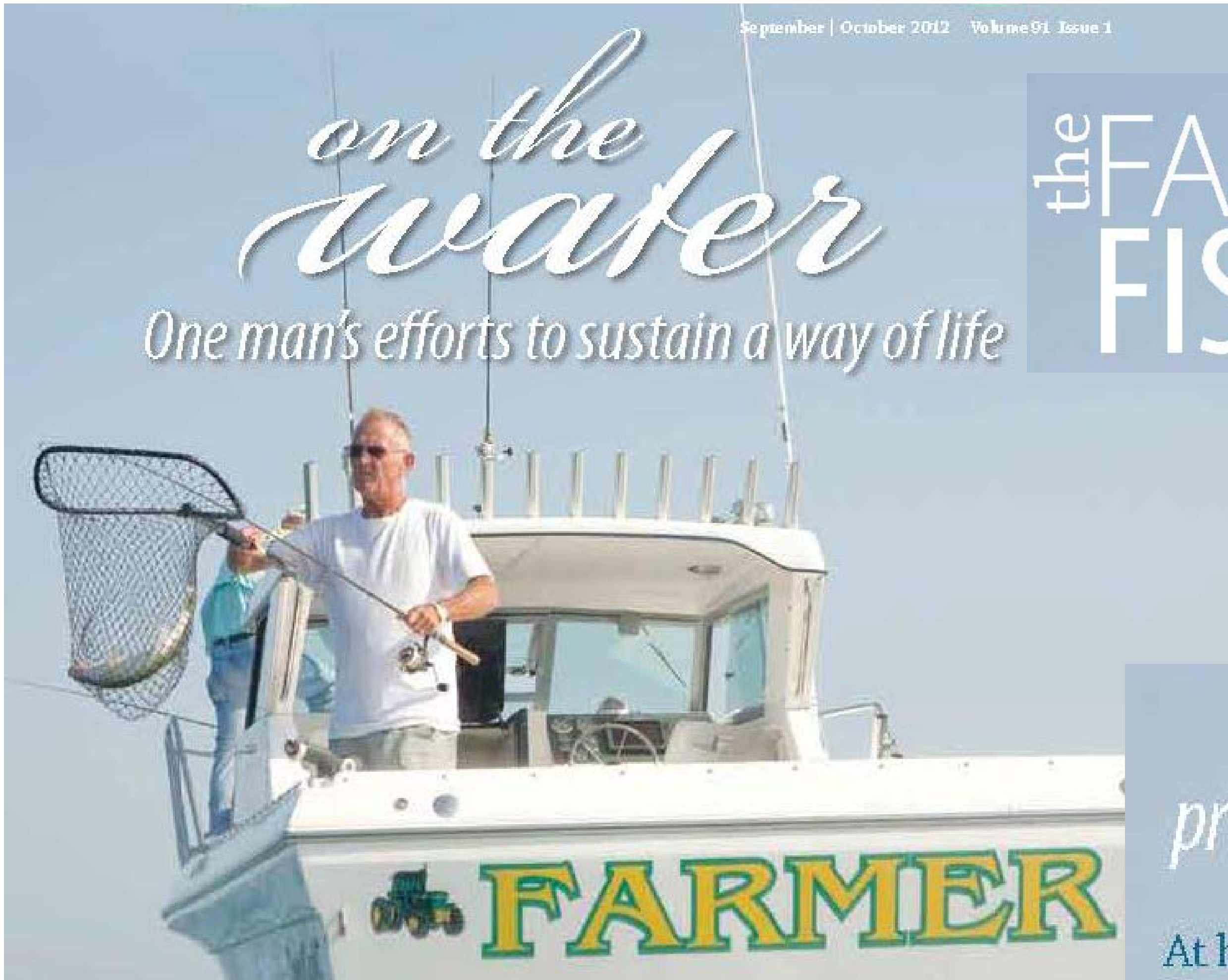
Reutter.1@osu.edu
ohioseagrant.osu.edu

Stone Laboratory
Ohio State Univ.
Box 119
Put-in-Bay, OH 43456
614-247-6500

We Don’t Have to Choose…

…between food production and water quality

Policy to Achieve Both



the FARMER & the FISHERMAN

Clean water is a priority for Don Ralph

At his Lake Erie cottage, he's not Don or Mr. Ralph. He's simply the farmer.

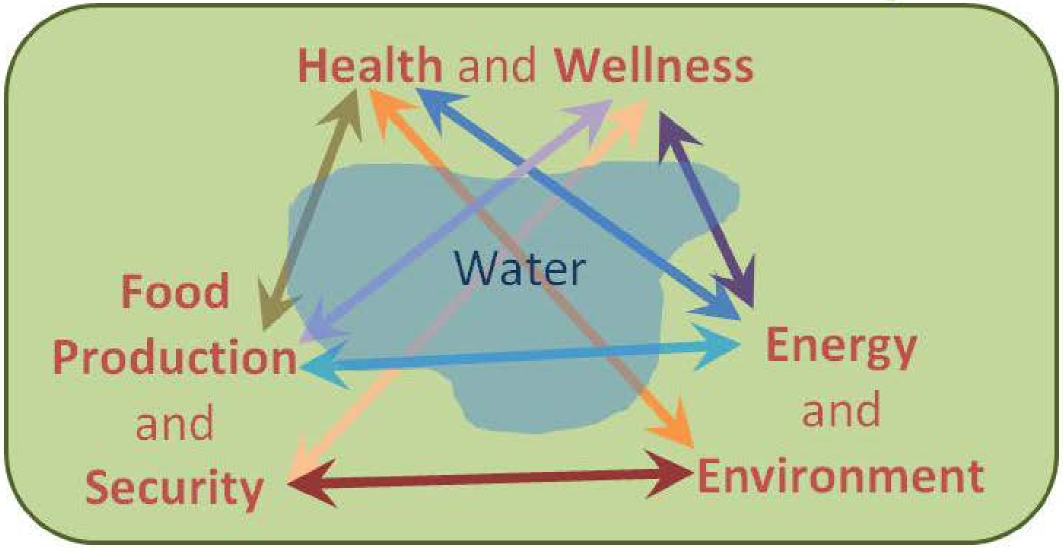
Where to Start

Water, water, everywhere,

Nor any drop to drink

Potential Integration of Discovery Themes

Sustainability



- Food production optimized to promote nutrition
- Sustained environment enables farm productivity
- Clean environment supporting physical health
- Synergized wellness and energy conservation initiatives
- Food production waste becomes biofuel
- Community development built on food security
- Low-impact pesticides reduce chronic disease incidence
- Individual health fuels reduced energy footprint

Farm Bureau's Role & Commitment

Buckeye Farm News | Ohio's Largest Agricultural Newspaper

'We can fix this'

Water Quality

Funding for water quality initiatives is essential

Patience is running thin when it comes to toxic algal blooms.

The public is worried. The media is engaged. Government is poised to act.

Meanwhile, farmers are taking action in their fields and at the statehouse.

Get Involved:

Farm Bureau members are asked to remind your lawmakers of the direct link between water quality and the amount of state money invested in OSU Extension and OARDC, the Ohio Sea Grants program, the National Center of Water Quality Research at Heidelberg University, Ohio Department of Agriculture and Ohio Department of Natural Resources' Division of Soil and Water Resources.

The Letter

- Unprecedented collaboration
- You are expected to do your part in cleaning up Ohio's waters
- If not voluntary, then mandatory actions
- Statewide Issue
- All nutrients applications (fertilizer/manure)
- Ag not only source, but we must do our share, lead!
- 4Rs, more resources coming
- Must proactively solve this challenge

Dear friend,

As a farmer in Ohio you have a significant challenge bearing down quickly. Government, special interest groups, the media and the public all expect you to help clean up the state's water resources.

If farmers don't do this on their own, there will be federal and state laws and regulations that will mandate how you farm.

That is why you're receiving this letter signed by nearly all of Ohio's agricultural organizations – to make it clear that farmers must take seriously their responsibility to manage nutrients.

This isn't just an issue around Grand Lake St. Marys or the western basin of Lake Erie. This affects livestock and crop farmers and those who apply manure or use fertilizer in every Ohio county. The harmful algal blooms that are driving public demands for solutions should not be blamed on farmers alone. Municipalities, homeowners and other industries will be expected to do their share to address the problems. But so, too, will agriculture.

There is still a lot of research to be done on exactly how we can best protect water quality while still farming economically. But the public, lawmakers and regulators won't wait for years of research. They're demanding action now, and we're obliged to deliver. Agriculture must begin immediately to reduce nutrient runoff in a manner that can be documented. If this can't be accomplished voluntarily, it will be imposed mandatorily.

A starting point is to commit to the principles of "4R Nutrient Stewardship," which means using the right fertilizer source, at the right rate, at the right time and with the right placement.

In coming weeks and months you will have opportunities to attend meetings, read articles and otherwise learn about the"4Rs" and other responses to the challenges agriculture is facing. Your agricultural organizations encourage you to actively seek out information, advice and training.

Farmers must proactively solve this challenge. There's more at risk than higher costs of regulation. Unless farmers make significant reductions in nutrient runoff, they will increasingly take the blame for phosphorus loading and toxic algae.

As an industry committed to doing what's right, agriculture should lead the way in accepting responsibility and acting responsibly.

Sincerely,

Ohio's agriculture community

Ohio AgriBusiness Association

Ohio Livestock Coalition

Ohio Cattlemen's Association

Ohio Nursery and Landscape Association

Ohio Corn Marketing Program

Ohio Pork Producers Council

Ohio Corn & Wheat Growers Association

Ohio Poultry Association

Ohio Dairy Producers Association

Ohio Produce Growers & Marketers Association

Ohio Ecological Food and Farm Association

Ohio Sheep Improvement Association

Ohio Farm Bureau Federation

Ohio Small Grains Marketing Program

Ohio Farmers Union

Ohio Soybean Association

Ohio Federation of Soil and Water Conservation Districts

Ohio Soybean Council

The Ohio State University

United Producers, Inc.

Our Plan…

Healthy Waters Ohio

25 Groups involved

Comprehensive statewide plan for Ohio water

- quality, usage, infrastructure, information, economic development

Phase 1 – Develop:

Strategy to address Agricultural Nutrient Management

- Technology and Research Needs
- Assessment, Monitoring and Evaluation
- Funding
- Education and Outreach

Involves Every Ohioan

Ohio water users withdraw about 11 billion gallons each day from Ohio streams, lakes and aquifers

Usage and Economic Benefits Include:

- Drinking Water
- Energy Production
- Shipping/Transportation
- Tourism
- Agriculture
- Industrial
- Boating/Swimming
- Commercial/Recreational Fishing

STOP THE Flood OF REGULATION


Recent Newspaper Headlines Tell The Story
Record-sized Lake Erie algae bloom of 2011 may become regular occurrence, study says
Spring Rain, Then Foul Algae in Ailing Lake Erie
Huge blooms may become common unless policies change
Worse Lake Erie algae woes forecast
Permanent algae signs will go in 14 state parks

What's Happening…

Additional Collaborators:
Ohio Resources Council
Nature Conservancy
Environmental Defense Fund
Lake Erie Improvement Association
Ohio Charter Boat Captains

What Might We Do…

- …to achieve public policy benefitting all Ohioans that promotes sustainable water management and allows for food production and water quality.

Seven Components

1. Change Perspective
2. Build on Ohio’s Strengths
3. Connect with Ohioans and their use of water
4. Improve water management
5. Work with all involved entities
6. Benefit from Education, Research & Technology
7. Enhance our environment and natural resources

Advocacy for Healthy Water Ohio

i. I will politely petition my neighbor, my elected official, Dean McPheron, Director Slack, Director Reutter, etc. with all appropriate requests.

ii. I have many opportunities to be heard, but I must know what I'm talking about.

iii. I will encourage my fellow citizens to aid in the cause – only those who drink water, eat, swim, fish and boat are eligible.

iv. Success is realized in both the result and my participation in the democratic process.

v. Each of us in Ohio need your help. Thank you for what you do.

Jack Fisher
Executive Vice President

614-246-8201

jfisher@ofbf.org

OHIO FARM BUREAU

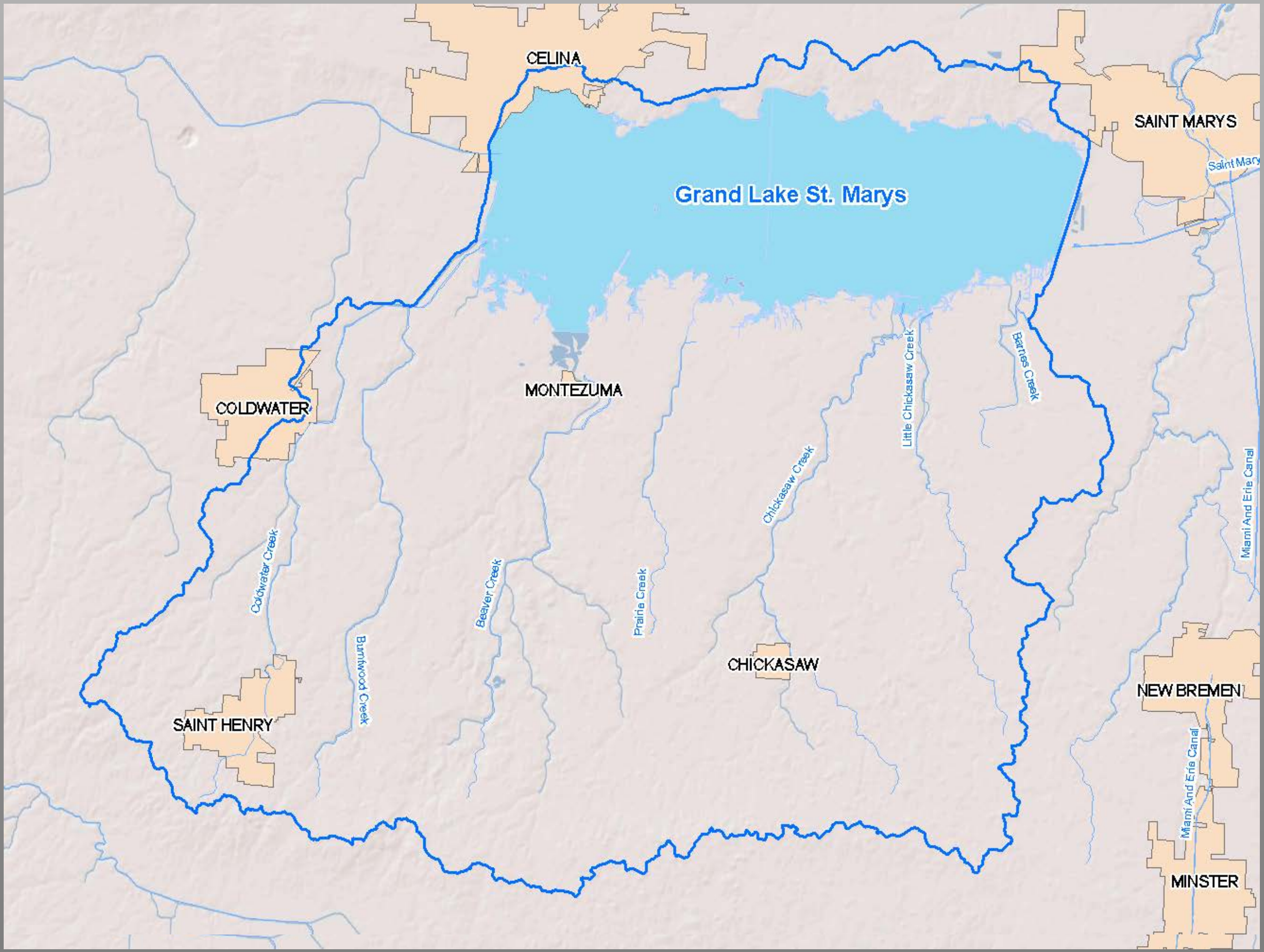
Grand Lake St. Marys

Grand Lake St. Marys

Watershed Details

- **Grand Lake St. Marys is a 13,500-acre recreational lake in western Ohio (the state's largest inland lake).**
- **Grand Lake St. Marys Watershed (in Ohio) covers approximately 50,000 acres.**
- **The lake also sits at the boundary between the Ohio River and Lake Erie watersheds.**

Grand Lake St. Marys Watershed



Grand Lake St. Marys Watershed

- Local Soil and Water Conservation Districts worked with farmers on Comprehensive Nutrient Management Plans (CNMPs).
- 150 CNMPs completed voluntarily.
- Issued 5 chief's orders.
- 154 NMPs now completed.
- One still in court.

Actions in Grand Lake St. Marys

- Nutrient management efforts (CNMPs)
- Dredging
- Treatment trains (constructed wetlands)
- Rough fish removal
- Aeration
- Alum treatments

GLSM Restoration Commission

- **Ag versus non-ag conflict**
- **No finger-pointing approach**
- **Expanding community and business support**

Maumee River Watershed

Lake Erie

Lake Erie

Ohio Clean Lakes Initiative

- **Focus: Western Lake Erie Basin region.**
- **Western Lake Erie Basin encompasses 4 million acres.**
- **Sen. Randy Gardner secured $3 million last budget.**
- **Focused on five counties last year: Defiance, Hancock, Henry, Putnam and Wood.**

Healthy Lake Erie Fund

- **Ohio has used $2.45 million.**

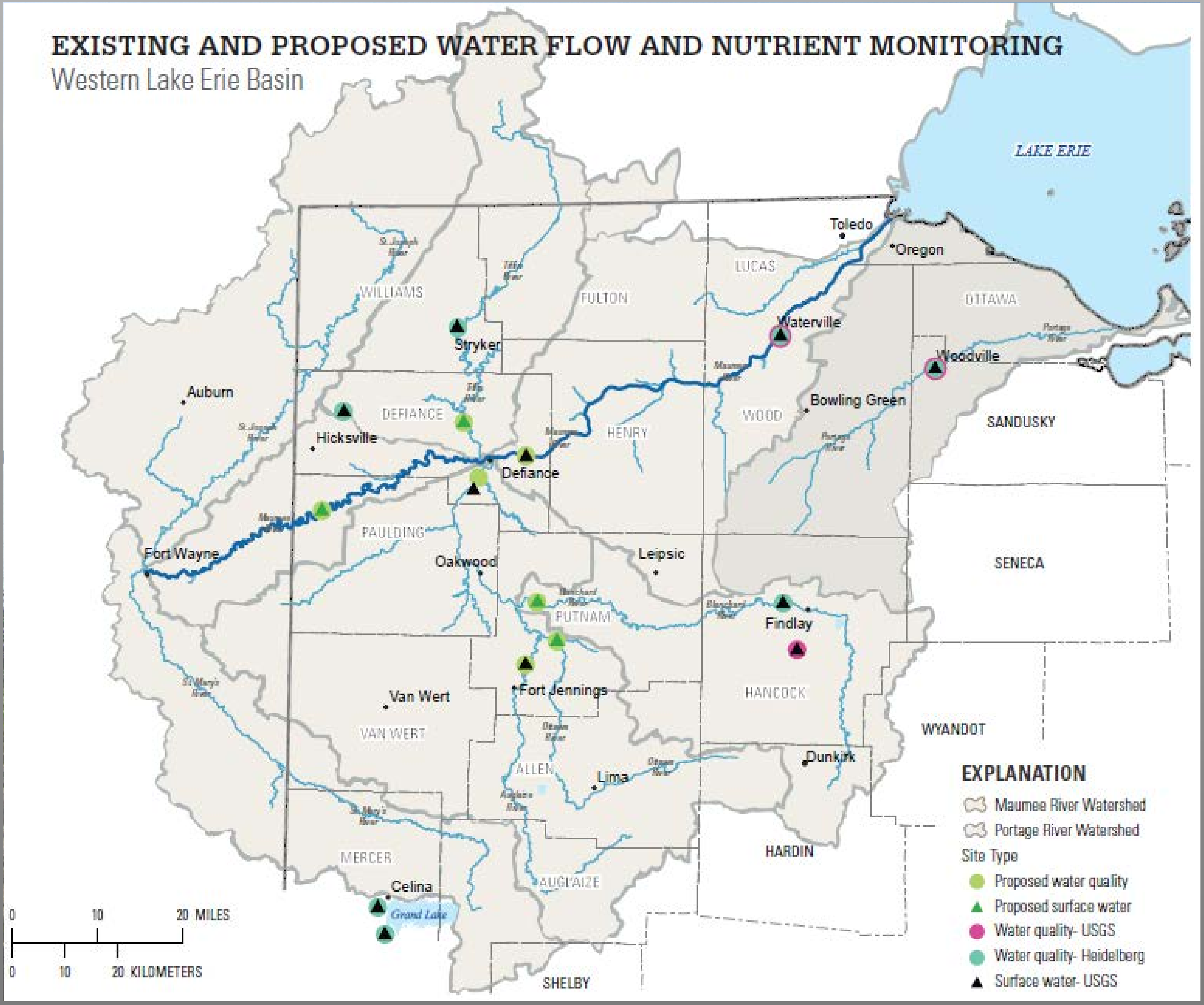
- **Practices include: controlled drainage structures, cover crops, variable rate technology.**

- **Result: Conservation practices are now implemented on more than 41,000 new acres within the Maumee River Watershed.**

Monitoring Stations

- **Twenty years of monitoring by Heidelberg University at four stations.**
- **The Ohio Legislature allocated an additional $1.1 million for monitoring stations in the Maumee River Watershed.**
- **Seven nutrient monitoring stations are being added within the watershed.**

Maumee River Watershed



Evaluate/Revise
Ohio Phosphorus Risk Index

Using

Field-Scale, Edge-of-Field Monitoring

Elizabeth (Libby) Dayton Ph. D.
(SENR, OSU)

Problem

- Phosphorus (P) is the agricultural nutrient most often implicated in the degradation of fresh surface water
- Historically, Manure/biosolids recommendations were based on crop N requirements, resulting in a 2 to 3 fold excess P application
- P application in excess of crop requirements results in soil P saturation and increased risk of P transport to surface water

Lake Erie Stats

Why is P Important?

- Drinking water for 11 million people
- 300 marinas in Ohio alone
- Walleye Capital of the world
- 40% of all Great Lakes charter boats
- Ohio's charter boat industry is one of the largest in North America
- $1.5 billion sport fishery
- One of top 10 sport fishing locations in the world
- Most valuable freshwater commercial fishery in the world
- Coastal county tourism value is $11.6 billion/yr & 117,000 jobs

ODNR Distressed Watershed Rules
Grand Lake St Marys

http://www.dnr.state.oh.us/portals/12/water/watershedprograms/GLSM/Watershed_in_Distres_FactSheet.pdf

OEPA Lake Erie Phosphorus Task Force

One Major Finding

Agriculture is a primary source of P to Lake Erie

⬇

Research Needs

Consensus: Examine/Revise
Ohio Agricultural P management Tools
To reduce P transport

OEPA Lake Erie Phosphorus Task Force II

Recommended P Loading Target Reductions
39% from 11,000 to 6,710 metric tons TP

Final Report 2010
http://www.epa.state.oh.us/portals/35/lakeerie/ptaskforce/Task_Force_Final_Report_April_2010.pdf

<u>Ohio Agriculture is Being Targeted</u>
due to
P transport into Ohio surface waters

P is culprit for harmful algal blooms

Ohio Agriculture IS Taking the lead in protecting water quality while maintaining production

Avoid Regulation
Good Public Relations
Good Stewardship

So What's the Path Forward?

On-Field Ohio !

USDA-NRCS Nat'l
Conservation Innovation Grant

$1 million Federal award
$1 million matching funds from Ohio farmers

Evaluation/Revision
of the Ohio Phosphorus Risk Index (Ohio P Index)
Using Field-Scale, Edge-of-Field Monitoring Data

Project Objectives

Because the Ohio P Index is expected to provide a field-scale estimate of *Risk* of P transport off farm fields

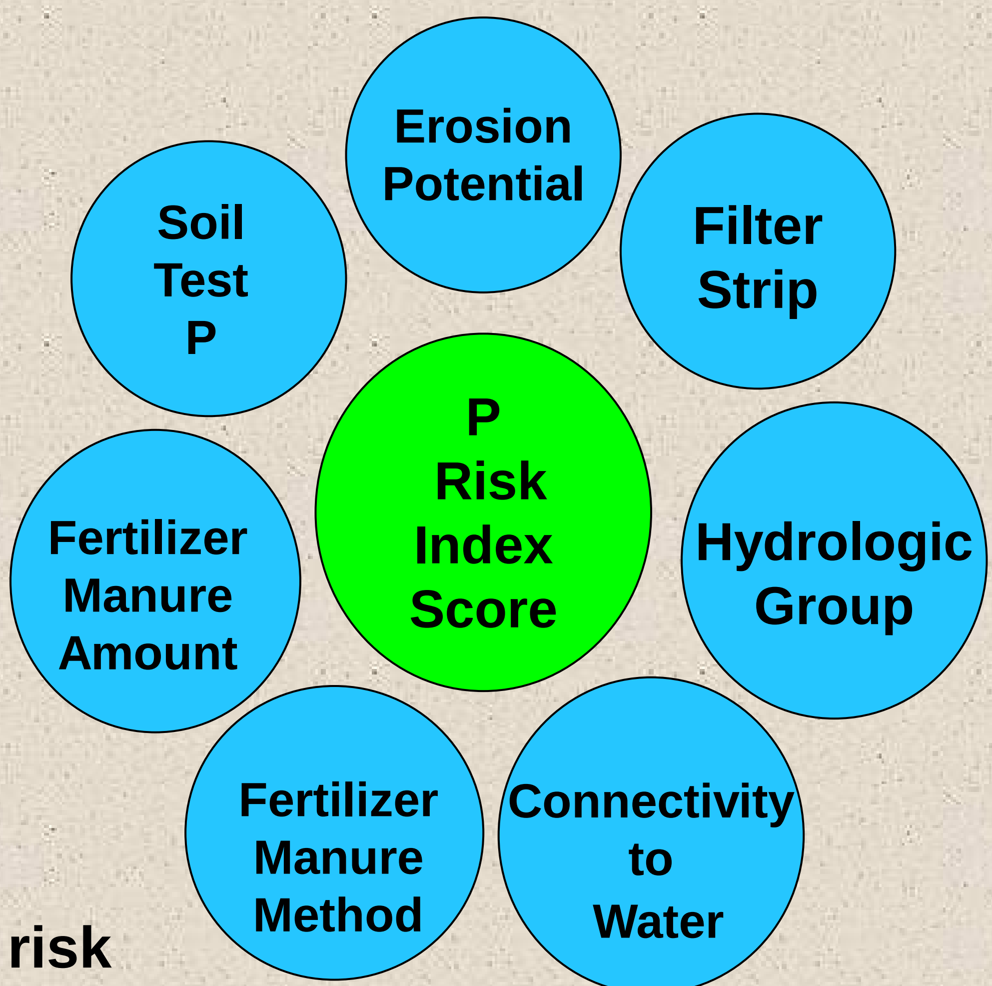
Used to judge performance !!

Objectives:

1. **Evaluate/revise Ohio P Index, provide confidence that Ohio P Index scores accurately reflect risk of P transport at the edge-of-field**
2. **Increase management options (BMPs) integrated into the Ohio P Index for fields with high scores**
3. **Broad implementation of revised and improved Ohio P Index to protect Ohio surface water quality**

1. Evaluate/Revise Current Ohio P Index:

Ensure P Index Scores accurately reflect P transport RISK at the field-scale using, edge-of field monitoring

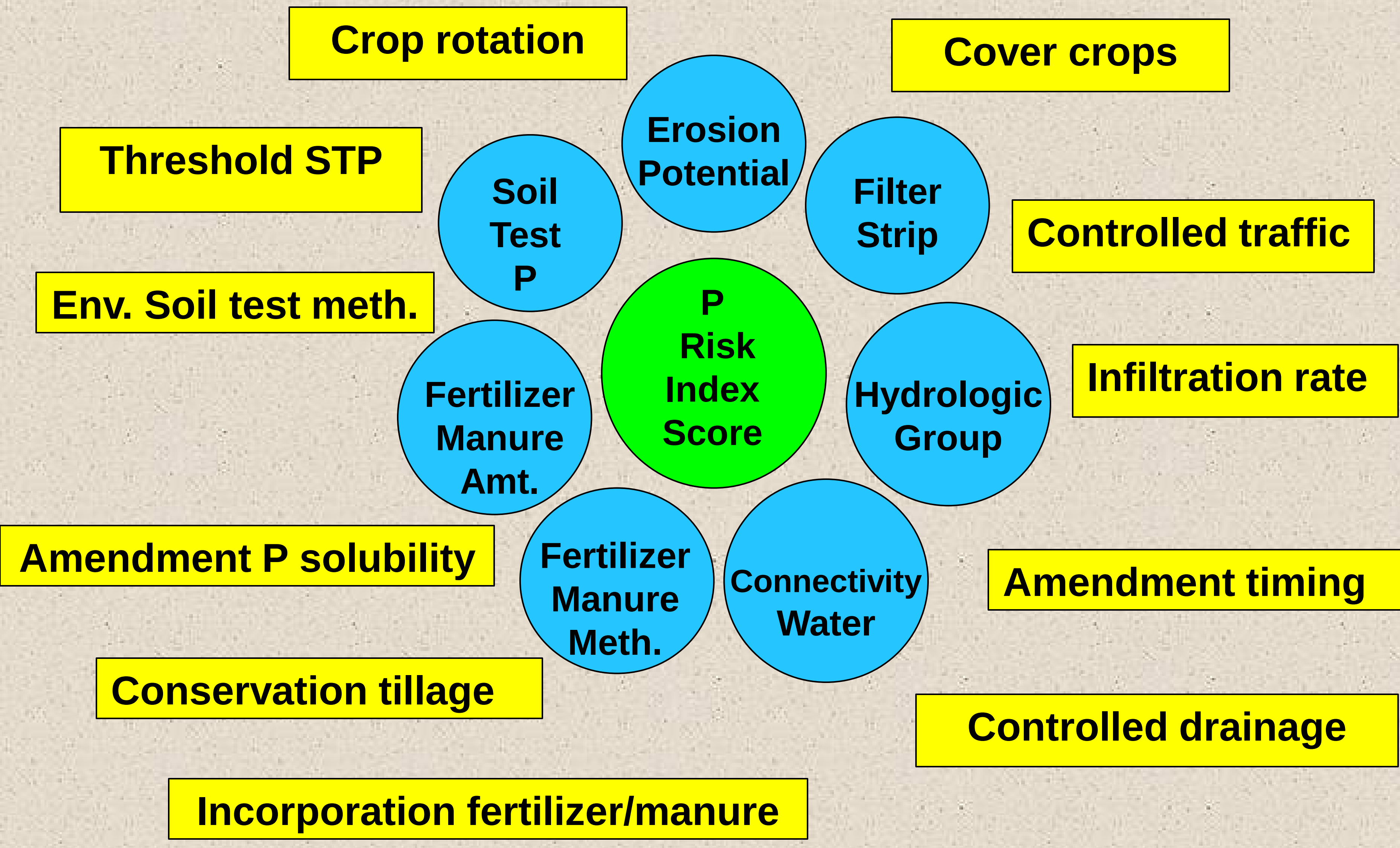


Current Parameters in *Ohio P Index to calculate scores

Low, medium, high & very high risk

*http://efotg.nrcs.usda.gov/references/public/OH/Nitrogen_and_Phosphorous_Risk_Assessment_Procedures.pdf

2. Integrate additional (BMPs) into P Index
Give Farmers more management options:



3. Implement Revised Ohio P Index

On-Line Interactive Tool

Develop easy to use on-line, interactive, GIS based tool so farmers can calculate their Index Score

Further! Additional BMP options to choose from to reduce P transport risk and Ohio P Index score

Important !!

If a BMP NOT Officially in Ohio P Risk Index Farmer does NOT get CREDIT for it

Field Site Selection

Ohio P Index Score = Transport Factors + Source Factors

Transport Factors	Source Factors
Runoff potential	Soil test P (STP)
Erosion potential	Planned P
Connectivity to water	Application amount & method
Filter Strip yes/no	

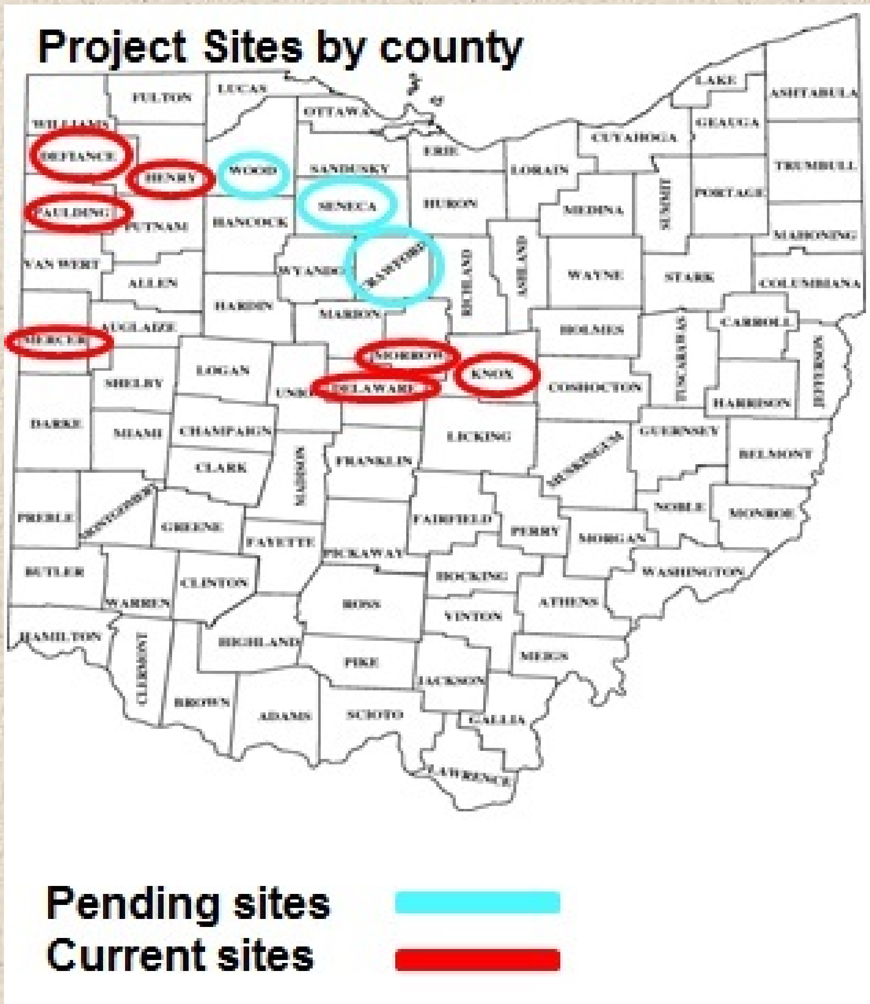
↓

Fairly "fixed" field/soil characteristic	Fairly Changeable management practices

↓

Need robust distribution across study fields
Similar to distribution in Ohio agriculture

Counties with Current/Pending Project Sites

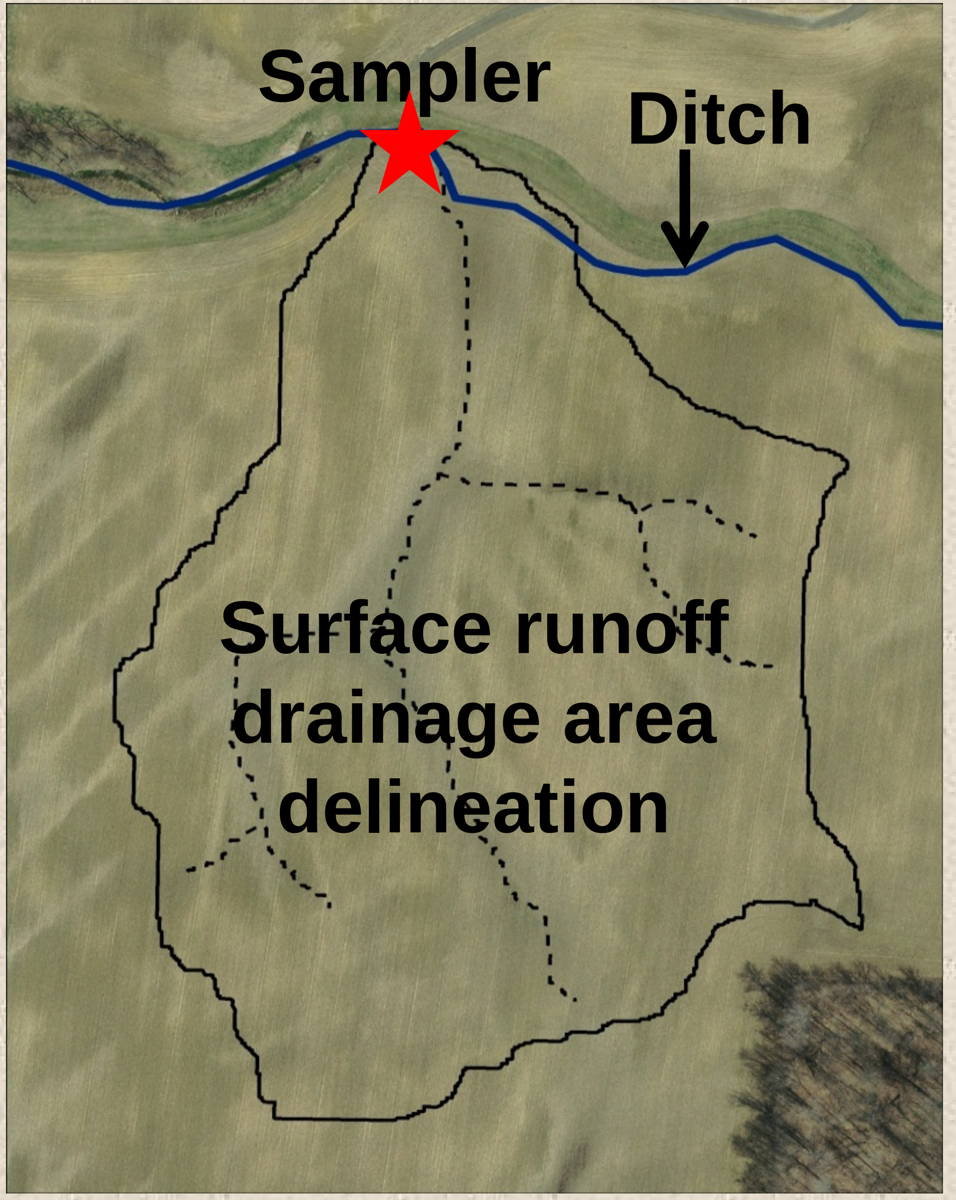


- 8 in GLSM
- 8 in Scioto
- 12 in WLEB

Plan on minimum 30 sites
Most with Surface
and
Sub-surface sampler

Special Thanks
to our
Participating Farmers

Surface Runoff Set-Up



- Delineate surface runoff drainage area
- Install sampler
- Measure water flow
- Collect runoff samples

Sub-Surface Runoff Set-Up

- Identify sub-surface drainage area
- Install sampler
- Measure water flow
- Collect sub-surface runoff samples


4230


4230

Data Collection Overview

- Field/Participating farmer management information
  - What they do, when and how, Yield
- Soil Physical Properties related to water infiltration
  - New consideration for P Index
  - Closer look at field water management
- Laboratory Analyses
  - Water Samples
    - RTP, RDP, RTN, $RDNH_4$and NO_3, Sediment
  - Soil Samples
    - STP (4 methods/2 depths) PAN, pH, TN/OC, texture, Total P

Soil Physical Properties "Quality" Data

Water Infiltration is the Key !!

Measured Properties

Texture
Aggregate Stability
Bulk Density
Organic Carbon
Water Holding Capacity
Penetration Resistance
Saturated Hydraulic Conductivity
% Residue Cover

↓

As Related to Management Practices

↓

As Related to Infiltration measured at the field-scale

In Addition

.

Evaluate Ohio N Leaching Procedure

- Relative Index rating of N leaching Potential
- Potential based on combining soil's hydrologic soil grouping & local county annual and seasonal (Oct. 1 to March 1) rainfall

Rating	N Leaching Potential
0 to 2	Low
3 to 10	Medium
10+	High
Tile drained	High

Financial Support

While CIG is a 3 year project we hope to continue
Cost approximately $500,000/yr to operate

Current Financial Support from Agri-business		Amount
Ohio Soybean Council		$450,000
Ohio Small Grain Marketing Program		$200,000
Ohio Corn & Wheat Growers Assoc.		$100,000
The Andersons Inc. Endowment, through OARDC		$100,000
The Andersons Inc. Charitable Foundation		$50,000
The Ohio Farm Bureau		$50,000
DuPont Pioneer Community Betterment Grant		$50,000
Nachurs Alpine Solutions		$30,000
United Soybean Board		$25,000
Luckey Farmers Inc.		$15,000
Trupointe Cooperative		$15,000
Additional donations		$4,000
	Total	$1,089,000
Current Federal Financial Support		
USDA-NRCS Conservation Innovation Grant (CIG)		$1,000,000

The Team…… So far

OHIO CORN MARKETING PROGRAM

Ohio AgriBusiness Association

trupointe

OHIO FARM BUREAU

SOY OHIO
Ohio Soybean Council

THE OHIO STATE UNIVERSITY EXTENSION

THE OHIO STATE UNIVERSITY

Statistical Consulting Service
scs.osu.edu

PIONEER.
A DUPONT BUSINESS

NRCS
Natural Resources Conservation Service

The Andersons

Ohio Department of Agriculture

Schlessman Hybrids
SCHLESSMAN

Conclusions

- Need to REDUCE P load to Ohio surface waters
- Ohio farmers are actively engaged in being part of the solution
- A revised Ohio P Risk Index can play an important role in P management
- Once revised, the P Risk Index will only be effective if it is routinely utilized

Thank You !!

Questions ??

Libby Dayton, dayton.15@osu.edu

School of Environment and Natural Resources

“A Nutrient Trading Model for Advancing Clean Water Initiatives”

Experiment Station Section Annual Meeting

Columbus, Ohio **September 24, 2013**

Richard H. Moore
Executive Director, Environmental Sciences Network
Professor, School of Environment and Natural Resources
College of Food, Agriculture, and Environmental Sciences
Ohio State University
Moore.11@osu.edu

WATER QUALITY TRADING

- A type of Environmental Services Trading
- Created in 2003 by US EPA
- Trading can occur between PS and PS or between PS and NPS (usually a WWTP trading credits with farmers who in conservation measures)
- Ohio EPA created rules in 2007

Goals of Water Quality Trading

- Improve water quality and environment
- Economic benefits to buyer and seller of credits
- Increase interaction of stakeholders in a watershed

EPA POINT SOURCE REGULATION—the driver

National Pollutant Discharge Elimination System (NPDES)

400,000 permits nationally

Municipal wastewater treatment systems

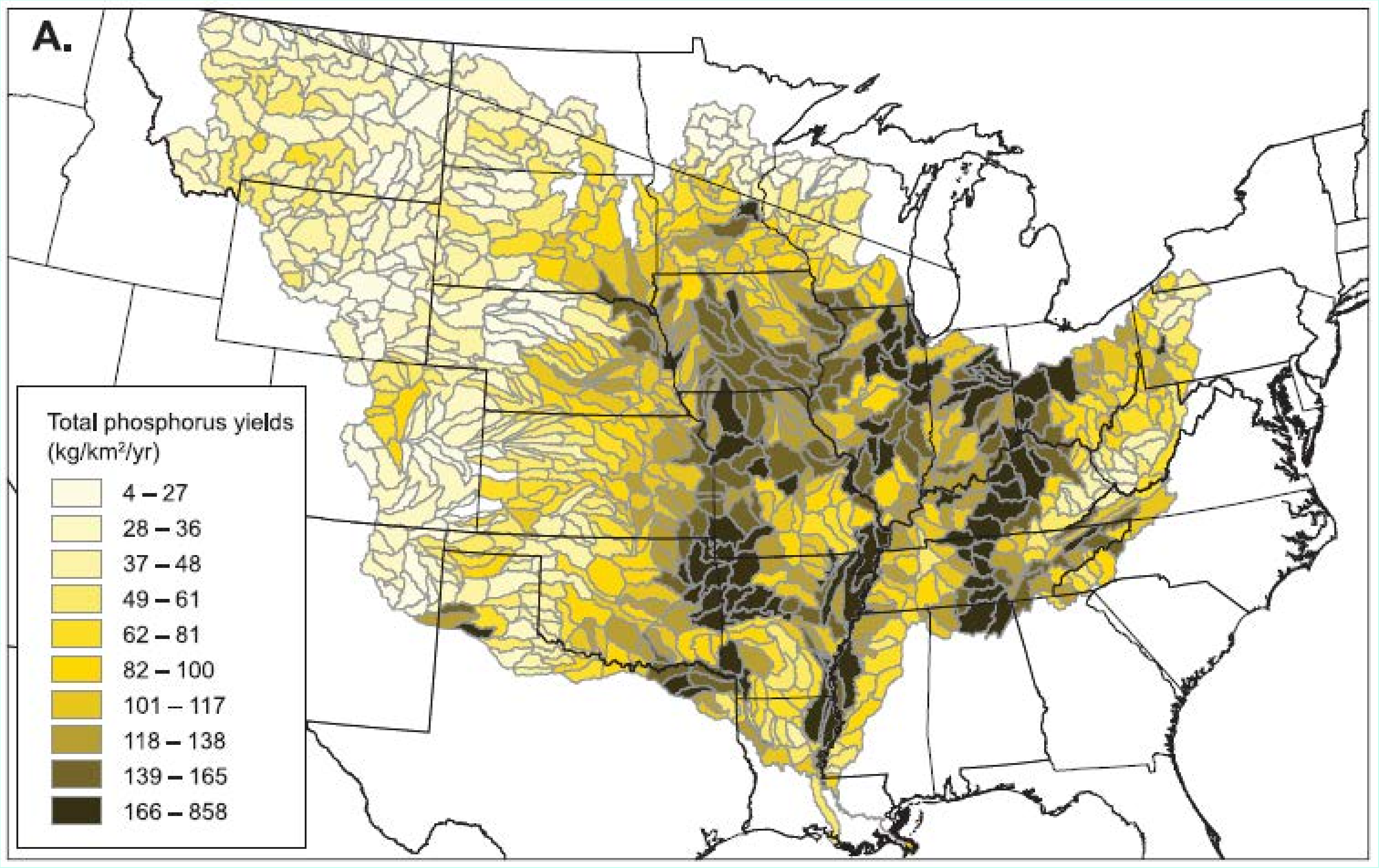
Municipal and industrial storm water systems

Industries and commercial facilities

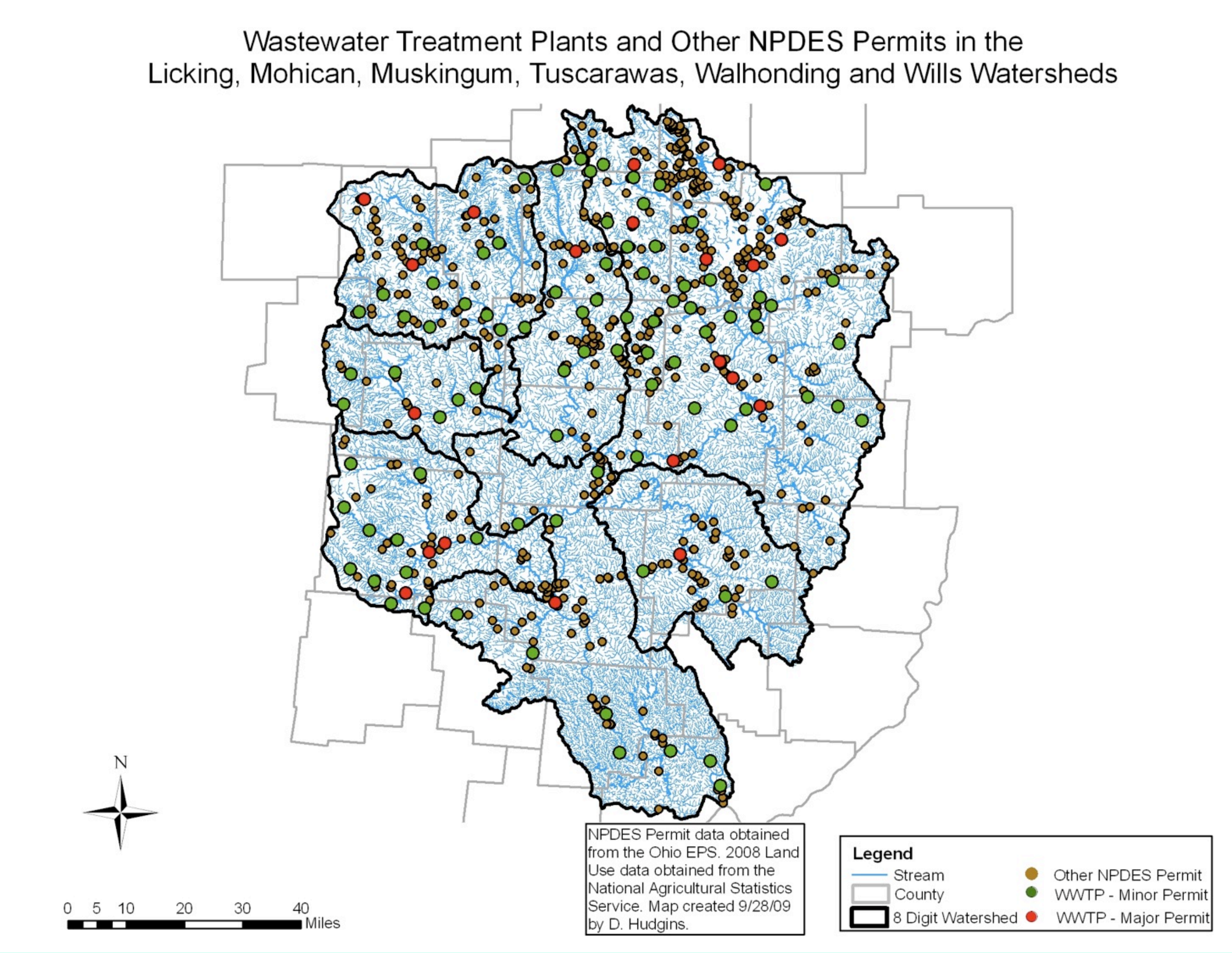
Concentrated Animal Feeding Operations

SPARROW MODEL 2011

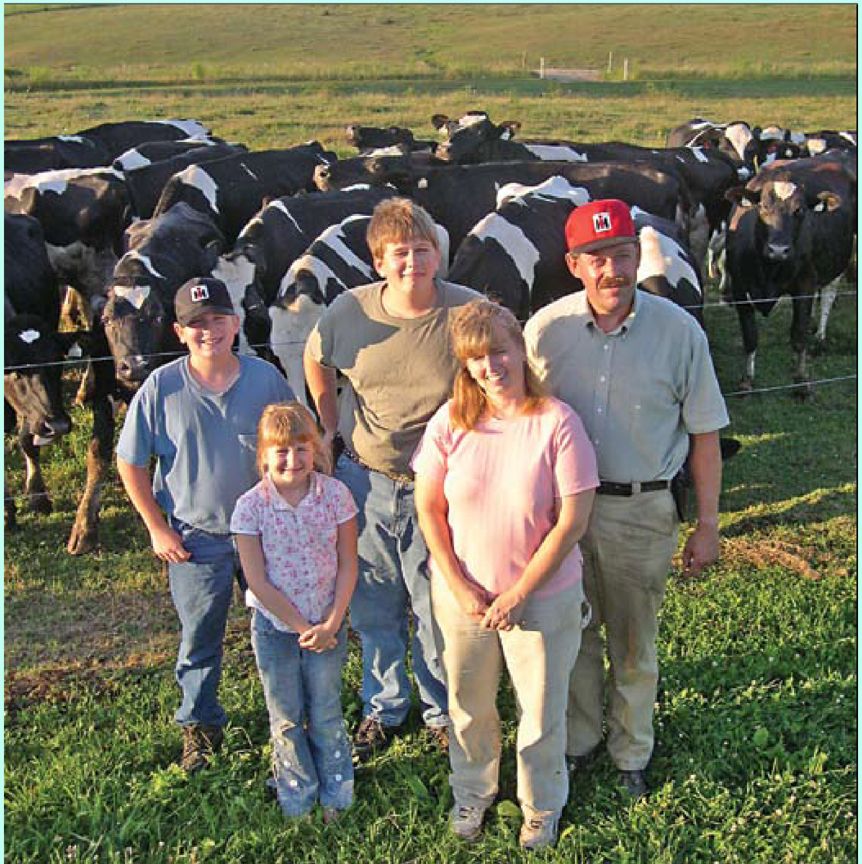
P IN MISSISSIPPI SYSTEM



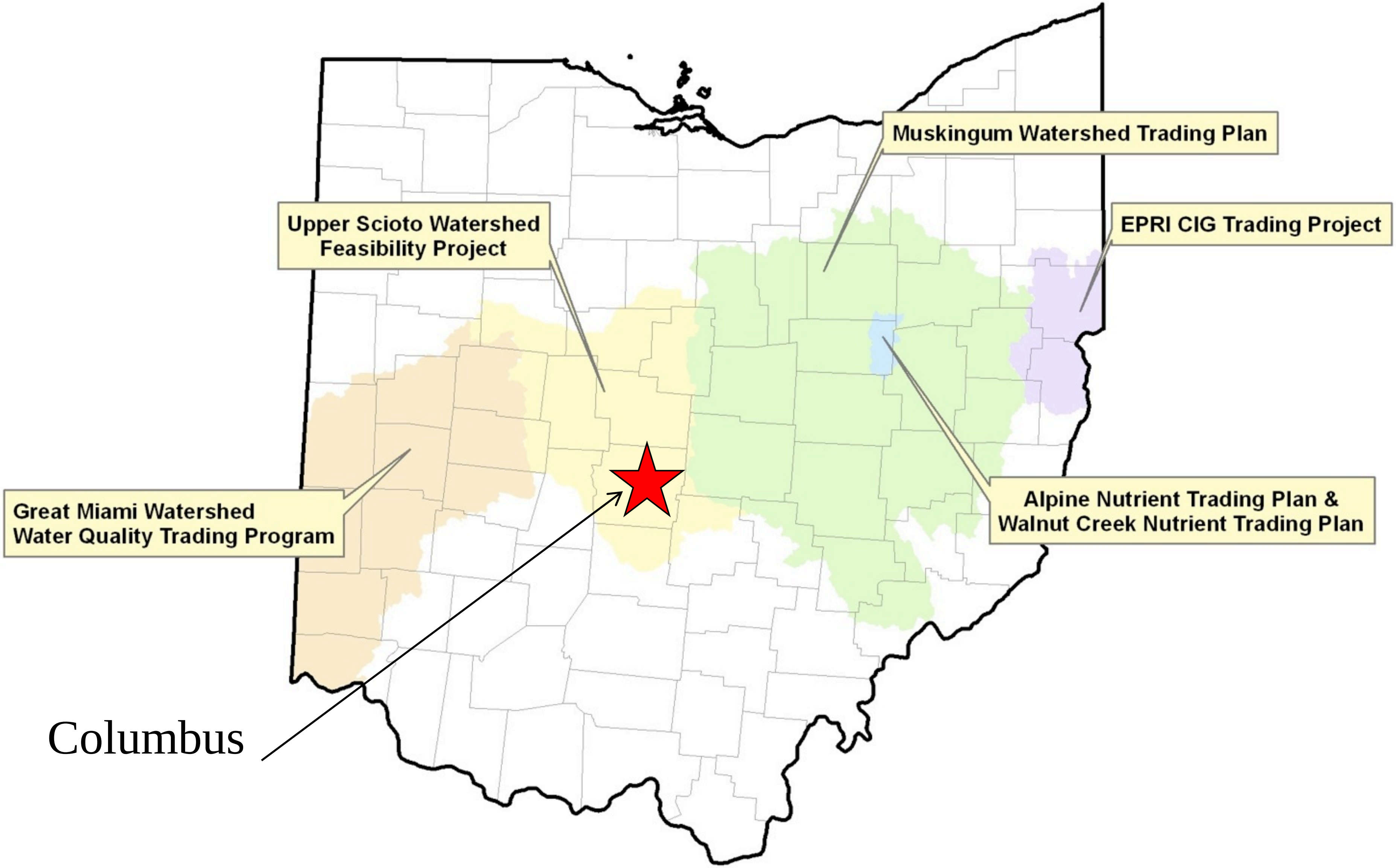
ABUNDANCE OF MINOR NPDES PERMITS



An Important Question: Who Benefits by Water Quality Trading?



Ohio Water Quality Trading Programs



Major and Minor NPDES Permits

MAJOR	MINOR
More than 1 MGD Design Flow	Less than 1 MGD Design Flow
Facility upgrade costs per gallon low	Facility upgrade costs per gallon high
Low transaction costs	High transaction costs
Usually downstream	Usually upstream

High Costs for Small WWTPs

0.1MGD WWTP PAY 3X 1 MGD WWTPs or 6-7 X a 10MGD WWTP

Table 6. Estimated Costs to Reduce TP to 0.1 mg/L[a]

Cost Type	Annual Average Flow			
	0.1 MGD	**1.0 MGD**	**10 MGD**	**30 MGD**
Capital Cost	$388,000	$1,315,000	$6,969,000	$18,330,000
O&M Cost	$54,385	$189,800	$1,095,000	$3,066,000

Source: CBP (2002)

[a] Costs were estimated assuming that TP is reduced using metal salt addition and microfiltration.[3] Facilities are assumed not have filtration and pumping stations before Tier 4 upgrades are installed.

Source: Hartman and Joshua Cleland 2007

Drinking Water Quality Needs by Columbus Ohio

Jackson Pike WWTP --79 MGD

Columbus Southerly WWTP-- 96 MGD

Scioto River Main Stem

Main Problem: Drinking water from Griggs and O'Shaughnessy Dams---must shift over to Hoover Reservoir when nitrates and atrazine levels are high

Alpine Cheese Company:
The Poster Child of WQ Trading!

NPDES Permits:

1/1/2007-12/31/2011—DONE!

1/1/2012-12/31/2017--RENEWED

Nutrient Trading for Agriculture and Industry

- Creative nutrient trading to promote cleaner water
- Saving pollution remediation costs to industry
- Improving the bottom line for farmers
- Creating local jobs

The Problem:

Alpine Cheese Company had phosphorus levels of 225ppm. The EPA goal for the NPDES 5 year permit was 1ppm. There was a much lower cost associated with filtering the first 221ppm than the last 3ppm. Alpine's NPDES permit was preventing plant expansion. The factory wanted to expand, creating 12 new jobs and local milk demand of 250,000 #/day.

Jarlsberg products wheel, loaf & lite loaf form.

Alpine Cheese Factory

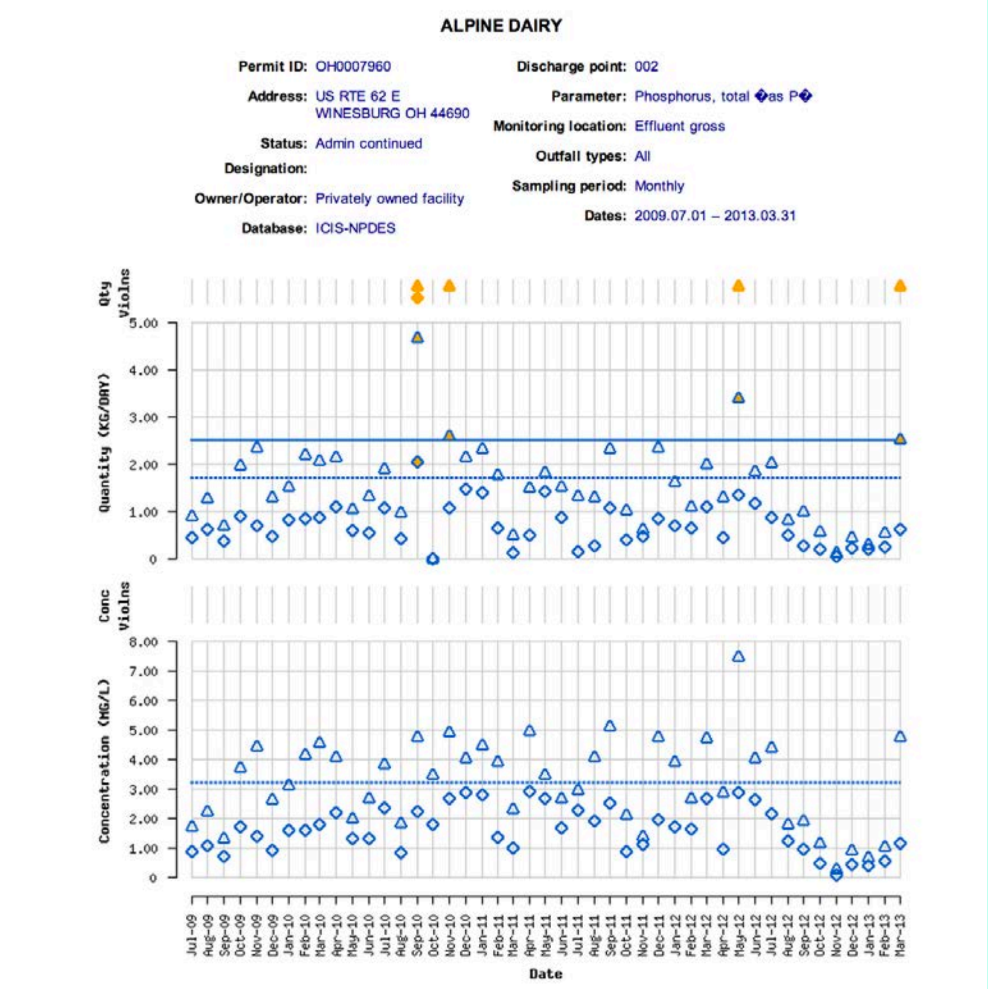
Alpine Trading: Basic Facts

- Facility Size—0.14 MGD
- Problem—EPA non compliance
- Solution---Partial facility upgrade + wq trading
- Amount traded: 2mg/l P
- Amount reduced through facility upgrade: over 200 mg/l
- Trading amount needed: 5500#P; actual reduced was 7200#
- Cost reduced from $800,000 to $318,000 in second permit cycle. (Over half of it is required voluntary sampling costs!) Second cycle uses pays farmers to continue long-term practices.

Middle Fork of Sugar Creek December 2010

Photo taken 12/21/10 of the Middle Fork of Sugar Creek just downstream from the Alpine Cheese Company. The stream is now in full attainment of Ohio EPA standards according to biological monitoring results just in from the Midwest Biodiversity Institute. Thanks go to the work of many famers, Alpine Cheese Company, and Holmes Soil and Water Conservation District. Thanks everyone!!!!

Alpine Cheese Factory Lowers Factory P Levels



The Results

- ✓ Worked with 25 farmers to install 91 practices
- ✓ We created 7,133 credits, we needed 5,500 by 2011. 75% of the credits are 15-20 years (paid).
- ✓ Nitrogen remediated for “free”.
- ✓ We have a waiting list of many farmers
- ✓ High Amish attendance at the local SWCD annual dinner.
- ✓ Ohio EPA is very supportive of this project.

The Results(2)

- ✓ 12 Jobs created at the cheese factory in expansion
- ✓ Quality of the milk improved resulting in higher cheese production
- ✓ Milk demand for local farms increased by improving the quality and expanding the factory.
- ✓ Market niche and area reputation for high quality cheese expanding

WHY DID IT WORK SO WELL?

- Small scale facility—upgrade costs high—provided more $/#P for conservation measures--$90/#P but with future rebates that lower the cost to $20/#P through future sale of long-term credits.
- SWCD was broker—high level of trust and feeling of partnership with community
- University research station (OARDC) participation—neutral and scientific
- Headwaters—easy to convince farmers that their efforts would be felt downstream
- Conservation measures were related to the cheese factory
- Added local jobs and improved the milk quality and herd health

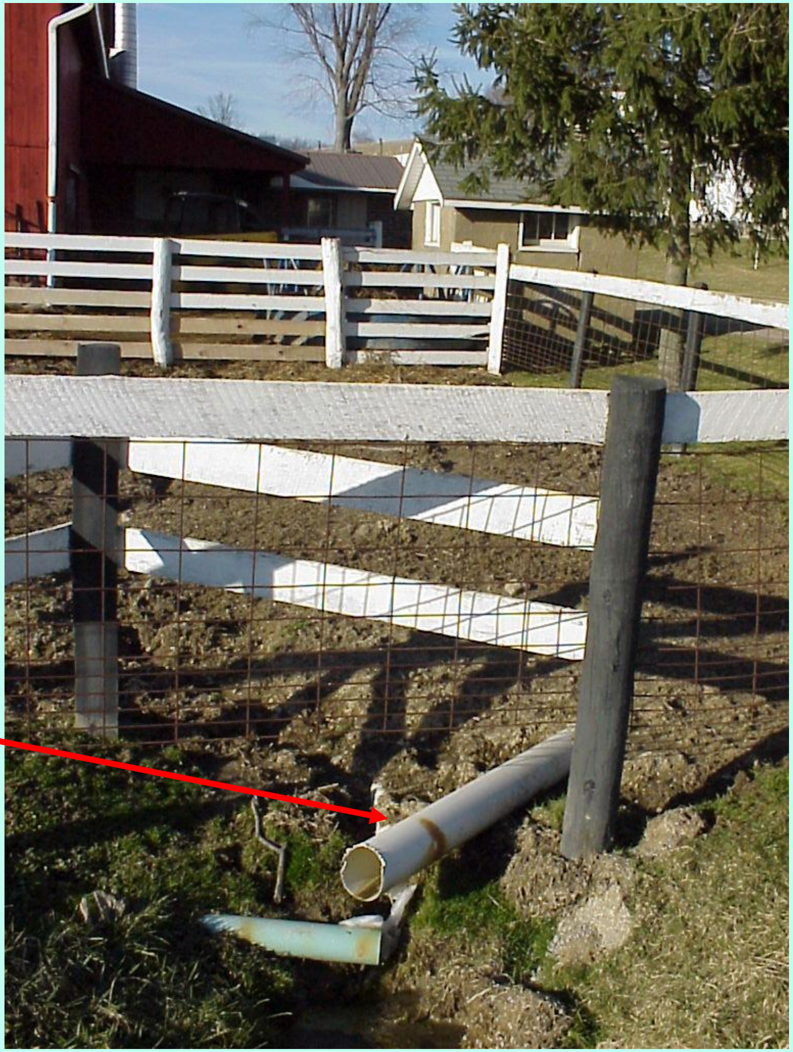
WQ TRADING
CAN BE COUPLED WITH ECONOMIC DEVELOPMENT

- The economic development advantages of the Alpine Cheese Factory far outweigh the cost of the program.
- --added jobs
- --improvement of specialty cheese niche
- --adding local milk demand
- --adding tax base

BMP’S: Milk House Waste

- Makes cultural sense—no brainer… (cheese factory and dairy farmers)--SYMBOLIC
- High concentration of phosphorus
- Proactive solution
- Leads to comprehensive solution to farm management (CNMP)
- Cost was about $4000 per tank—pumped out onto field or $3000 for sawdust biofilter.

Milk House Waste 1:1 credit ratio



MILK HOUSE
WASTE

LOWERING BACTERIA LEVEL ON DAIRY FARMS INCREASED PRODUCTION EFFICIENCY AT THE CHEESE FACTORY

Amish Dairy Farm

Fences cows out of stream

→

Somatic Cell count in milk decreased

From 365,000 to 165,000

→

Lower Mastitis

Rate and increased Milk Income

Premium by $0.75/cwt ($22.50/COW/YR)

→

New Amish Organic Coop Formed in 2003 (now over 100 farms)—to preserve cultural values

→

HINTS FROM THE ALPINE CHEESE CASE ON HOW TO REACH OUR FULL POTENTIAL—

1). Headwaters based

2). Community based

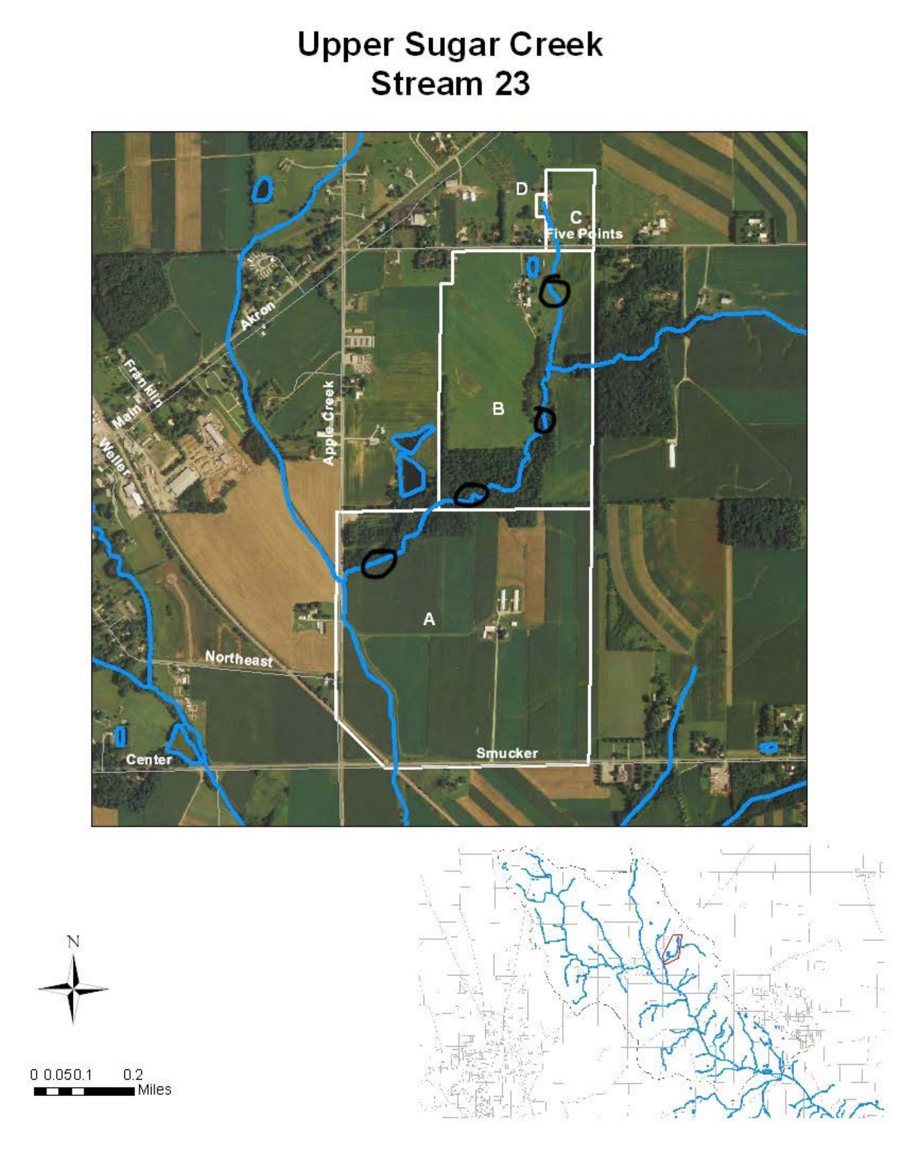
The great PR alone was worth it for the company…..

COMMON SENSE POINT: TRADING SHOULD FOCUS ON THE HEADWATERS

We find that first-order headwaters contribute approximately 70% of the mean-annual water volume and 65% of the nitrogen flux in second-order streams. Their contributions to mean water volume and nitrogen flux decline only marginally to about 55% and 40% in fourth- and higher-order rivers that include navigable waters and their tributaries.

•Source: The Role of Headwater Streams in Downstream Water Quality Richard B. Alexander et al. JAWRA Journal of the American Water Resources Association Vol.43, pages 41–59, February 2007.

EACH PRIMARY HEADWATER STREAM



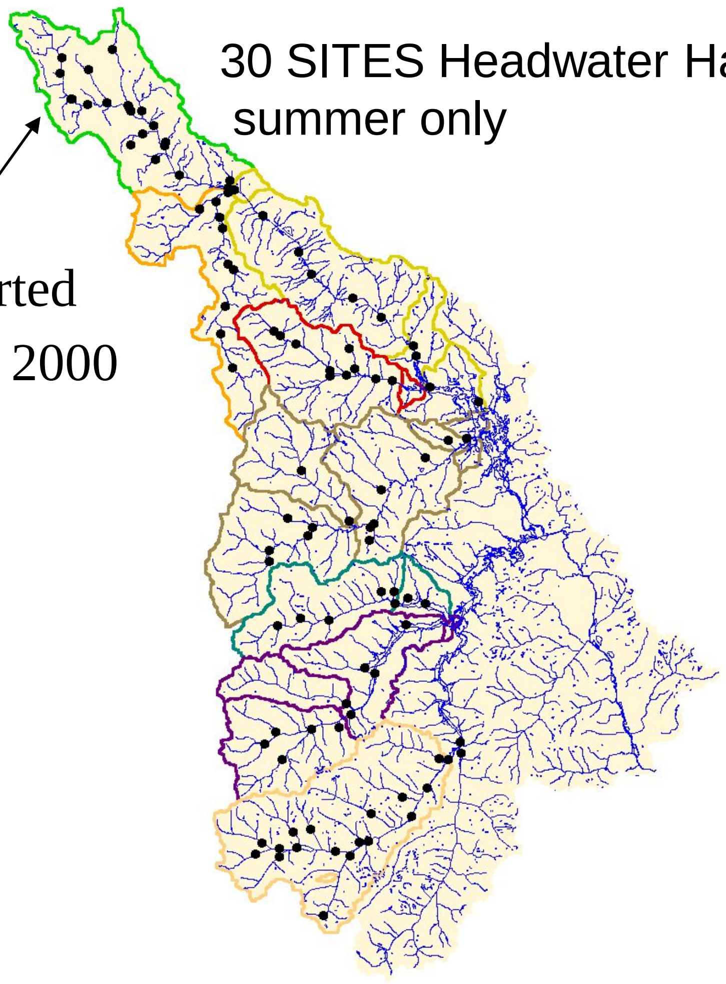
23B

Sugar Creek Watershed
Sample Sites

105 SITES WQ BIWEEKLY

30 SITES Headwater Habitat
summer only

We started
here in 2000



SUGAR CREEK METHOD
(headwaters and participatory focus)

- NATURAL AND SOCIAL SCIENTISTS TEAMED TOGETHER
- LEAD SOCIAL SCIENTIST AND LEAD NATURAL SCIENTIST HAD COMMON BACKGROUND IN ECOLOGY
- RESEARCHERS TEAMED WITH FARMERS (SELF-SELECTED)
- FARMERS INQUIRY RESULTED IN NEW INQUIRY BY RESEARCHERS
- FARM LEVEL DATA RESULTED IN FARMERS BECOMING CO-INVESTIGATORS

LESSONS:
Build Partnerships

Farmer Partner Tours for Each Other to Show Conservation Practices

Gaining Public Acceptance: NSF Fellows: Place-based Research and Teaching

Site 1 Credit Union - 7:30 a.m. Wooster International Baccalaureate Junior Class

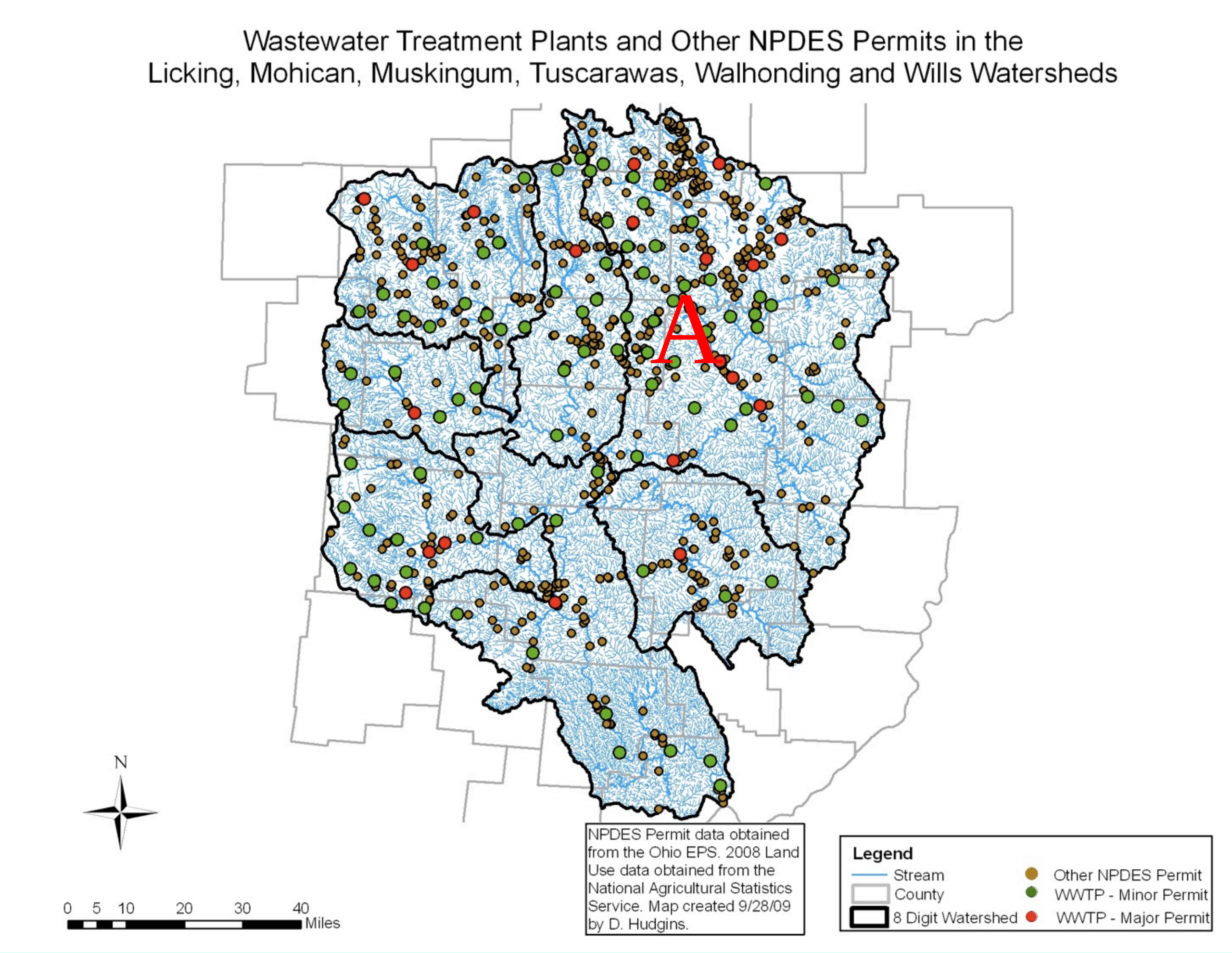
•Checking out catch in d-net

Site 2 Baptist Church – 10:00 a.m. Wooster International Baccalaureate Junior Class

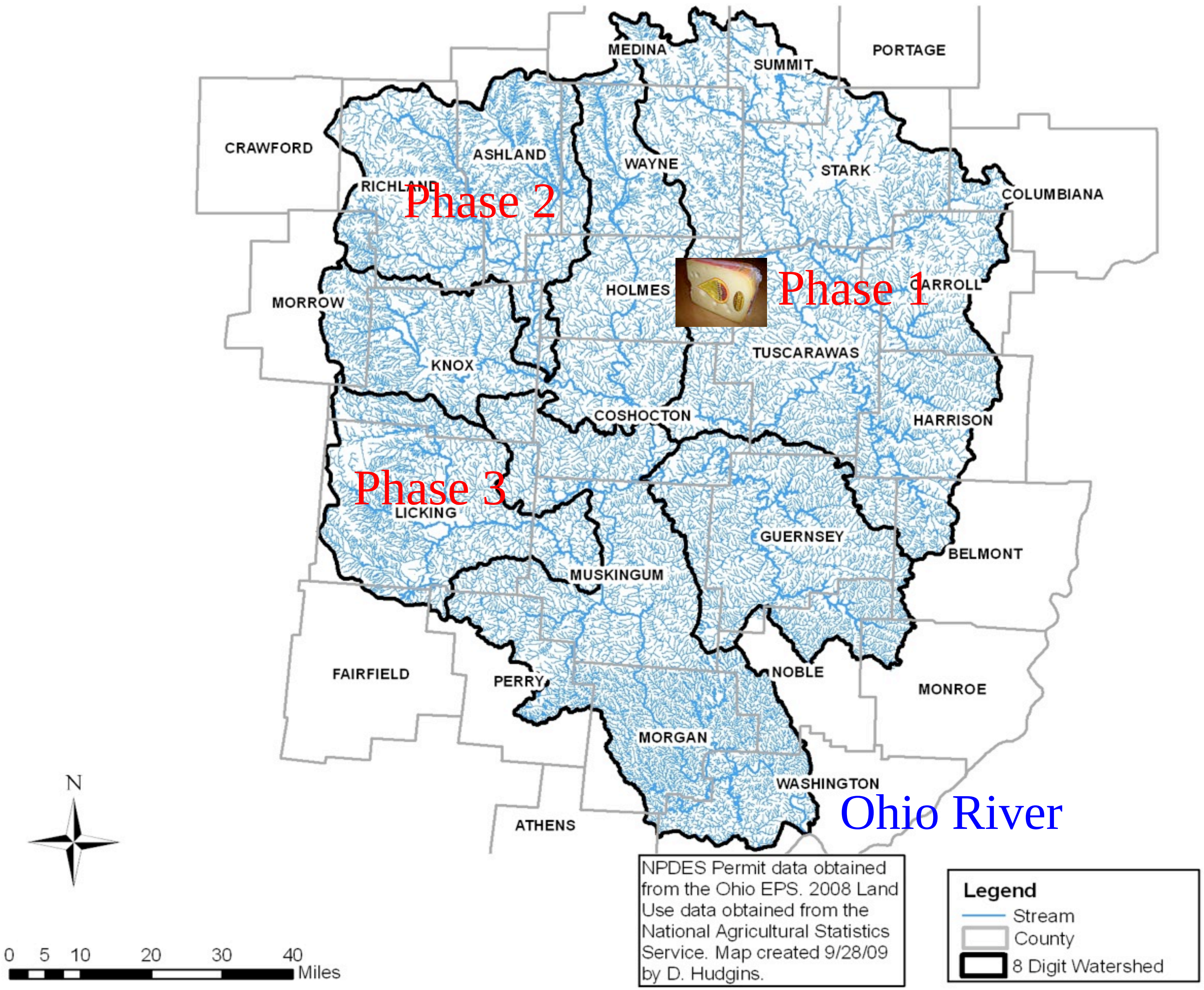
Building on Local Culture: Christian Baptisms in SC Stream

Our Next Steps

ABUNDANCE OF MINOR NPDES PERMITS



Counties in the
Licking, Mohican, Muskingum, Tuscarawas, Walhonding and Wills Watersheds



OUR RESEARCH CHALLENGES

Transaction Costs—how to lower

How to give incentives for upstream conservation

How to create synergy between multiple PS

How to include local economic development

Critical Source Areas—modeling

How to Effectively Engage Local Community

THANK YOU!

Global Climate Change: Glaciers, Water and People

Lonnie G. Thompson

School of Earth Sciences and Byrd Polar Research Center, The Ohio State University

2013 Experimental Station Committee on Organization and Policy,

Hilton Columbus at Easton, Columbus, Ohio

Objective

Introduction to global climate change
Glaciers as recorders of global climate change
Examples of how humans have been impacted by past changes in climate
Evidence for recent acceleration of the rate of glacier loss such that some glaciers are now smaller than they have been in over 6000 years

Why B.F. Skinner became pessimistic about human beings.
"Immediate consequences outweigh delayed consequences"
"Consequences for the individual outweigh consequences for others" *P. Chance, 2007*

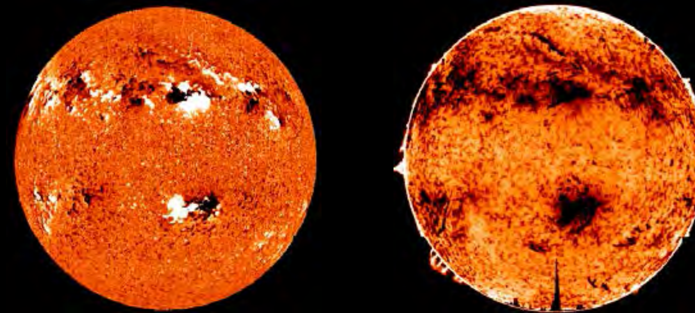
Increase in extreme weather events
Impacts of future climate change on water sustainability

Our greatest challenges in the 21st Century

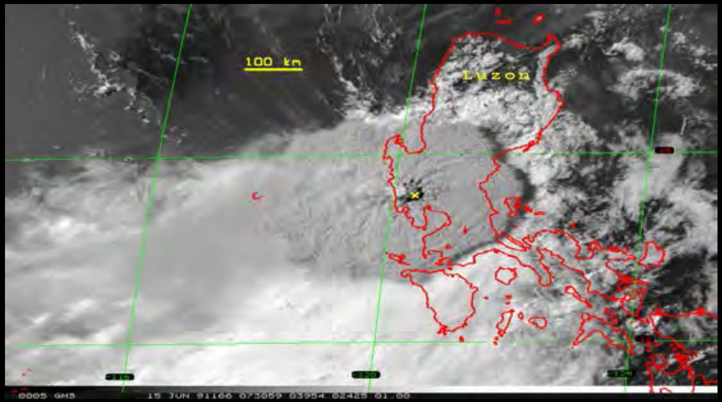
Natural mechanisms influence climate

Natural mechanisms

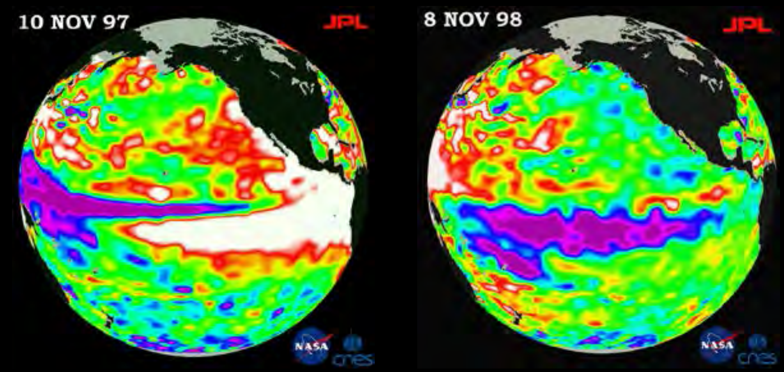
Changes in solar output



Changes in the amount of volcanic aerosols in the atmosphere



Internal variability of the coupled atmosphere-ocean system (e.g., ENSO, monsoon systems, NAO)



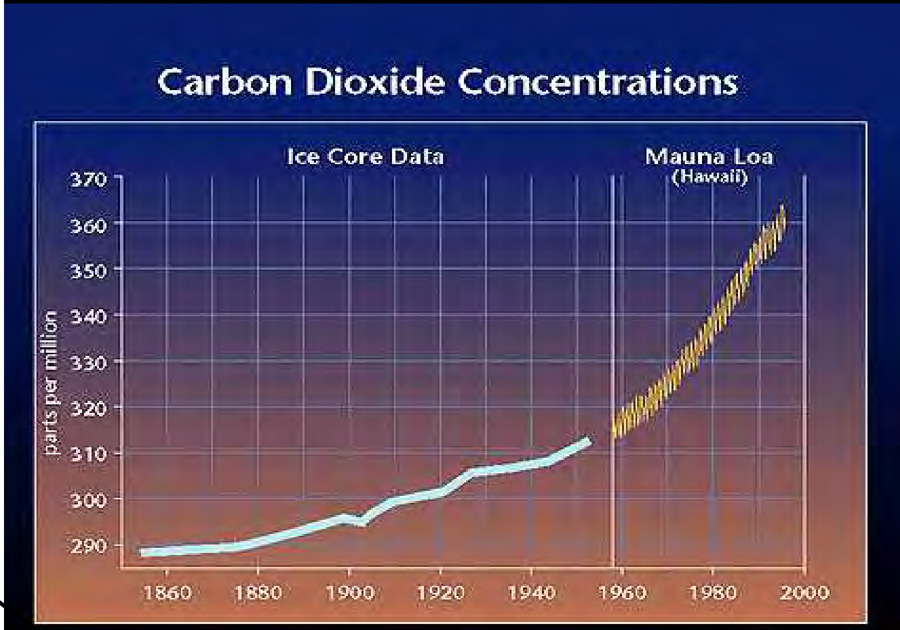
Human factors also influence climate

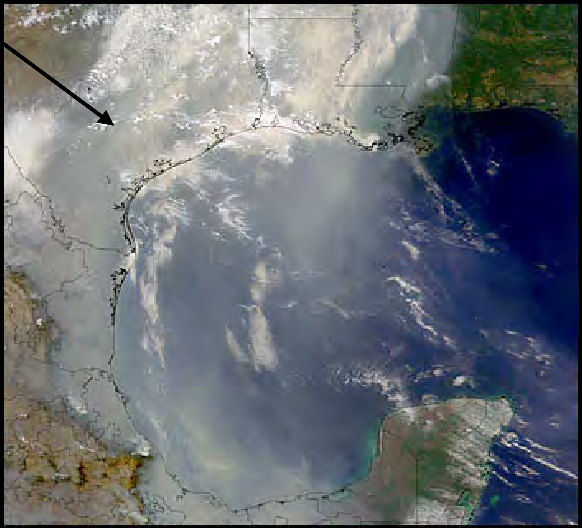
Non-natural mechanisms

Changes in the concentrations of atmospheric greenhouse gases

Changes in aerosols and particles from burning fossil fuels and biomass
- coal (sulfate aerosols) – cooling
- biomass (black carbon) – warming

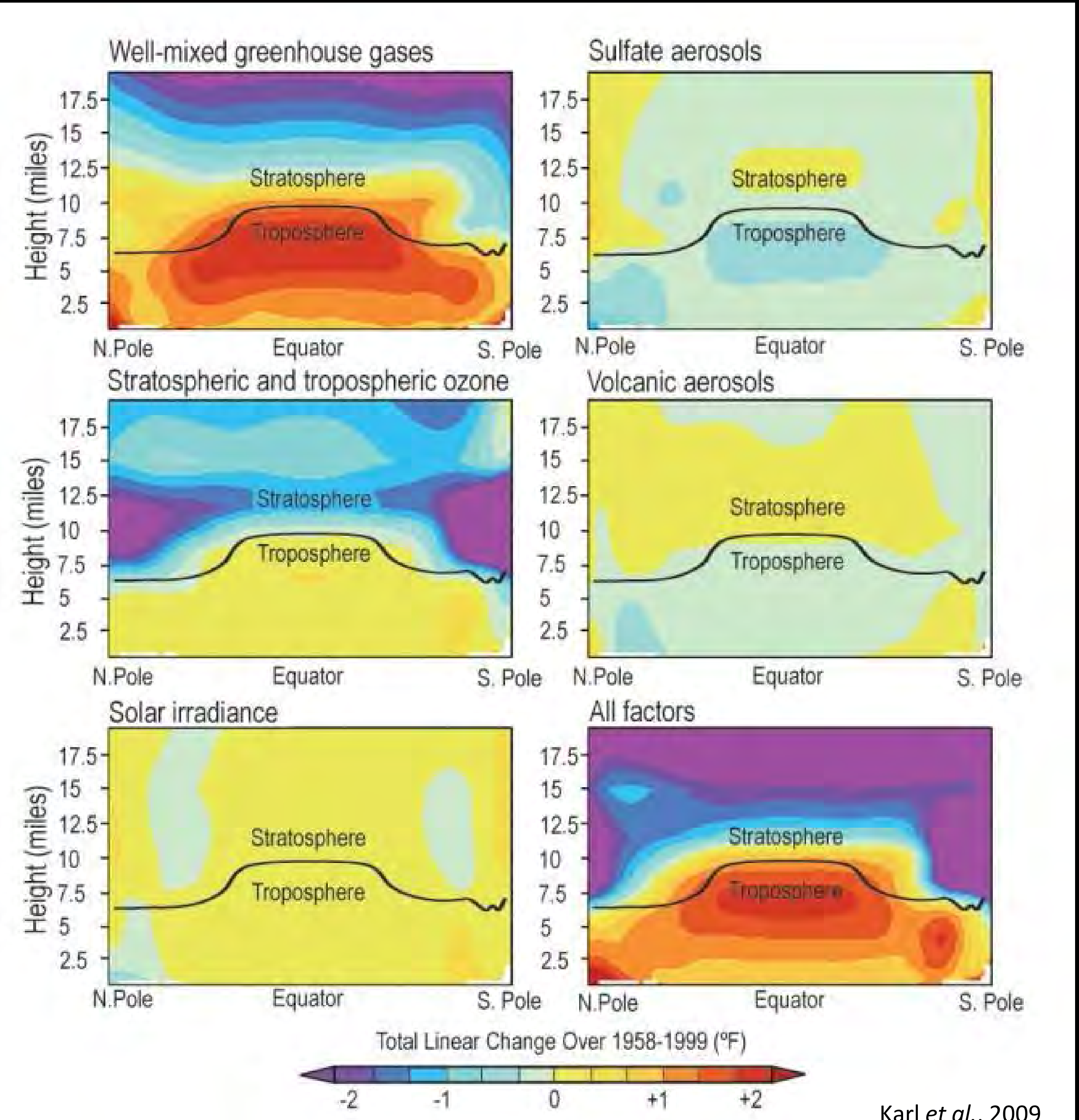
Changes in the reflectivity (albedo) of Earth's surface and the hydrologic cycle





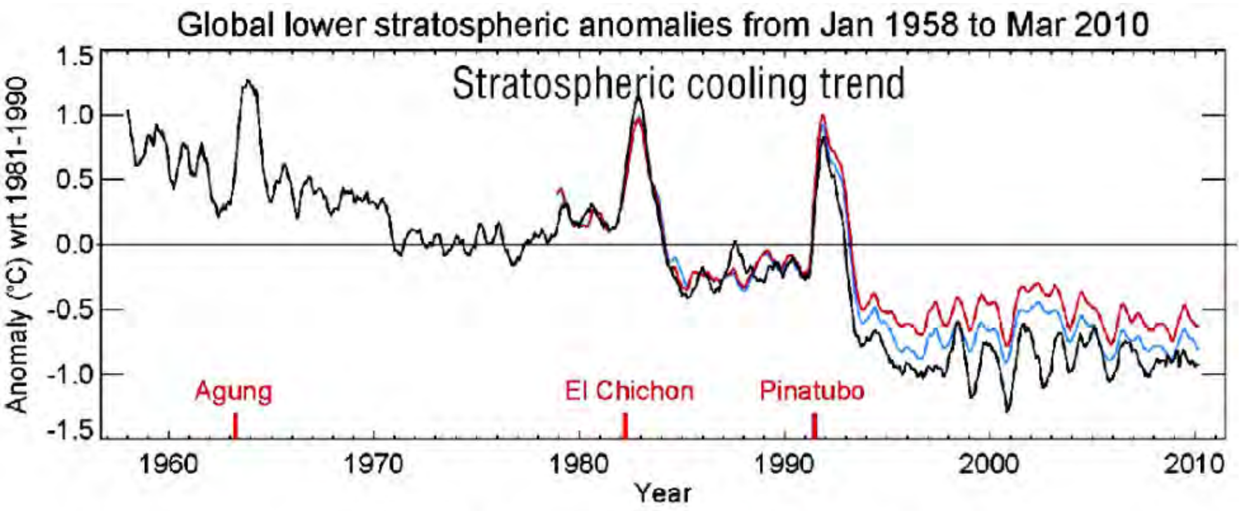
Smoke from fires in Guatemala and Mexico (May 14, 1998)

Climate Responses to Different Forcing Mechanisms

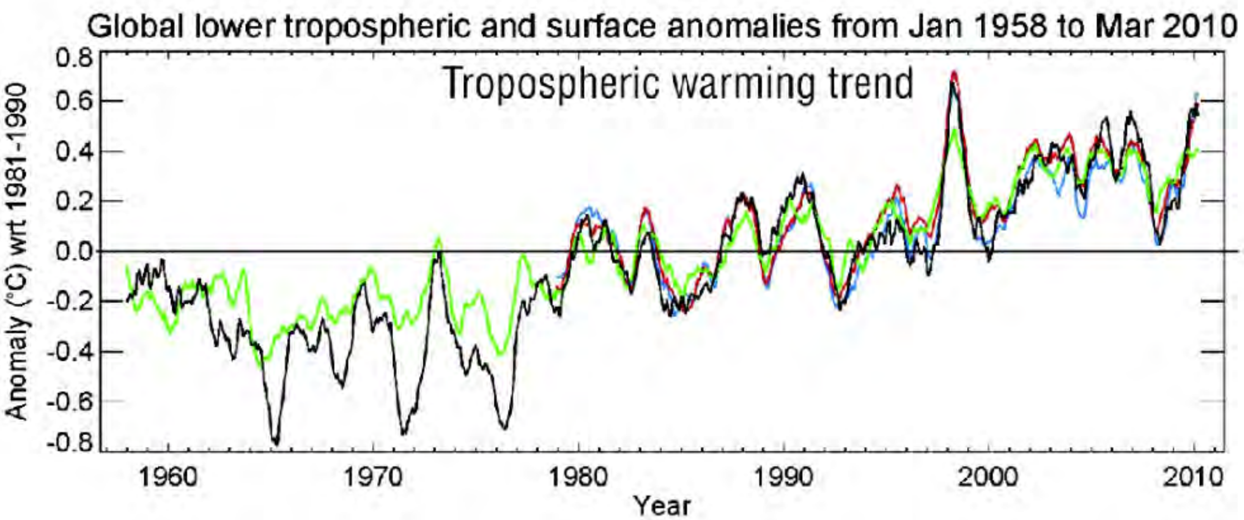


Karl *et al.*, 2009

Atmospheric temperatures since 1958



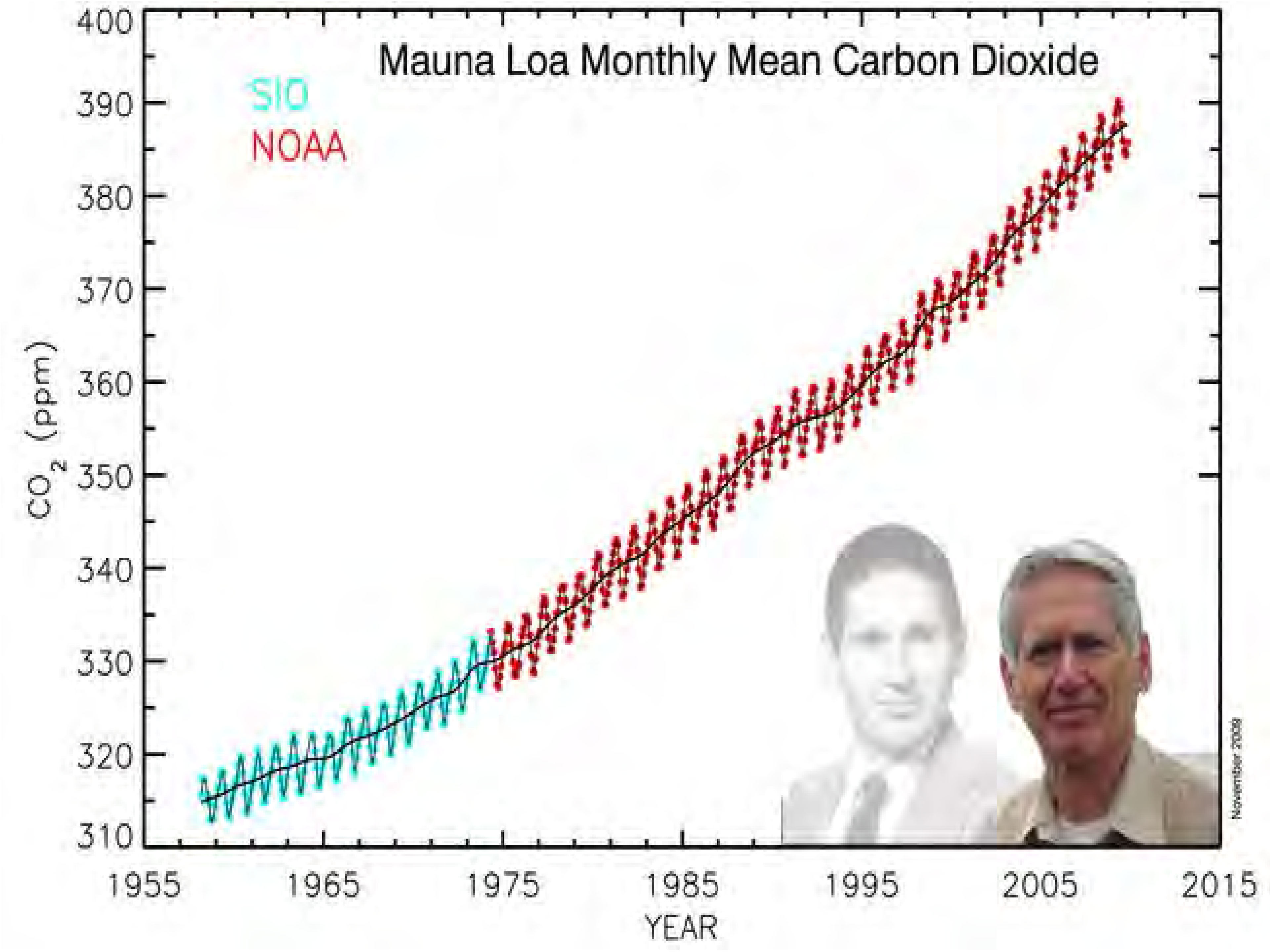
Stratosphere is cooling



Troposphere is warming

This response is expected from GHG forcing & is predicted by climate models. It is not forced by the sun!

Source: Hadley Center (data available at http://hadobs.metoffice.com/hadat/images.html).



Mauna Loa Monthly Mean Carbon Dioxide
SIO
NOAA
CO_2 (ppm)
400
390
380
370
360
350
340
330
320
310
1955
1965
1975
1985
1995
2005
2015
YEAR
November 2009

Population

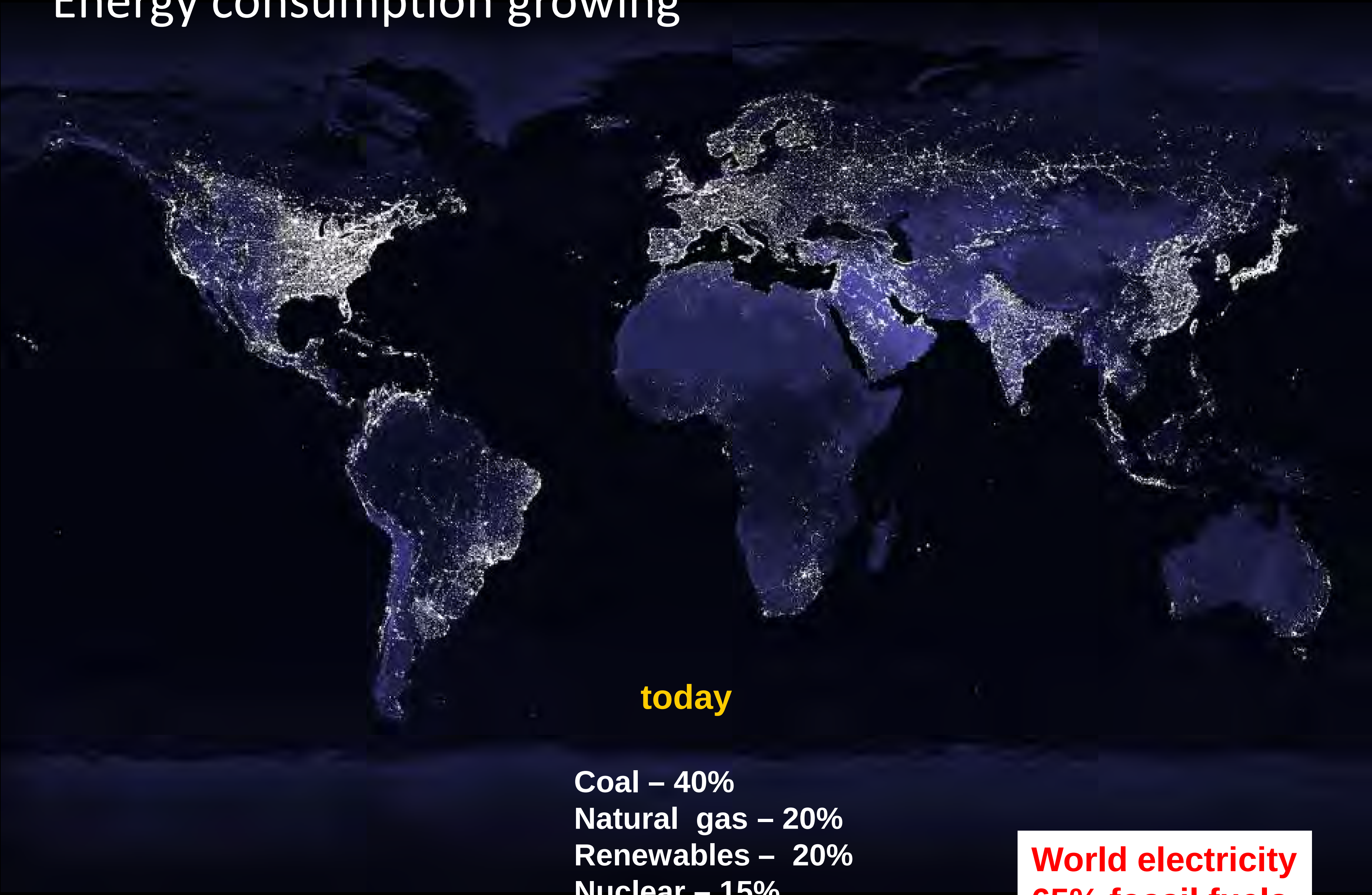
1.0 billion	in 1850
2.0 billion	in 1930
4.1 billion	in 1975
6.1 billion	in 2000
7.0 billion	in 2012
9.0 billion	by 2050

In 2012 we also need animals and crops

17 billion	Fowl
1.9 billion	Sheep and goats
1.4 billion	Cattle
1.0 billion	Pigs
400 million	Dogs
500 million	Cats

In contrast, the pre-exploitation number of American Bison: 60 - 80 million

Energy consumption growing



today

Coal – 40%
Natural gas – 20%
Renewables – 20%
Nuclear – 15%
Oil / Other Petroleum – 5%

World electricity 65% fossil fuels

… to unprecedented demands

Looking ahead to 2030 … you can see sustained growth in global demand for electricity is inevitable.

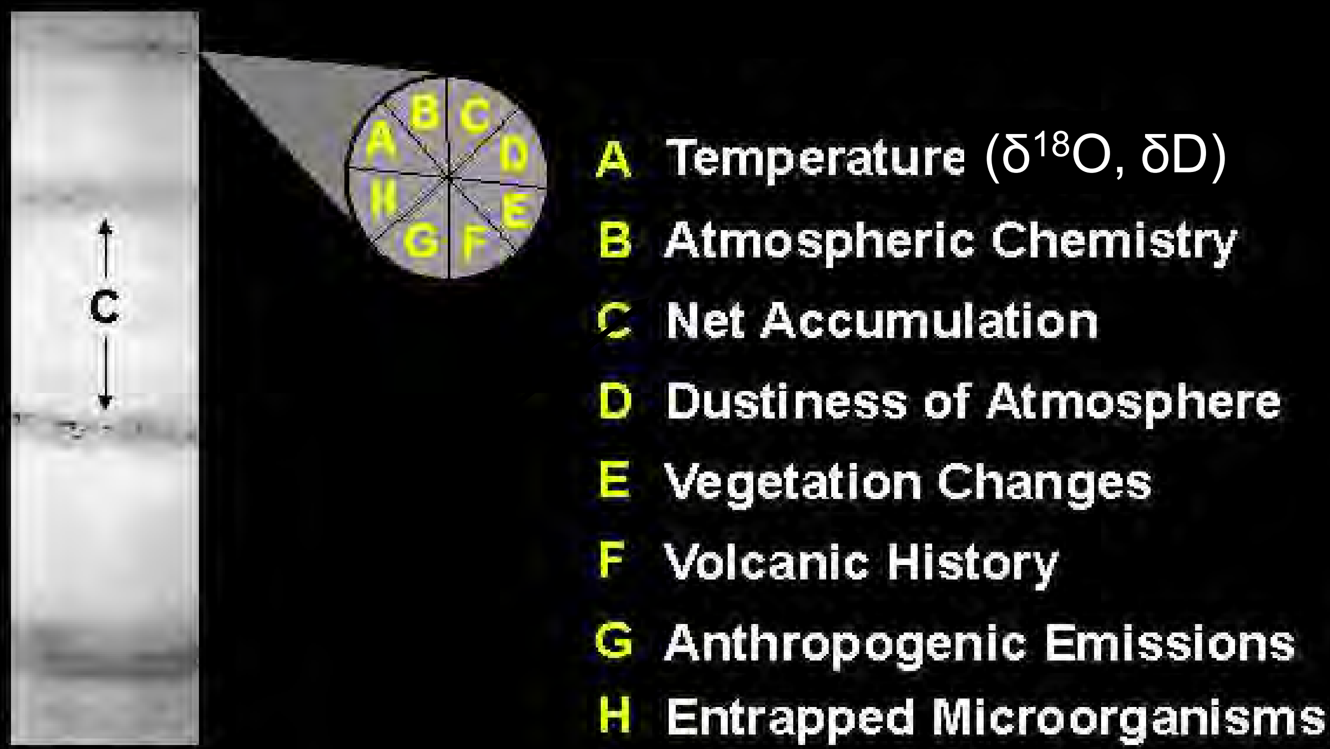
Demand is forecasted to more than double by 2030 (Energy Information Administration).

Source: Mark Little, General Electric Global Research

Ice cores are powerful contributors to multi-proxy reconstructions:

1) they provide multiple lines of climatic & environmental evidence

2) ideal for revealing rapid climate changes



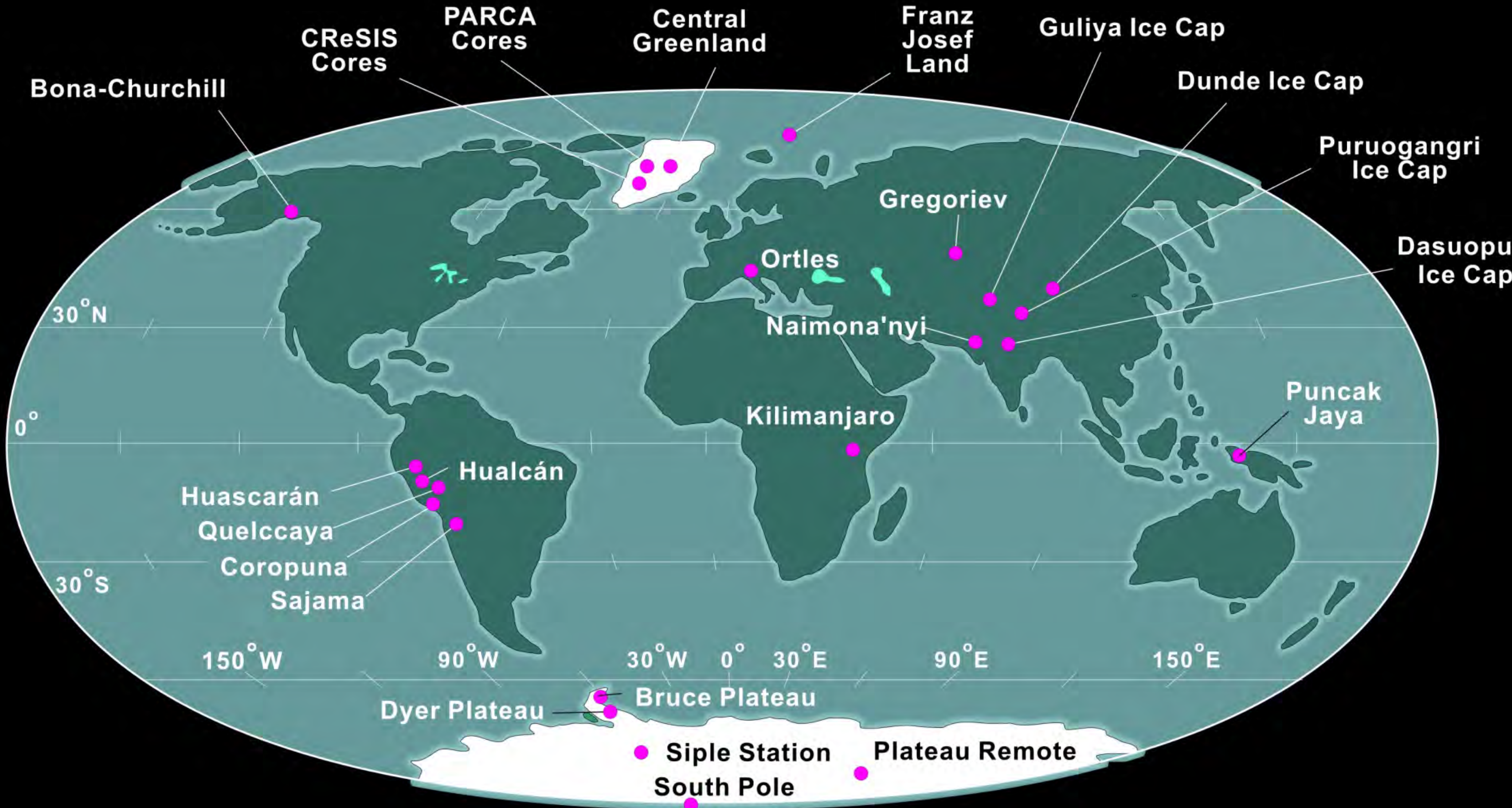
Guliya ice cap, Tibet

Class-100 clean room houses the equipment to analyze dust, isotopes and chemicals

Freezers for storage and cold rooms for physical property measurements

Machine shop for fabrication of our drills

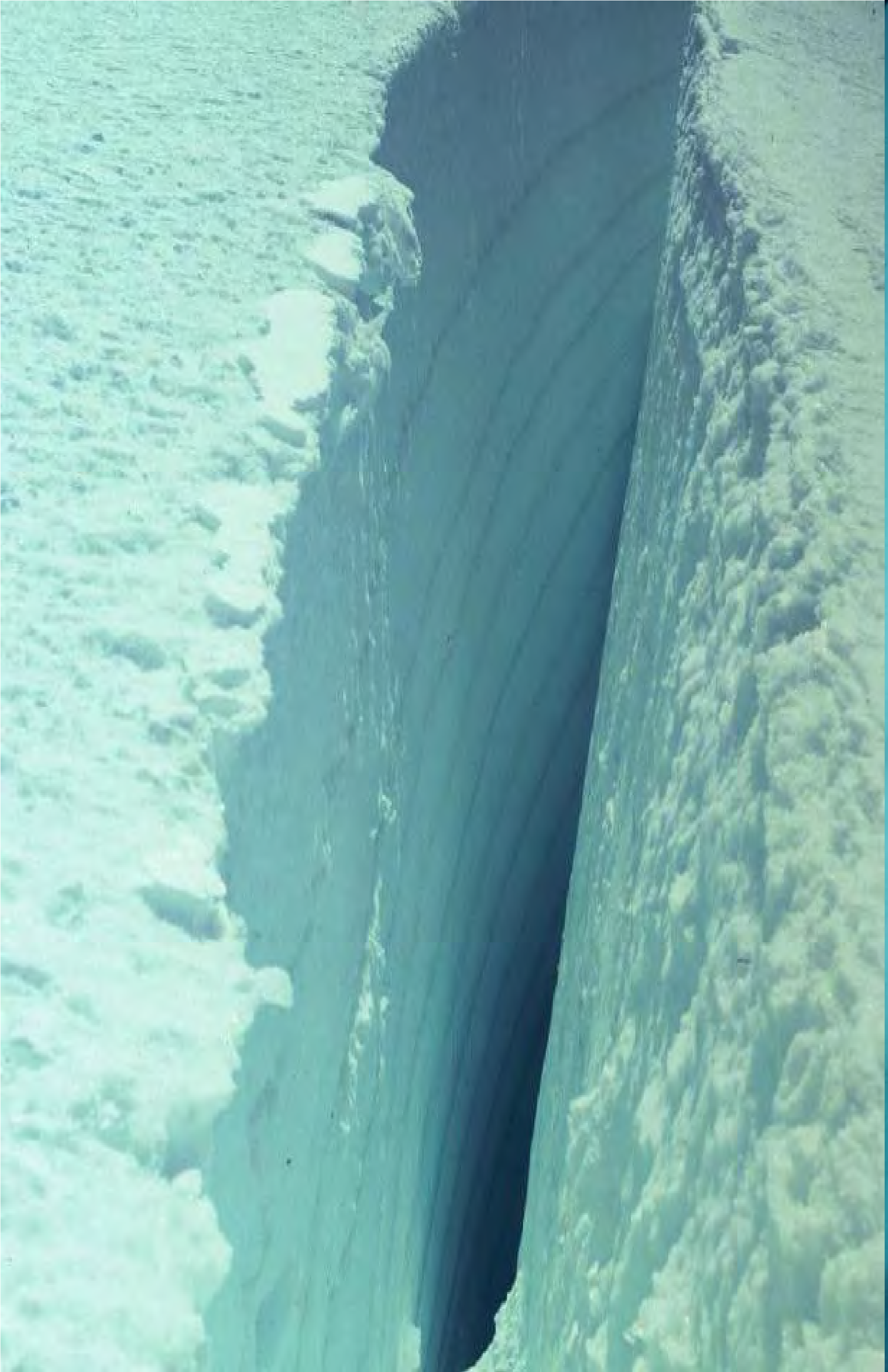
Ohio State Ice Core Sites



● *Ice Cores drilled by the OSU Ice Core Paleoclimatology Group*

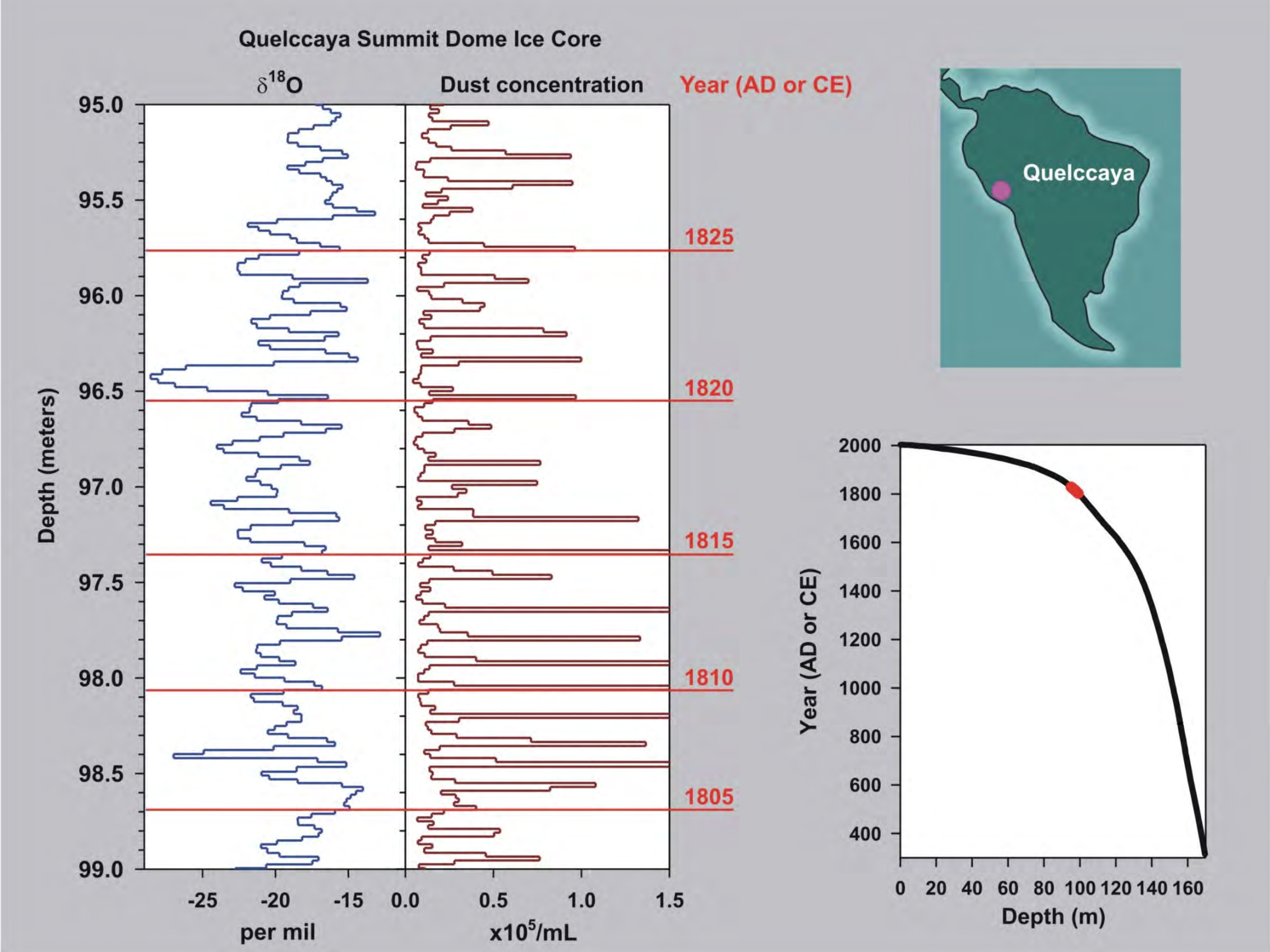
As of October 2011

Quelccaya Ice Cap, Peru

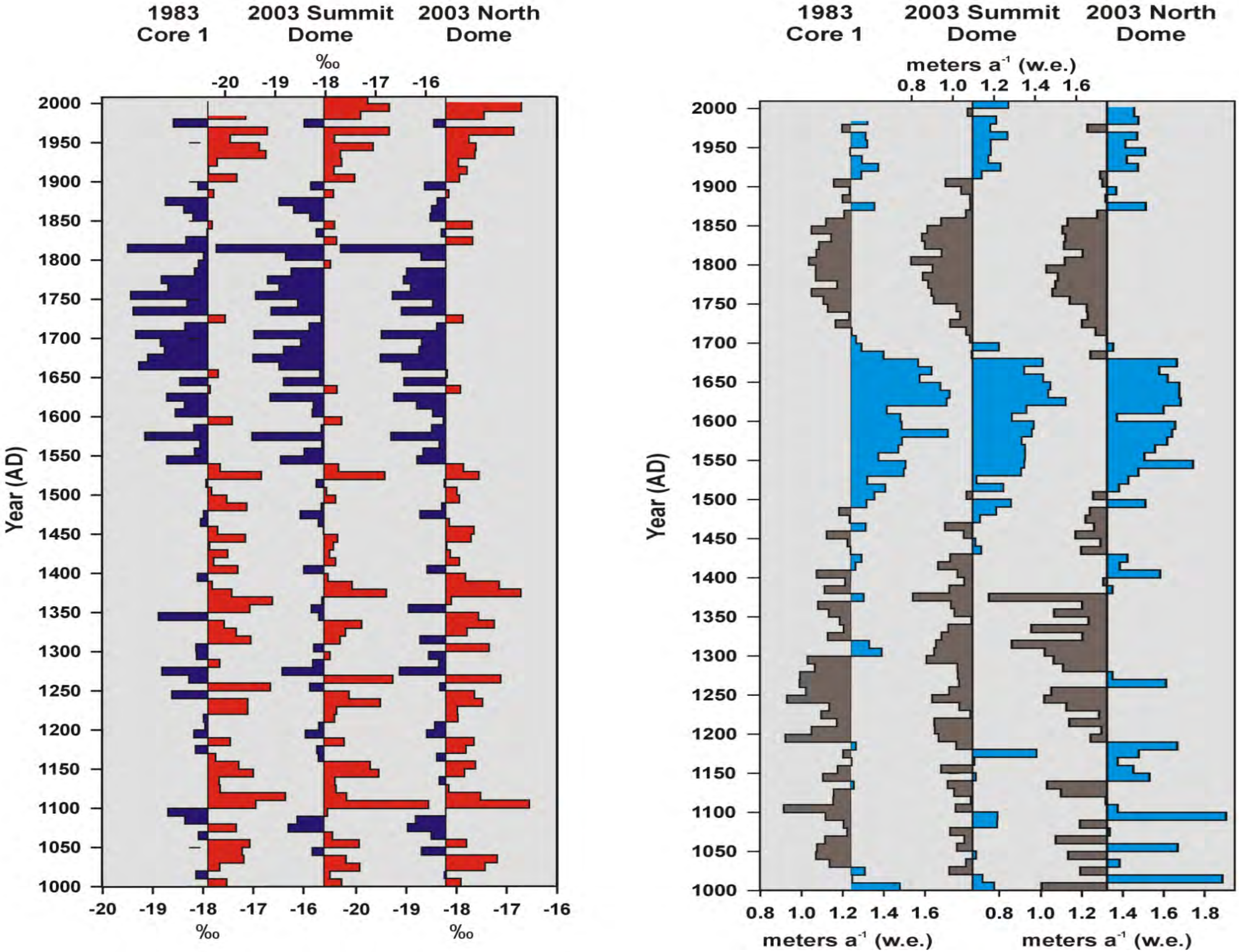




MOUNTAIN



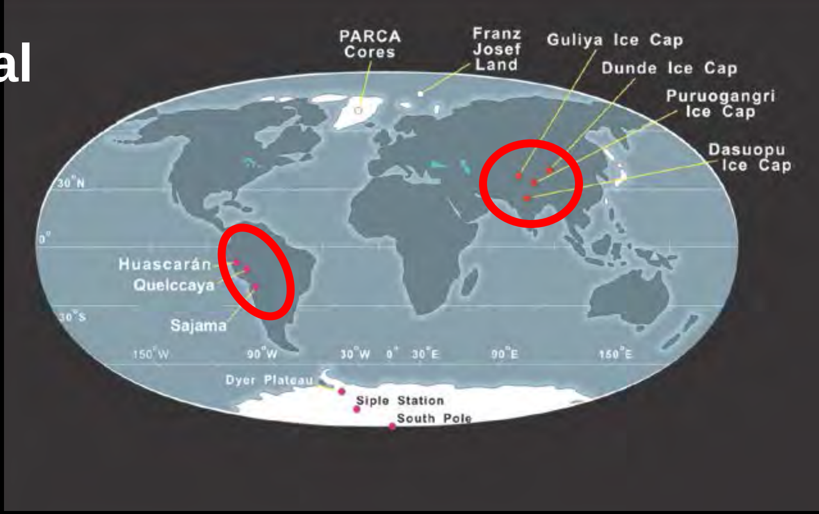
Quelccaya Summit Dome Ice Core
δ18O
Dust concentration
Year (AD or CE)
Depth (meters)
95.0
95.5
96.0
96.5
97.0
97.5
98.0
98.5
99.0
1825
1820
1815
1810
1805
-25
-20
-15
0.0
0.5
1.0
1.5
per mil
x10⁵/mL
Quelccaya
Year (AD or CE)
2000
1800
1600
1400
1200
1000
800
600
400
0
20
40
60
80
100
120
140
160
Depth (m)

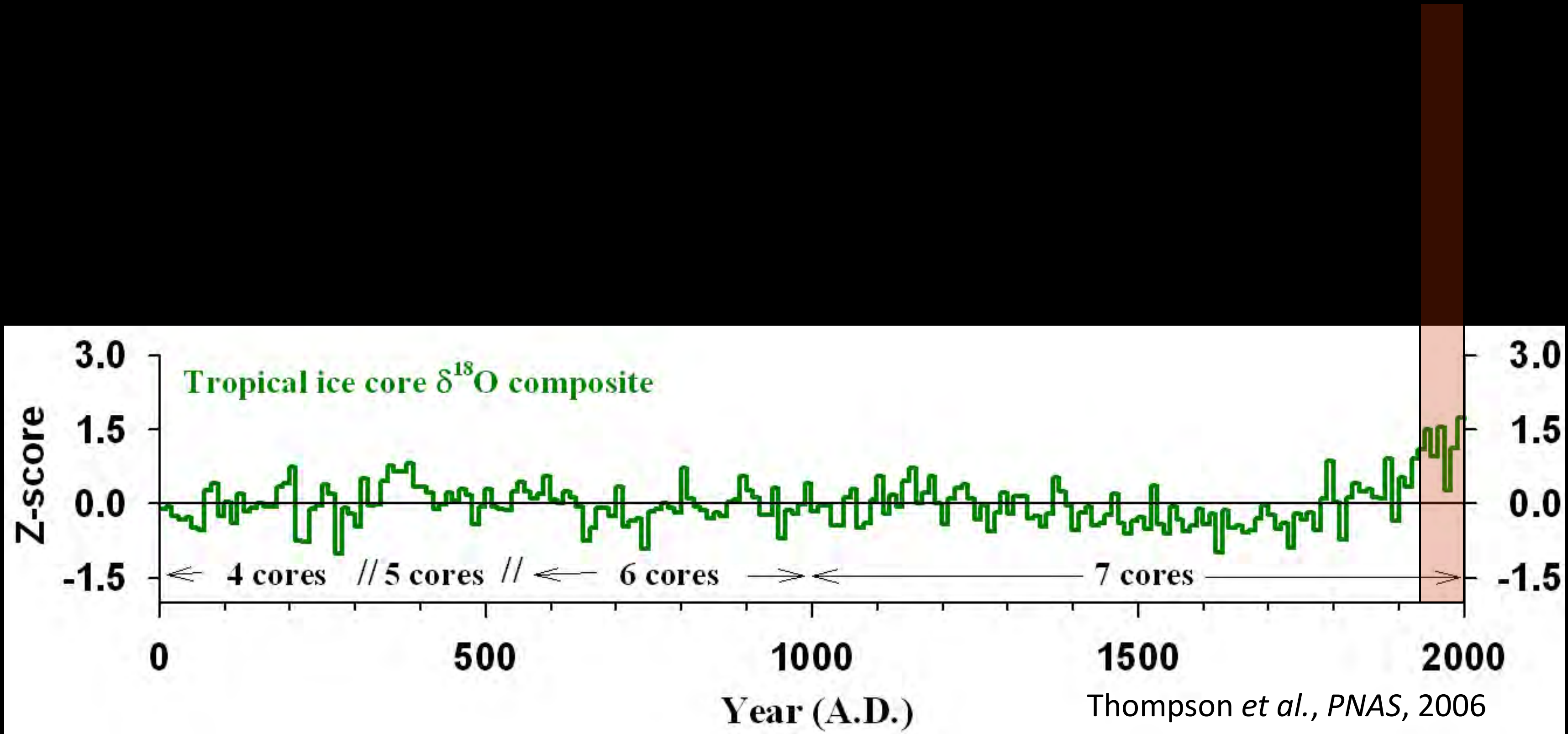


1983 Core 1
2003 Summit Dome
2003 North Dome
‰
-20 -19 -18 -17 -16
Year (AD)
2000 1950 1900 1850 1800 1750 1700 1650 1600 1550 1500 1450 1400 1350 1300 1250 1200 1150 1100 1050 1000
-20 -19 -18 -17 -16 -20 -19 -18 -17 -16
‰
‰
1983 Core 1
2003 Summit Dome
2003 North Dome
meters a⁻¹ (w.e.)
0.8 1.0 1.2 1.4 1.6
Year (AD)
2000 1950 1900 1850 1800 1750 1700 1650 1600 1550 1500 1450 1400 1350 1300 1250 1200 1150 1100 1050 1000
0.8 1.0 1.2 1.4 1.6 0.8 1.0 1.2 1.4 1.6 1.8
meters a⁻¹ (w.e.)
meters a⁻¹ (w.e.)

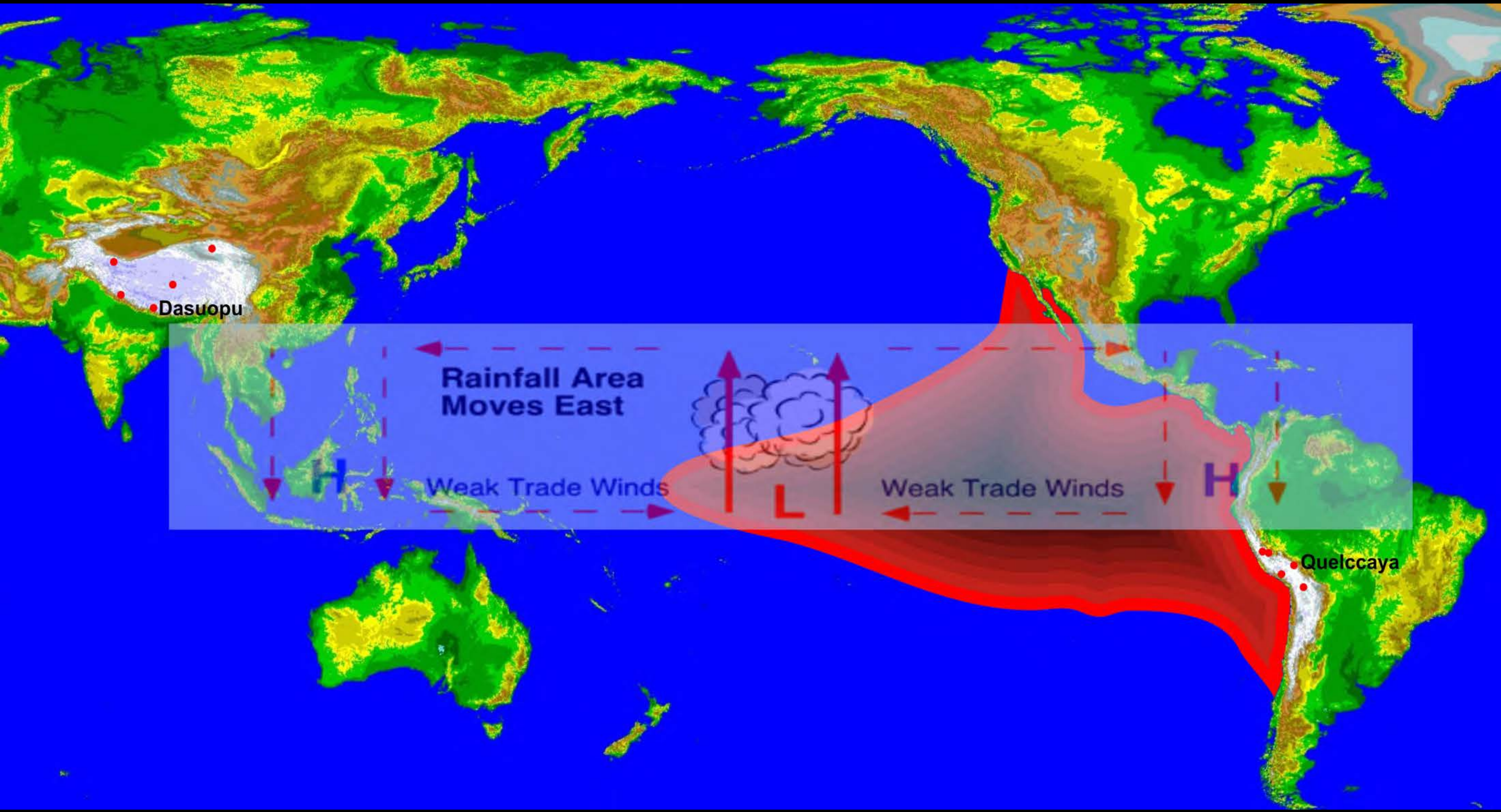
High elevation, low latitude ice cores reveal

- regional differences
- larger scale changes





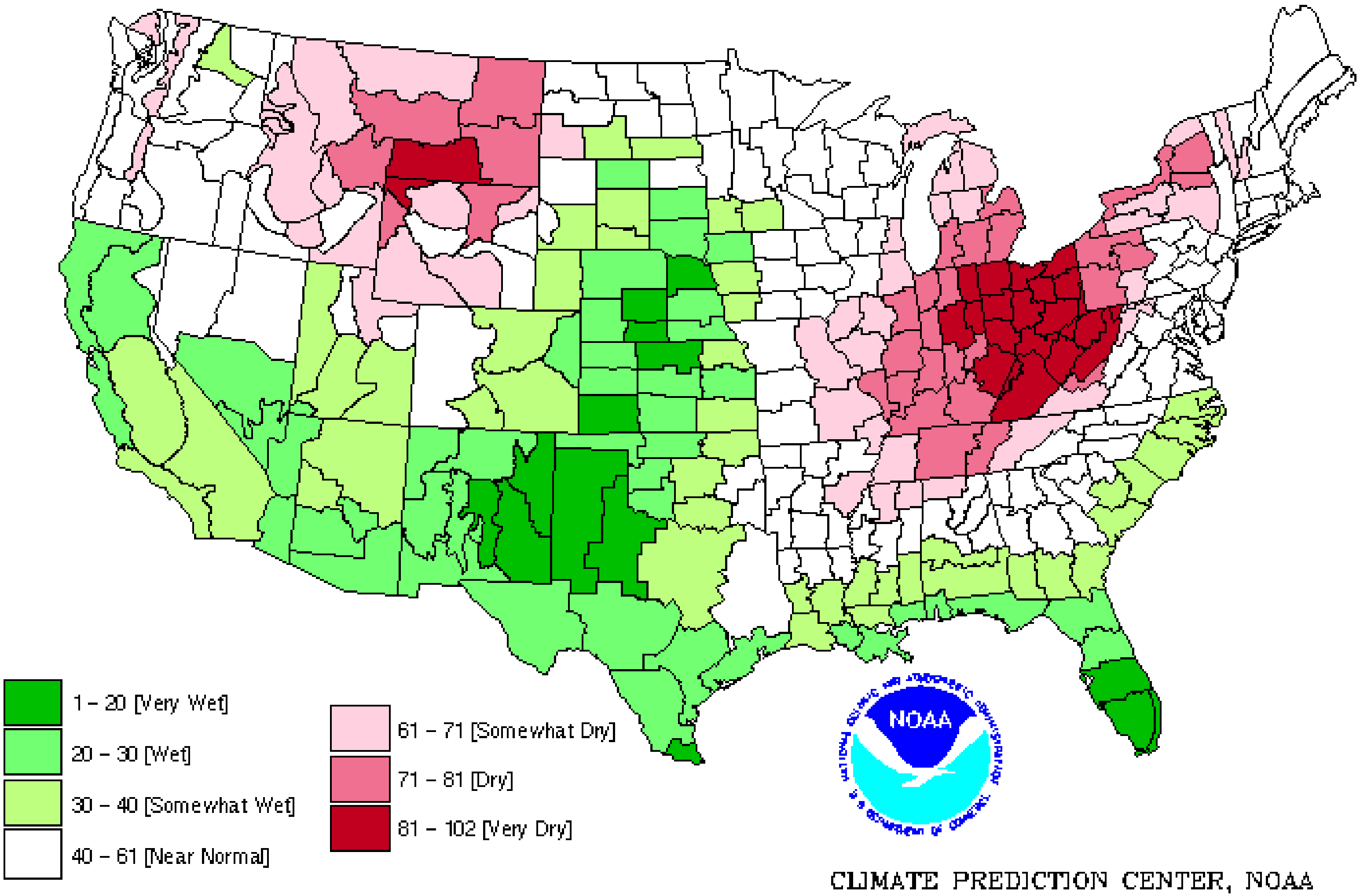
Thompson *et al.*, *PNAS*, 2006

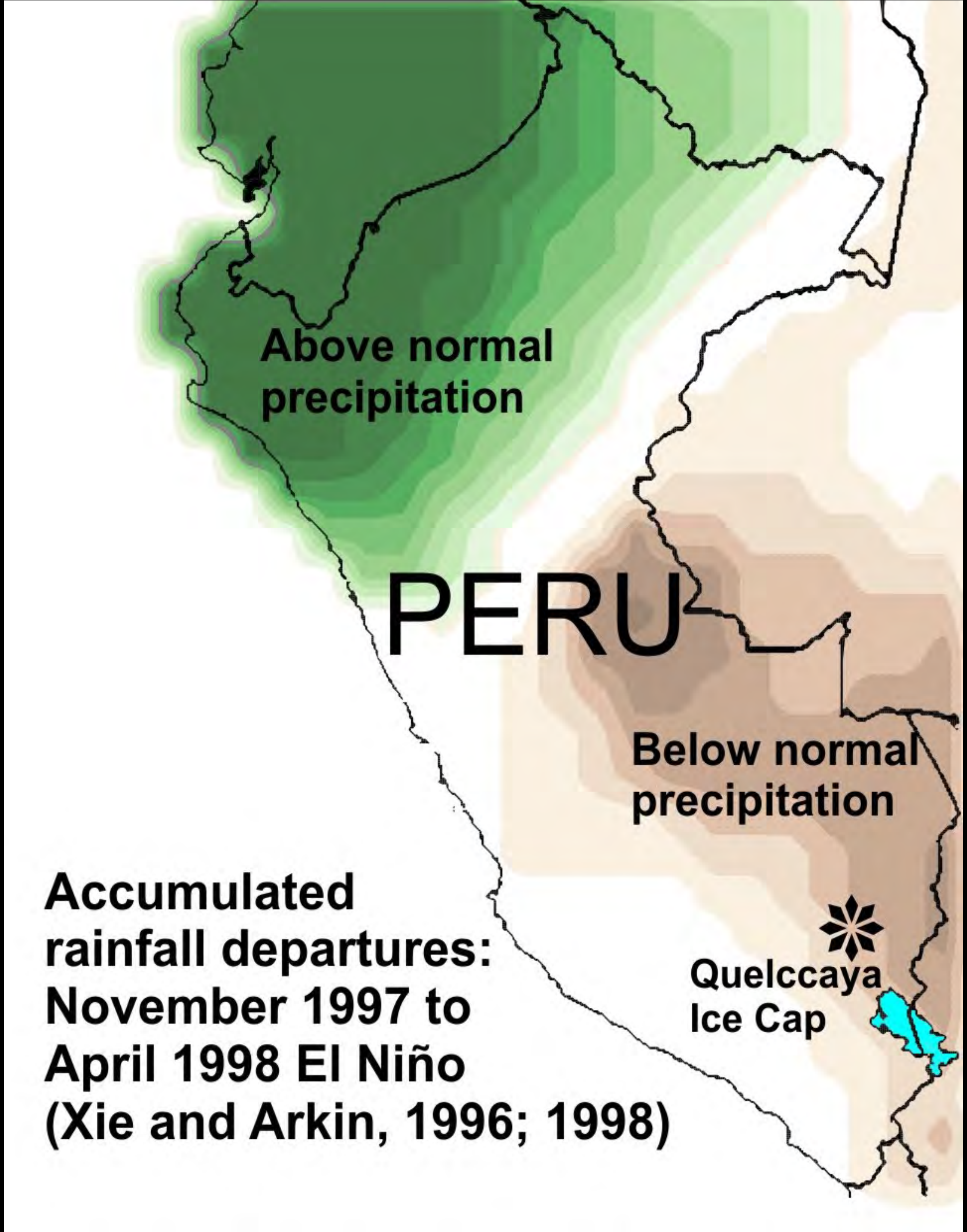

Dasuopu
Rainfall Area
Moves East
H
Weak Trade Winds
L
Weak Trade Winds
H
Quelccaya

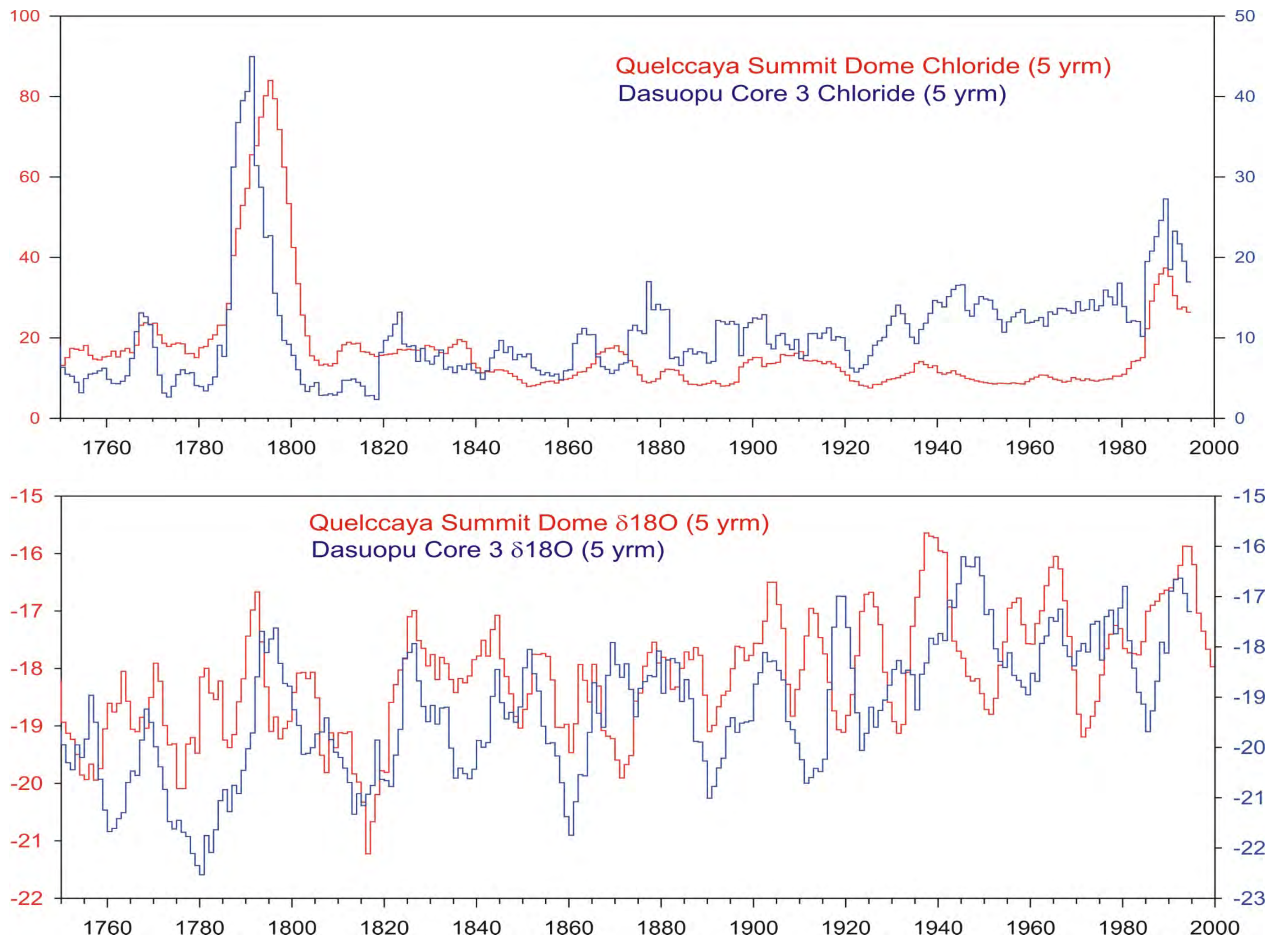
AVERAGE JANUARY - MARCH [3-month] PRECIPITATION RANKINGS DURING ENSO EVENTS

1915 1919 1941 1958 1966 1969 1973 1983 1987 1992

Based on 1895-1997



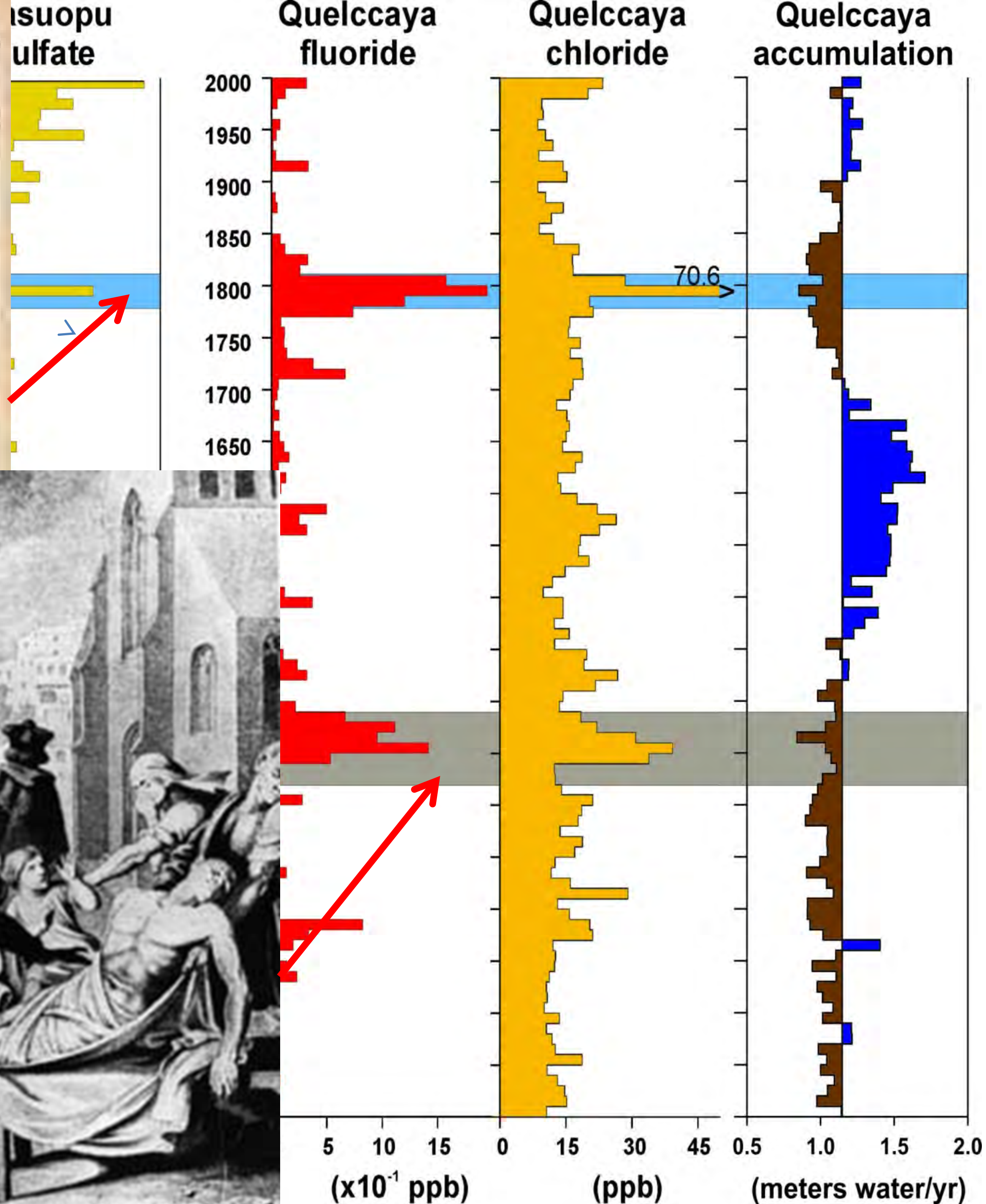

Above normal
precipitation
PERU
Below normal
precipitation
Quelccaya
Ice Cap
Accumulated
rainfall departures:
November 1997 to
April 1998 El Niño
(Xie and Arkin, 1996; 1998)



Quelccaya Summit Dome Chloride (5 yrm)
Dasuopu Core 3 Chloride (5 yrm)
100
80
60
40
20
0
50
40
30
20
10
0
1760
1780
1800
1820
1840
1860
1880
1900
1920
1940
1960
1980
2000
Quelccaya Summit Dome δ18O (5 yrm)
Dasuopu Core 3 δ18O (5 yrm)
-15
-16
-17
-18
-19
-20
-21
-22
-15
-16
-17
-18
-19
-20
-21
-22
-23
1760
1780
1800
1820
1840
1860
1880
1900
1920
1940
1960
1980
2000


INDIA in 1795.
20.
Region of the
Doji Bara famine
1791-92
OUDH
MAHRATTA


Hulton Archive


sulfate
Quelccaya fluoride
Quelccaya chloride
Quelccaya accumulation
2000
1950
1900
1850
1800
1750
1700
1650
70.6
5
10
15
0
15
30
45
0.5
1.0
1.5
2.0
(x10-1 ppb)
(ppb)
(meters water/yr)

Nature's best thermometer, perhaps its most sensitive and unambiguous indicator of climate change, is ice.

> **"Ice asks no questions,**
> **presents no arguments,**
> **reads no newspapers**
> **listens to no debates.**
> **It is not burdened by ideology and carries**
> **no political baggage as it changes**
> **from solid to liquid. It just melts."**

From *A World Without Ice* by Henry Pollack, 2009

Muir Glacier, SE Alaska

August, 1941 (photo by William Field)

August, 2004 (photo by Bruce Molnia)

Kyetrak Glacier, Eastern Himalayas

Courtesy of the Royal Geographical Society

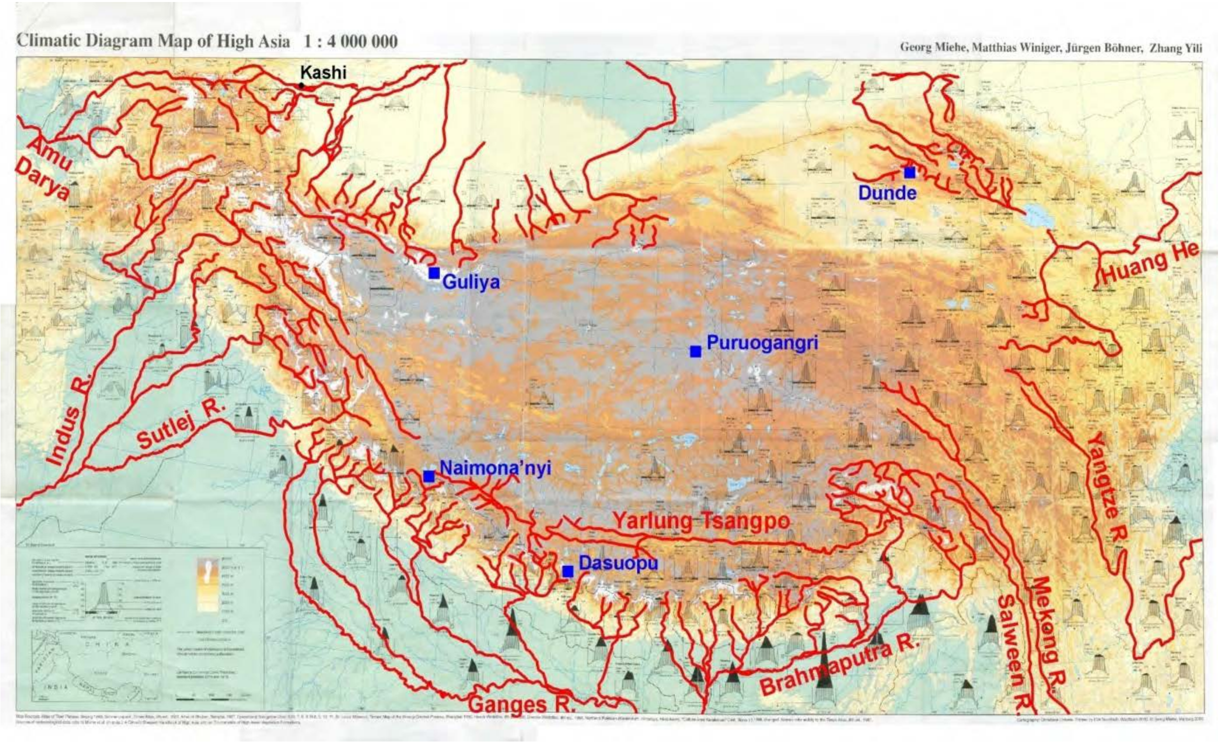
1921

Courtesy of Glacier Works

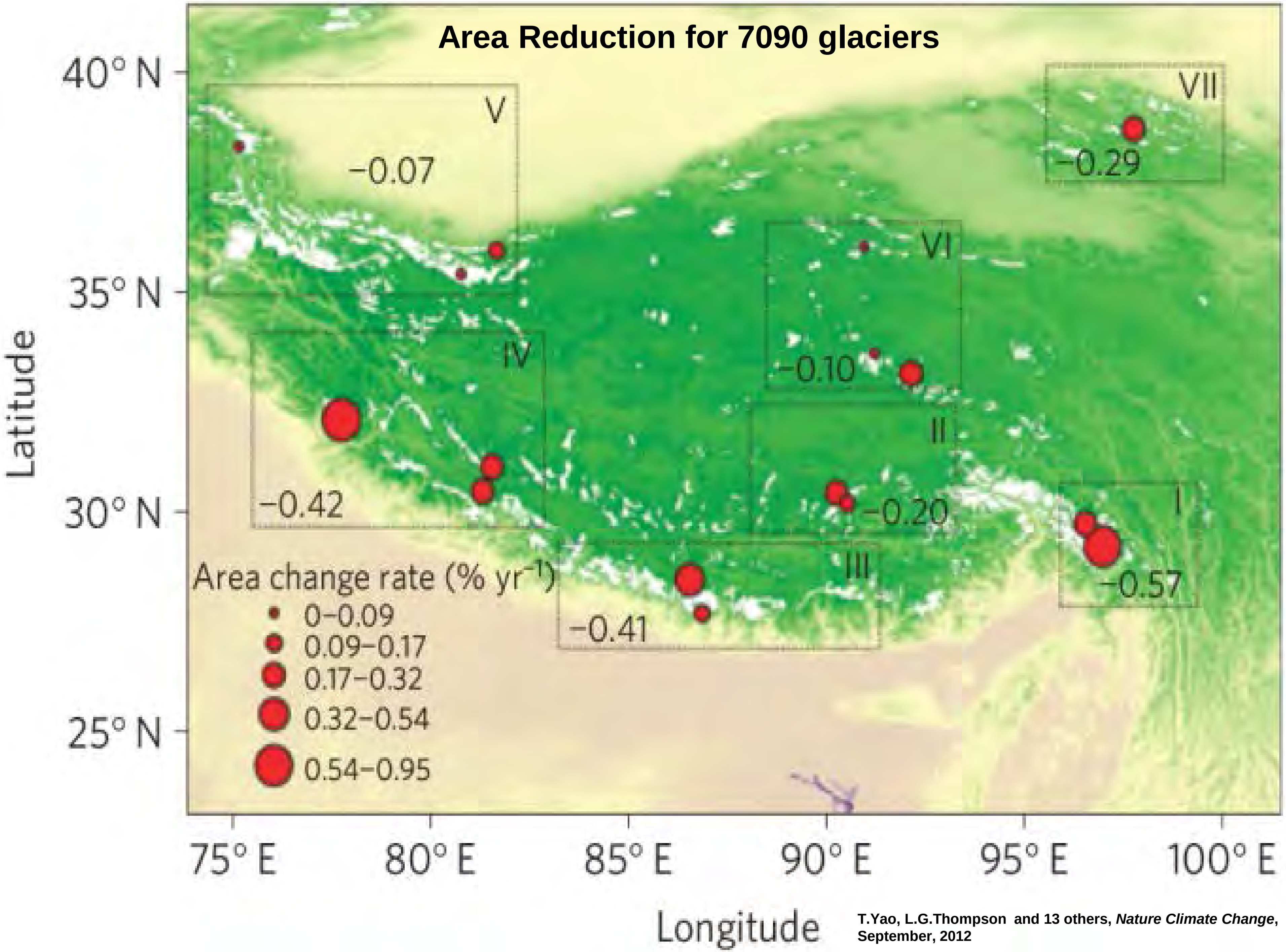
2009

The Third Pole … high, cold, remote & threatened by climate change

- **Centered on the Tibetan Plateau & Himalayas**
- **Covers 5 million km^2**
- **One of the largest glacial stores of fresh water over 46,000 glaciers (Asia's water tower)**
- **Glaciers feed Asia's largest rivers**
- **Help sustain 1.5 billion people in 10 countries**



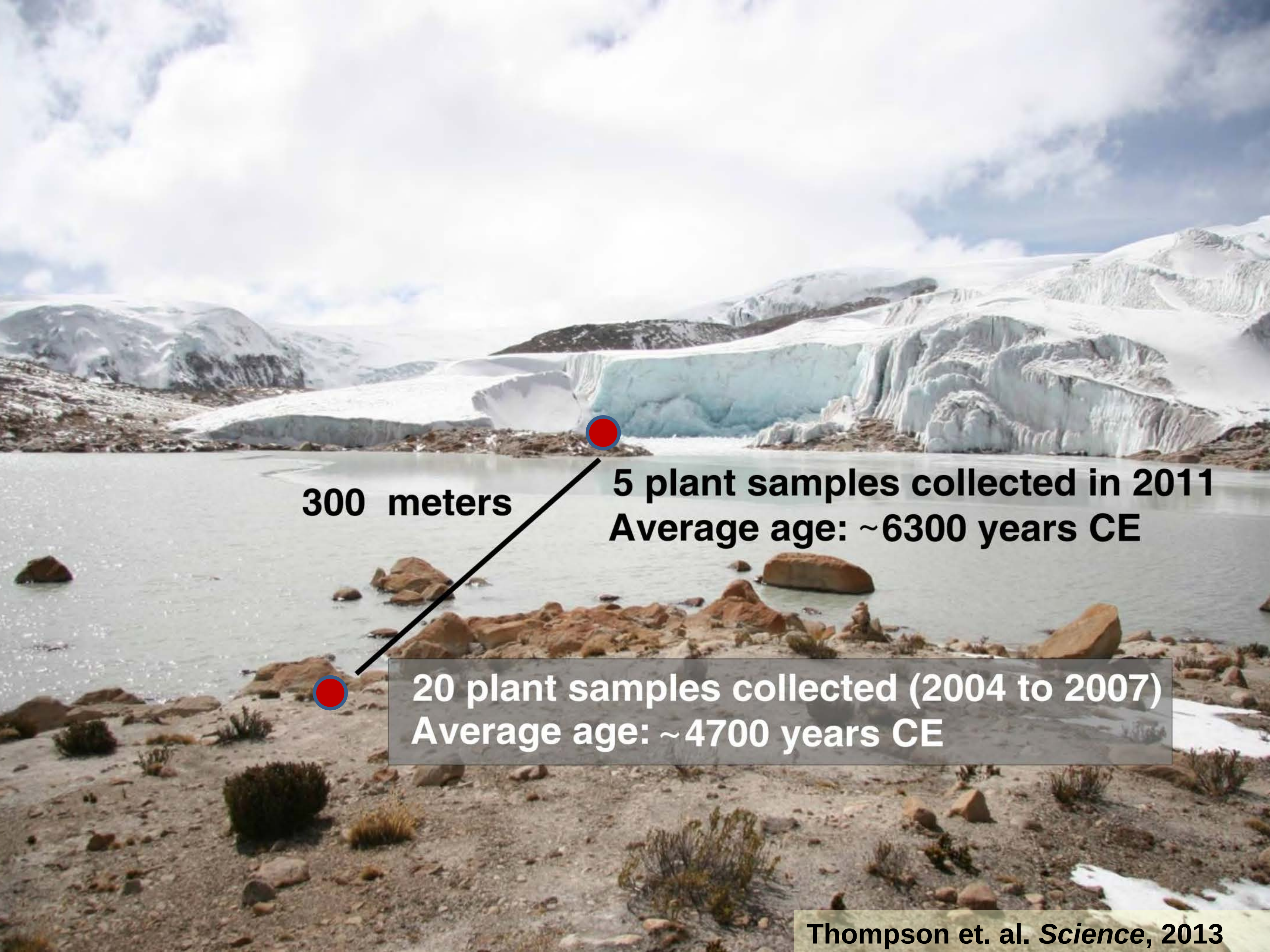
Area Reduction for 7090 glaciers



T.Yao, L.G.Thompson and 13 others, *Nature Climate Change*, September, 2012

Ghiacciai della Lobbia e dell'Adamello/Mandrone
(*102 anni*)

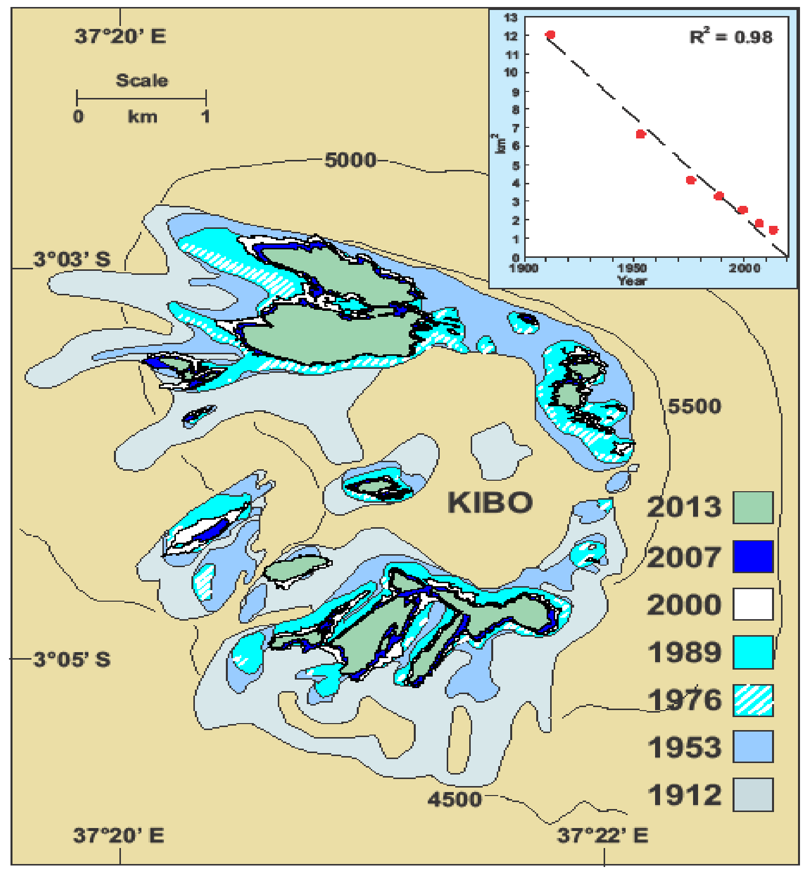
Qori Kalis Glacier, Quelccaya Ice Cap, Peru


300 meters
5 plant samples collected in 2011
Average age: ~6300 years CE
20 plant samples collected (2004 to 2007)
Average age: ~4700 years CE
Thompson et. al. *Science*, 2013

88.3% of the ice present in 1912 has disappeared
40% of the ice present in 2000 had disappeared by 2013

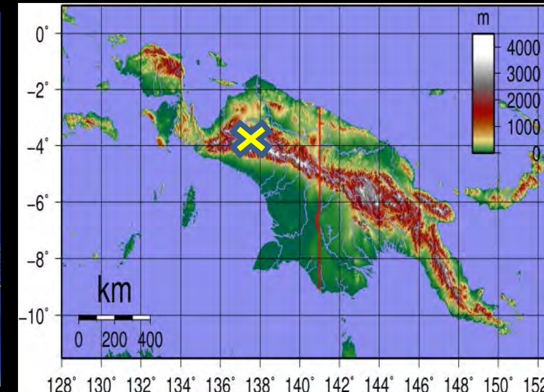
Kilimanjaro,
Africa

Total Area Of Ice On Kilimanjaro
(1912, 1953, 1976, 1989, 2000, 2007, 2013)



1912 - 1989 after Hastenrath and Greischar, *J. Glaciol.*, 1997
2000 after Thompson *et al.*, *Science*, 2002; 2007 from Thompson (OSU)

Ice Fields near Puncak Jaya, Papua, Indonesia drilled 2010



1936

1991

2001

East Northwall Firn, 2010
Papua, Indonesia
(New Guinea)

How to manage a world with threats from climate change, rising sea levels and rising energy consumption?

In 2011, Ohio experienced its wettest year on record.

The cost of extensive repairs to roads and bridges was estimated at almost $40 million. In requesting assistance for disastrous flooding that Occurred in April and May, Ohio's Governor John Kasich said in a letter to President Obama that the impacts in Ohio were "of such severity and magnitude that effective response is beyond the capabilities of the state and local government."


Pakistan flooding, Sept. 25, 2011, Sindh Province (source: Faisal Mahmood/Reuters))
2011: Overall losses: $148 billion
Insured losses: $55 billion

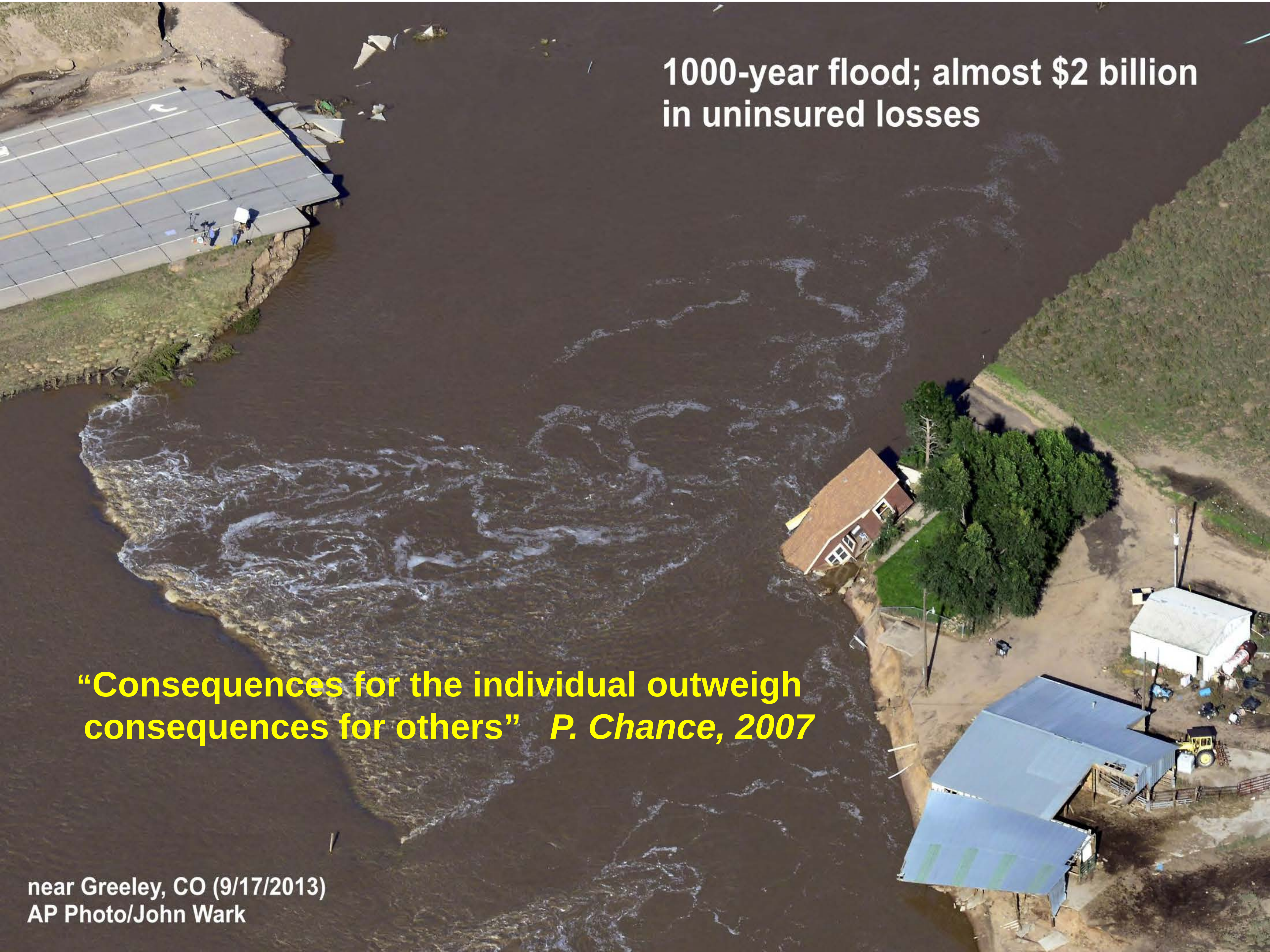
October 30, 2012

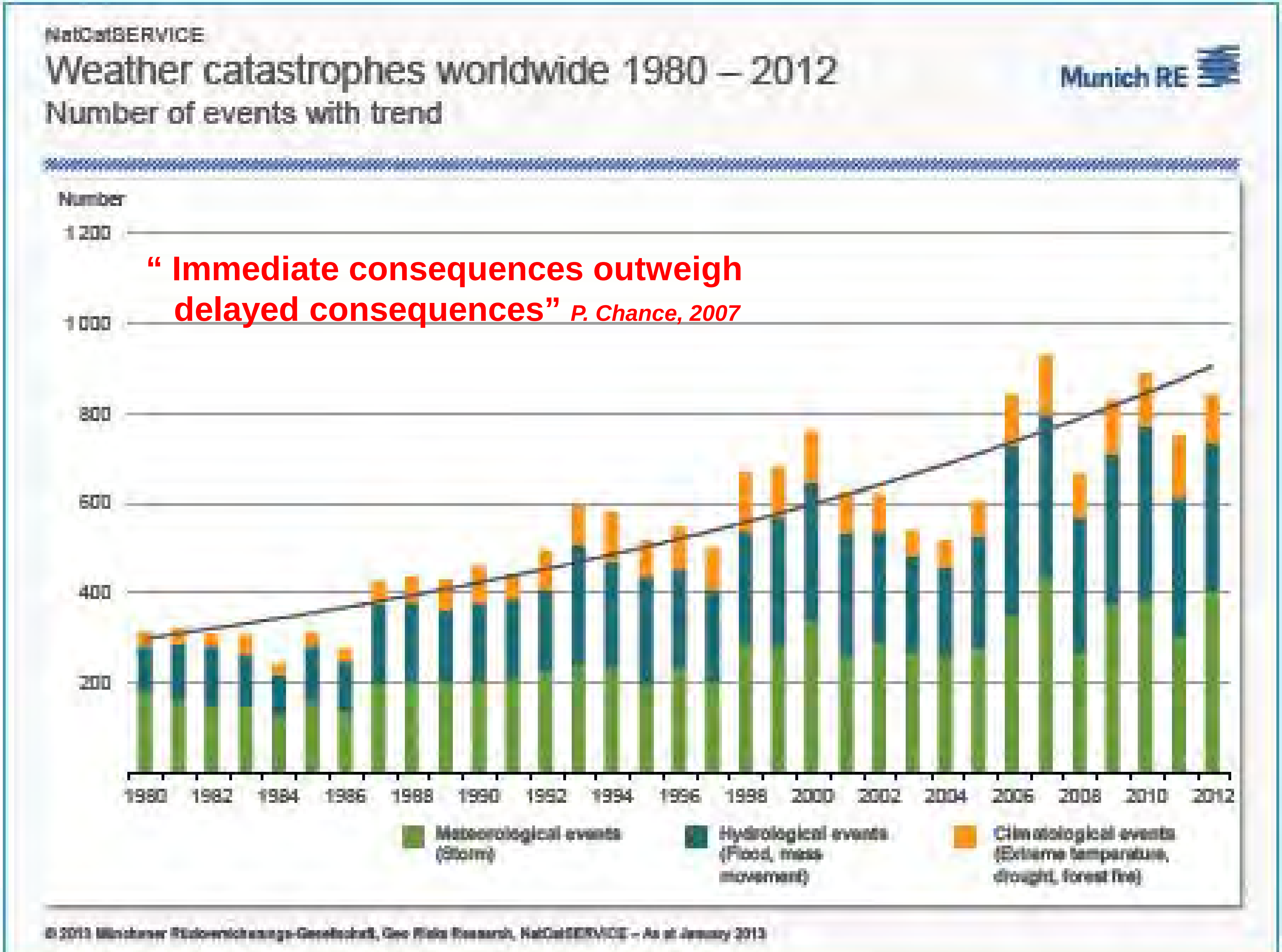
Hurricane / Superstorm Sandy
Death toll: 110
Estimated cost: $60 Billion

Illustrates the conditions and events and scenarios that we can expect from climate change. In New York and New Jersey there are 45 superfund toxic waste sites within half a mile of the coast.

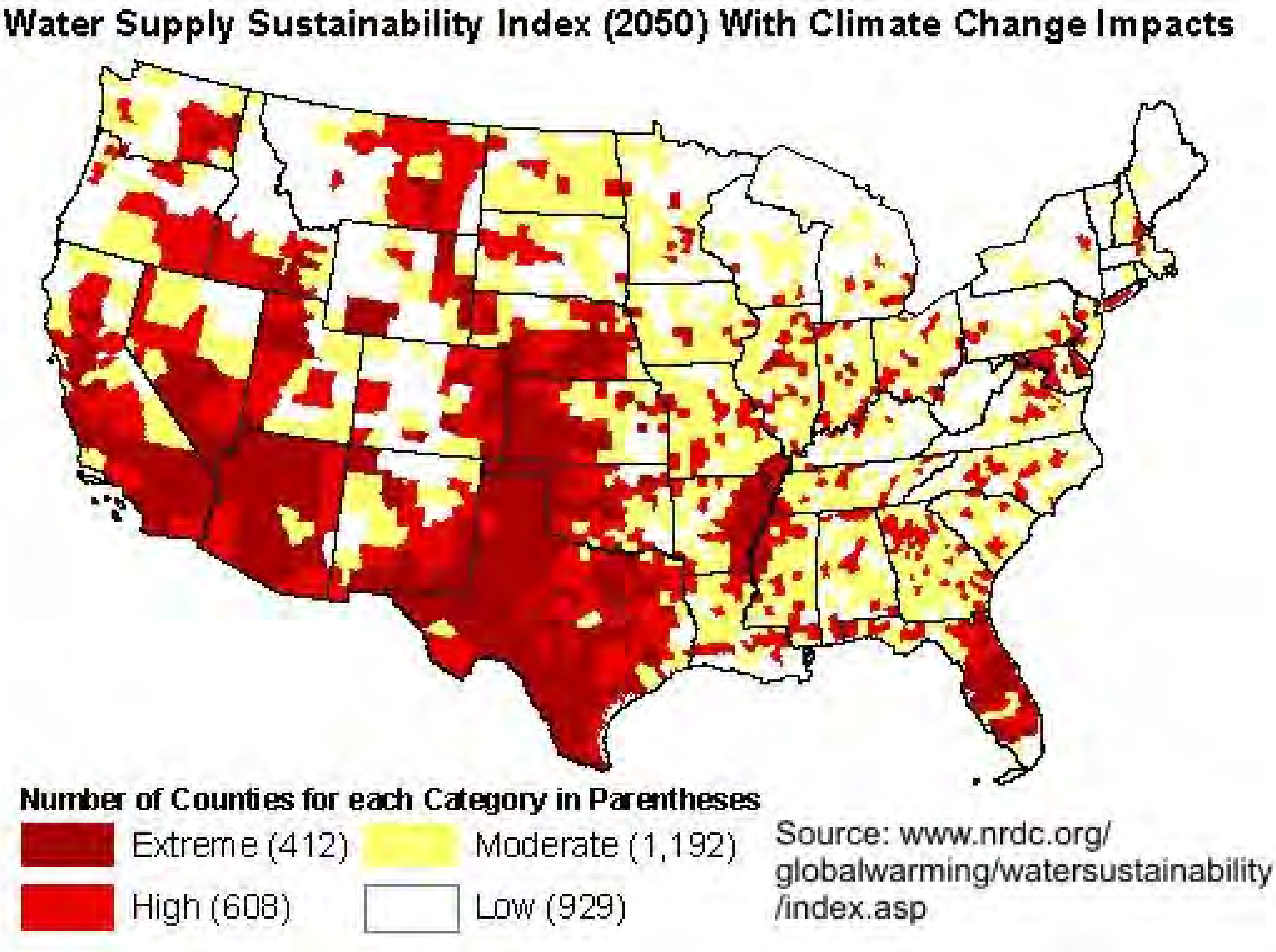
Summer 2013, Australia


RIM Fire, August 25, 2013 Near Yosemite National Park
The U.S has endured a near-record 2012 wildfire season
with the total acres burned roughly the same size as
Massachusetts and Connecticut combined:
2006-- 9.8 million acres
2007-- 9.3 million acres
2012-- 9.1 million acres

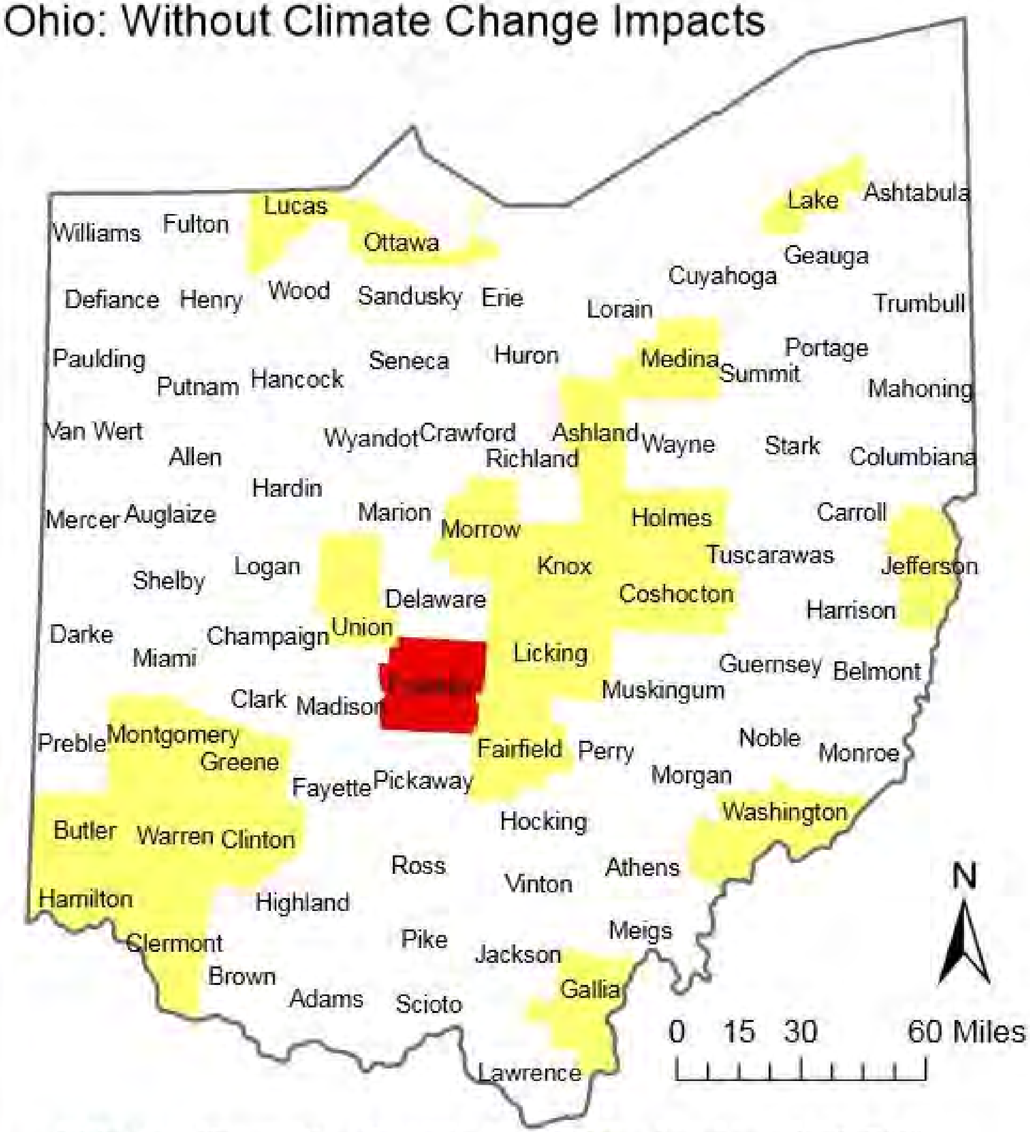

1000-year flood; almost $2 billion in uninsured losses
"Consequences for the individual outweigh consequences for others" P. Chance, 2007
near Greeley, CO (9/17/2013)
AP Photo/John Wark



“ Immediate consequences outweigh delayed consequences” ***P. Chance, 2007***


Water Supply Sustainability Index (2050) With Climate Change Impacts
Number of Counties for each Category in Parentheses
Extreme (412)
Moderate (1,192)
High (608)
Low (929)
Source: www.nrdc.org/globalwarming/watersustainability/index.asp

Ohio: Without Climate Change Impacts

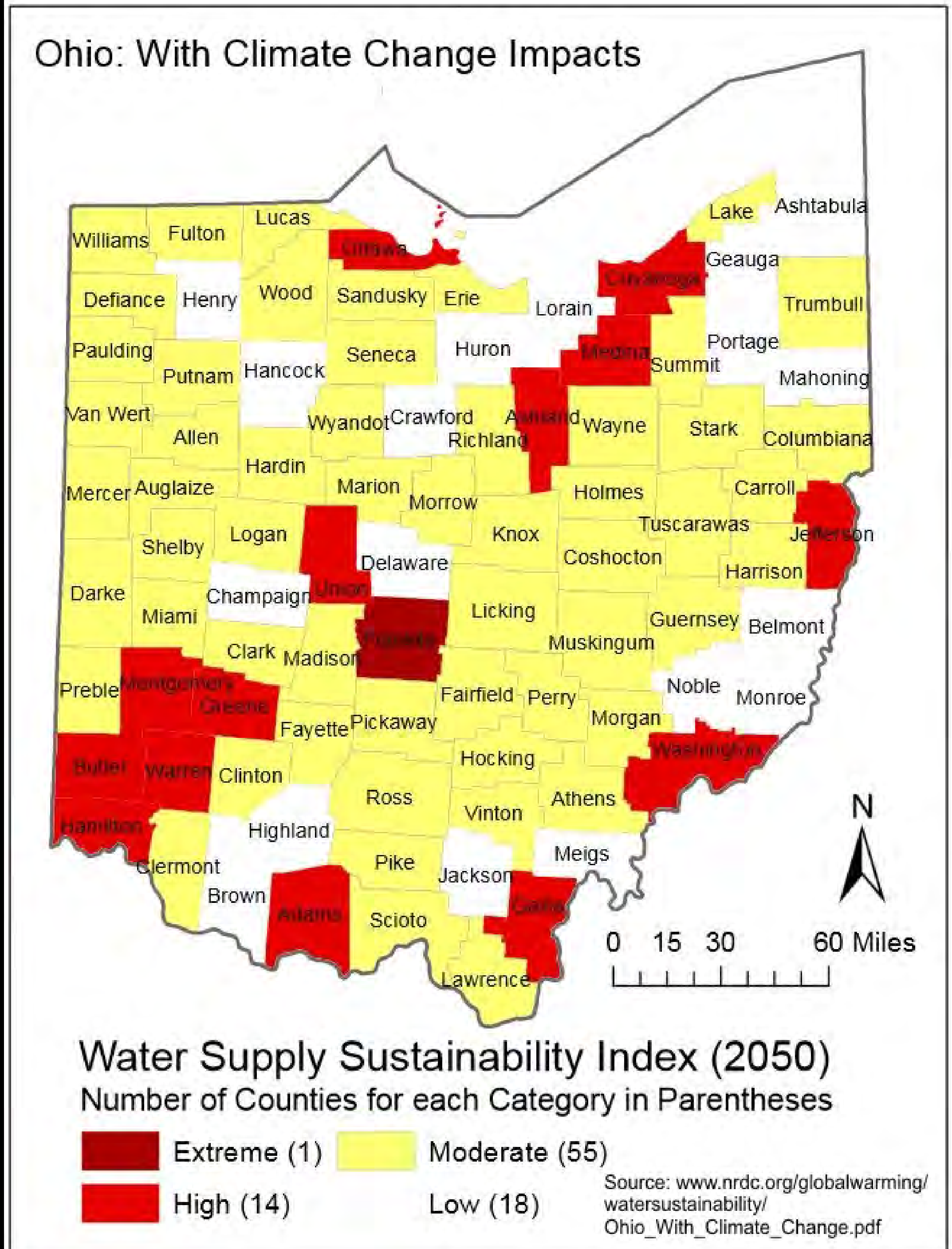


Water Supply Sustainability Index (2050)

Number of Counties for each Category in Parentheses

Extreme (0)
High (1)
Moderate (22)
Low (65)

Source: www.nrdc.org/globalwarming/watersustainability/Ohio_Without_Climate_Change.pdf


Ohio: With Climate Change Impacts
Williams
Fulton
Lucas
Ottawa
Lake
Ashtabula
Geauga
Cuyahoga
Defiance
Henry
Wood
Sandusky
Erie
Lorain
Trumbull
Paulding
Putnam
Hancock
Seneca
Huron
Medina
Summit
Portage
Mahoning
Van Wert
Allen
Wyandot
Crawford
Richland
Ashland
Wayne
Stark
Columbiana
Hardin
Mercer
Auglaize
Marion
Morrow
Holmes
Carroll
Logan
Knox
Tuscarawas
Jefferson
Shelby
Delaware
Coshocton
Harrison
Champaign
Union
Darke
Miami
Licking
Guernsey
Belmont
Muskingum
Clark
Madison
Preble
Montgomery
Greene
Fairfield
Perry
Noble
Monroe
Fayette
Pickaway
Morgan
Washington
Butler
Warren
Clinton
Hocking
Ross
Athens
Vinton
Hamilton
Highland
Meigs
Clermont
Pike
Jackson
Brown
Adams
Gallia
Scioto
Lawrence
N
0 15 30 60 Miles
Water Supply Sustainability Index (2050)
Number of Counties for each Category in Parentheses
Extreme (1)
Moderate (55)
High (14)
Low (18)
Source: www.nrdc.org/globalwarming/watersustainability/Ohio_With_Climate_Change.pdf

Our greatest challenges of the 21st Century will be:
(1) learning how to get along with each other and
(2) learning how to get along with our Planet.

These two challenges deal with human behavior and are closely related!

For Global Climate Change --- Nature is the Time Keeper!

THE OHIO STATE UNIVERSITY

/ByrdPolar

@ByrdPolar

/ByrdPolar

BYRD POLAR RESEARCH CENTER

THE OHIO STATE UNIVERSITY

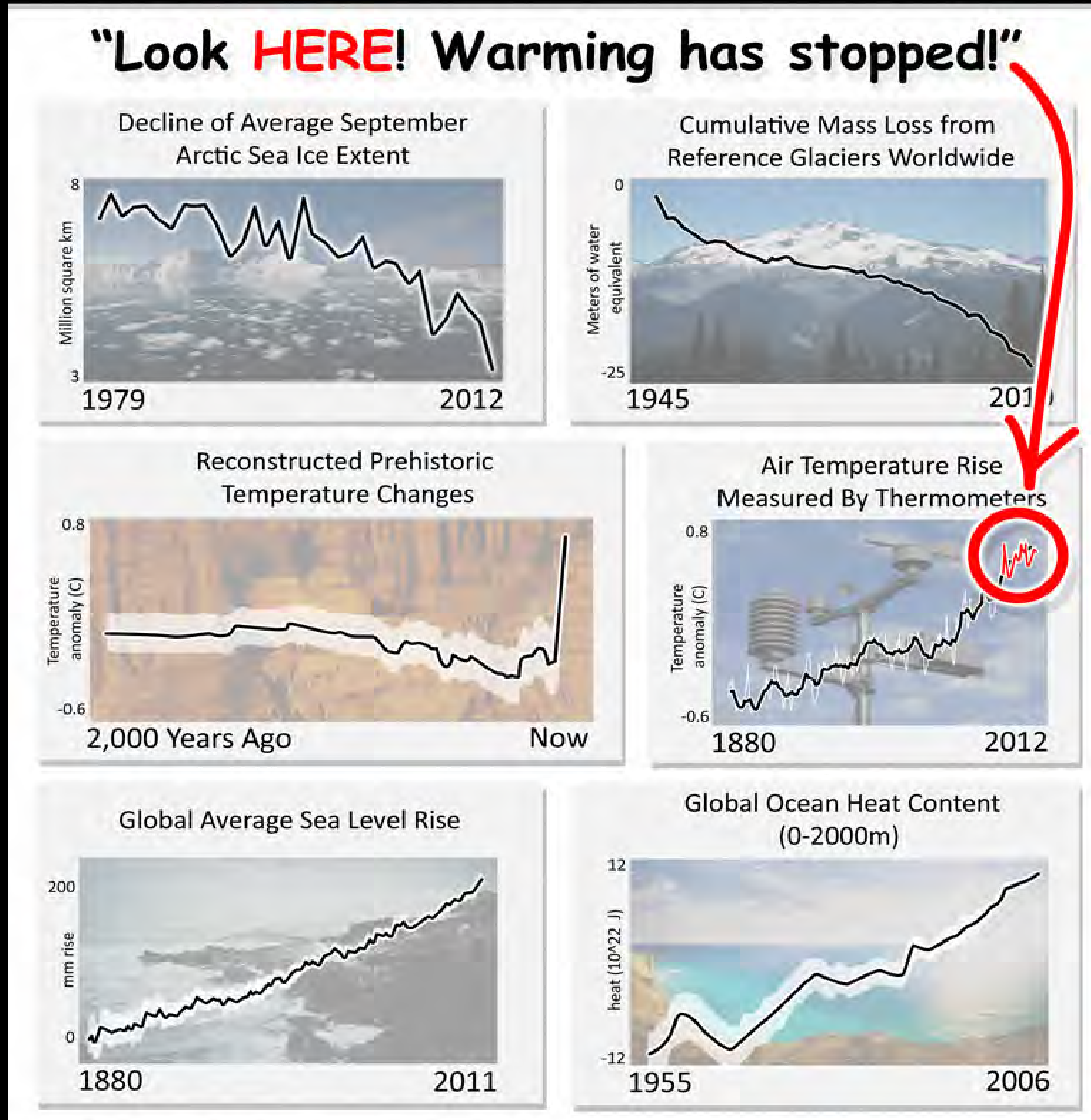
http://bprc.osu.edu/

Lonnie G. Thompson

thompson.3@osu.edu

bprc.osu.edu

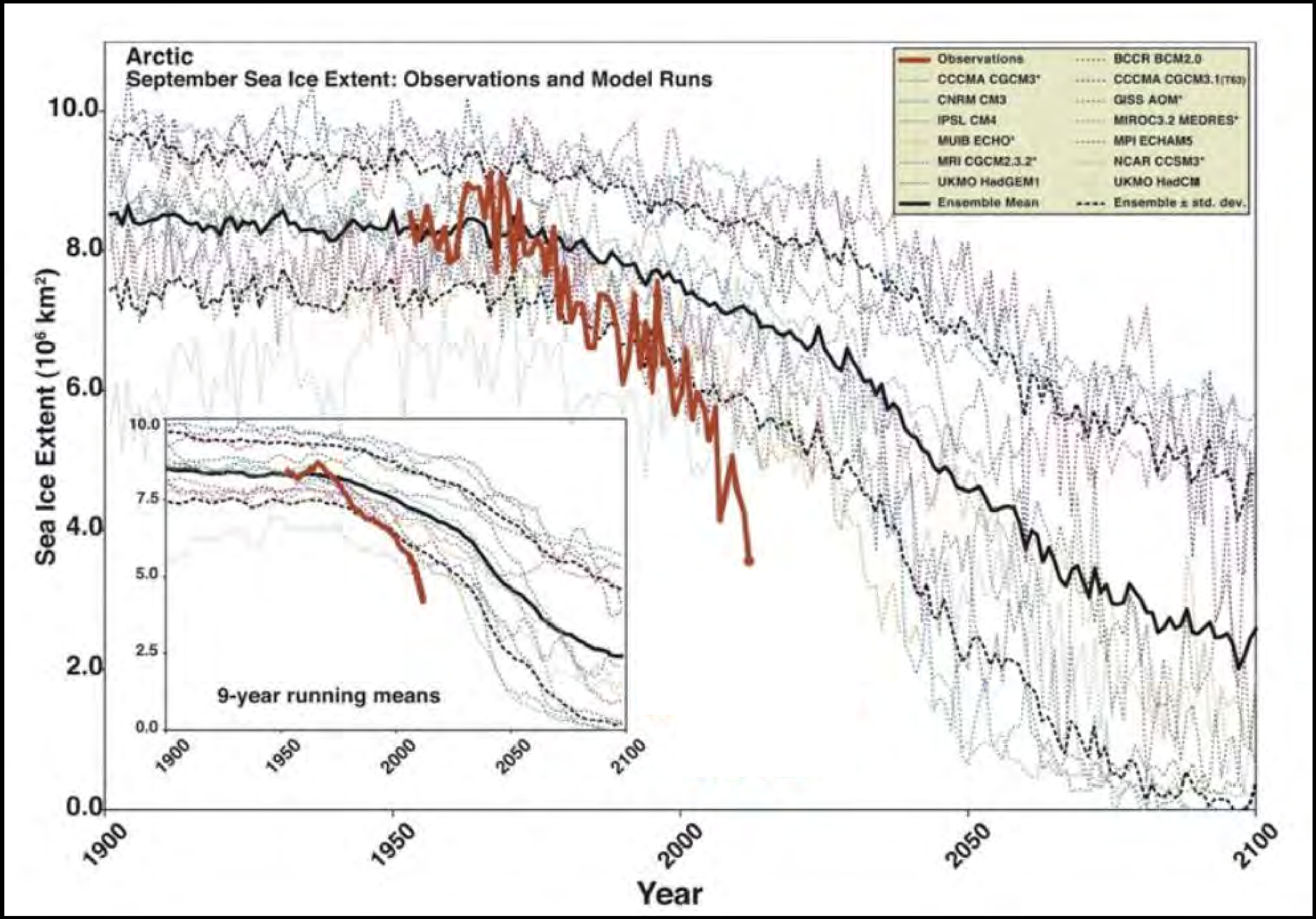
How “skeptics” want you to see climate change:



Be a Realist. Look at the whole picture.

Sources: Arctic ice, glaciers, sea level data: epa.gov/climatechange/science/indicators. Prehistoric temperatures: Marcott et al. (2013). Air temperatures: NASA GISTEMP Analysis. Ocean heat: Levitus et al. (2013). Based on a graphic from SkepticalScience.com.

Climate System Models Did Not Predict This!



Model runs: Stroeve *et al.*, 2007

Perfect Storm is Brewing

Ingredients for a Perfect Disaster:

- 1000-year CO_2 Lifetime
- Climate System Inertia
- Positive (Amplifying) Feedbacks
- Fossil Fuel Addiction

Alternative: A Brighter Future

- Low Cost Fuels
- Clean Air & Water
- Economic Development, Good Jobs


May 20, 2013 EF5; Moore, Oklahoma

Industry Employment: Needs for the Future

John L. Sherwood

The University of Georgia
College of Agricultural and Environmental Sciences

The American Phytopathological Society

U.S. Department of Labor and U.S.D.A.:

-an expected growth in most agriculture-related fields.

-over the next 5 years, there will be a 5% increase in the need for graduates in these disciplines, but a 10% decline in the number of students choosing these important programs as their career path

Volenec, et al. SCIENCE VOL 335 24 FEBRUARY 2012

"At a time when China and Brazil are ramping up their investment in agricultural research, we cannot afford ours be gutted, or worse still, be ignored."

-Cathy Woteki, House Appropriations Comm. 4/17/2013

REPORT TO THE PRESIDENT ON AGRICULTURAL PREPAREDNESS AND THE AGRICULTURE RESEARCH ENTERPRISE

Executive Office of the President

President's Council of Advisors on Science and Technology

DECEMBER 2012

The United States is the undisputed world leader in agricultural production today, but as we look out across the 21st century, agriculture faces a series of challenges:

- Managing new pests, pathogens, and invasive plants.
- Increasing the efficiency of water use.
- Reducing the environmental footprint of agriculture.
- Growing food in a changing climate.
- Managing the production of bioenergy.
- Producing safe and nutritious food.
- Assisting with global food secure and maintaining abundant yields.

…provide the means to train the next generation of farmers and agricultural researchers and researchers and meet the workforce demands of U.S. agriculture in the 21st century.

HOW MANY?

-Formed in 2009

-Novel and innovative partnerships are needed to meet unprecedented demands

-To generate support to train future generations of agricultural scientists

-Engaged Readex Research; since 1947 delivering effective market research surveys

A preliminary analysis of answers from the six largest responding CSAW companies shows they expect to hire more than 1,000 scientist-level FTEs between now and 2015, representing 13% of their current U.S. agricultural scientist workforce.

84% of the total are needed in the disciplines of:

- plant sciences
- plant breeding/genetics
- plant protection

43%will need to hold the Ph.D.

US ag scientist hires by discipline will be in roughly the same proportion as the current (2012) domestic ag scientist workforce:

- 20% plant sciences,
- 40% plant breeding/genetics,
- 24% plant protection,
- Remainder:

environmental science/ecology regulatory science, and other.

Plant sciences:

.33 FTE hrs:
plant science/agronomy,

Remaining hrs:
plant production
plant development
seed technology.

Plant breeding/genetics:

.33 FTE plant molecular genetics

.33 FTE traditional plant breeding

.33 FTE plant biotechnology.

Plant protection:

.33 FTE hrs: development/discovery of new and novel chemistries for crop production and protection

Remaining hrs split between seven other sub-disciplines.

Companies are concerned about filling this workforce need between now and 2015.

In each of the three major disciplines, virtually all respondents agreed (often strongly) with these statements:

- **The pipeline of graduates in this discipline isn't as full as it needs to be.**
- **We anticipate challenges in finding quality applicants.**
- **We are likely to have difficulty hiring the education and experience we seek.**
- **We will need to retrain some of those we hire in this discipline.**

<u>Where and How?</u>

- Headhunter / professional search firms
- Hiring from other companies
- Use scientific society job services
- Participate in scientific society annual meetings to identify potential candidates

Where and How?

- Direct contact with university departments for upcoming graduates
- Focus on key universities
- Focus on individuals who receive internships / fellowships from your organization

“Secret ingredient” to filling the pipeline:

Positive exposure
to a discipline
through
work experience or
introductory classes.

MacDonald, et al. 2009 Plant Dis.

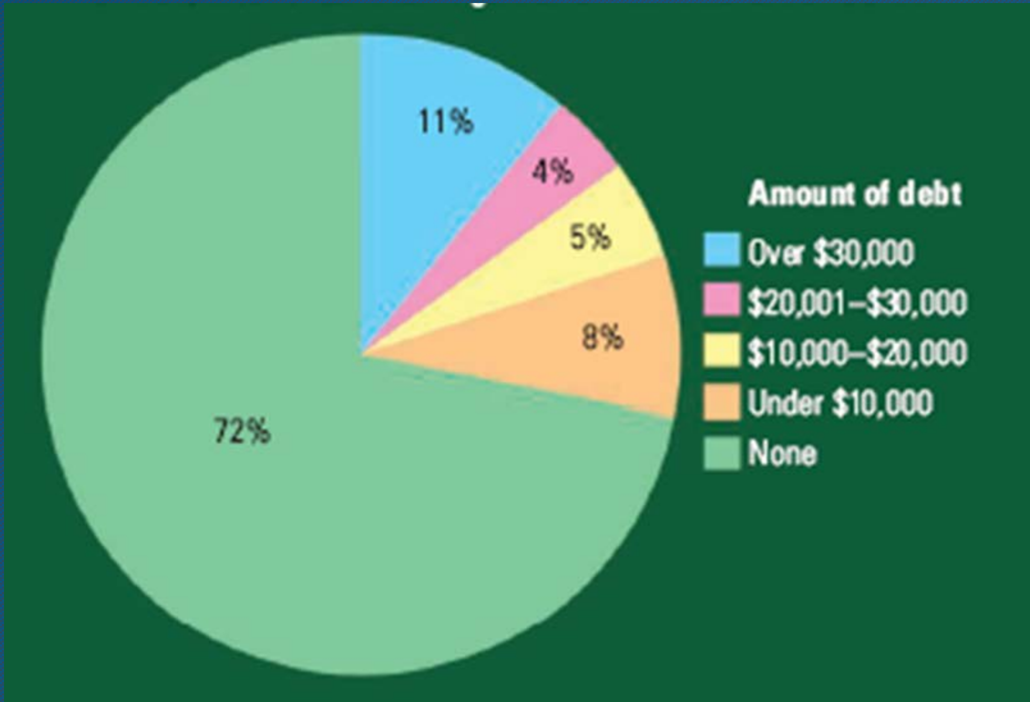
Graduate Student Loan/Employment Survey

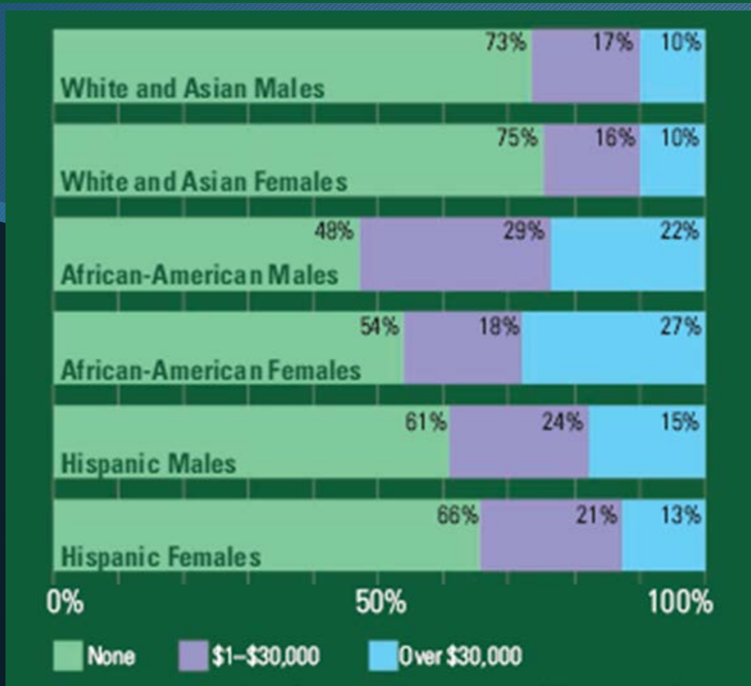
Conducted: July 2013

Response Rate: 28%

Completions: 241 completions (288 initiated=64-PostDocs & 224-Students)

Demographic: All current APS Student and PostDoc members (862)





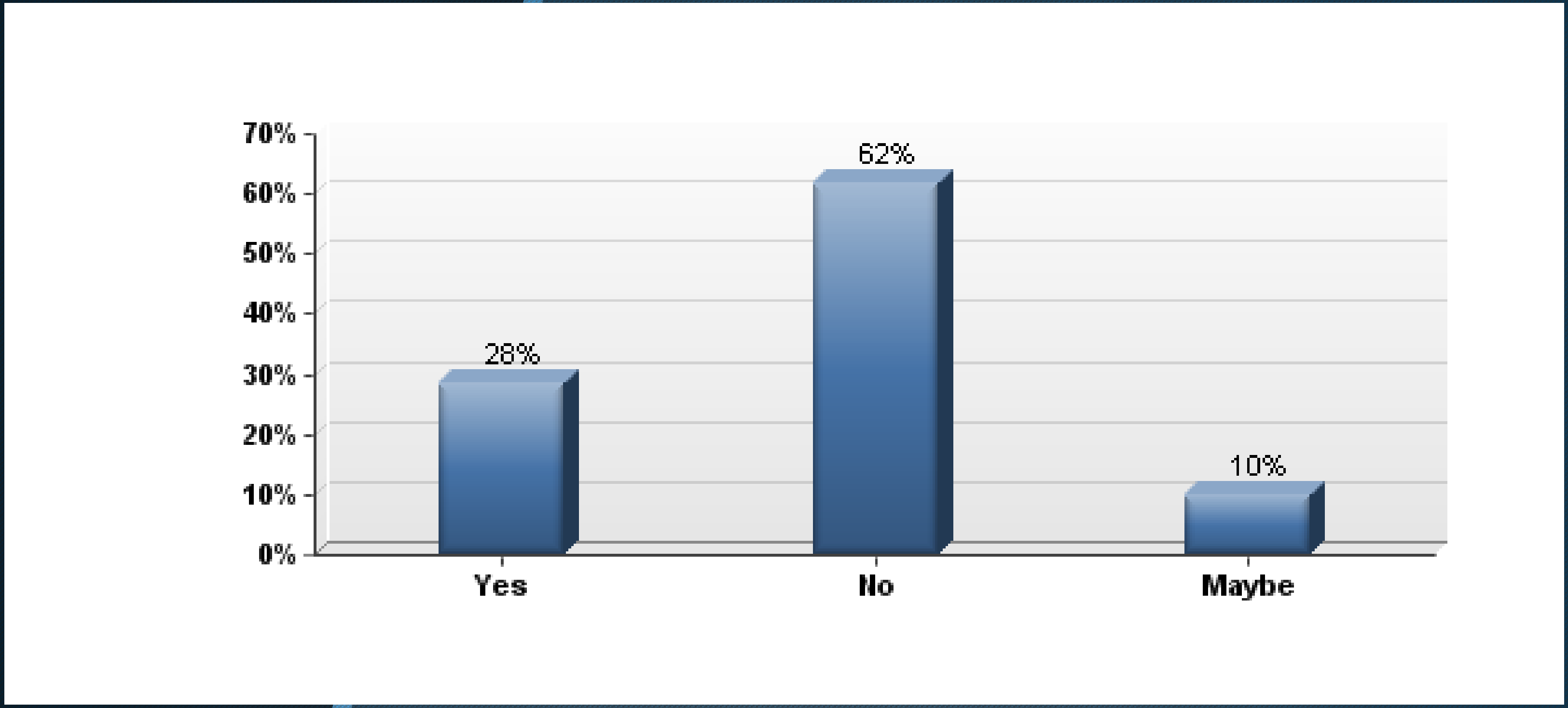
Overall, most STEM Ph.D.s graduate with little or no debt …

… but that's not true for many African-American and Hispanic students.

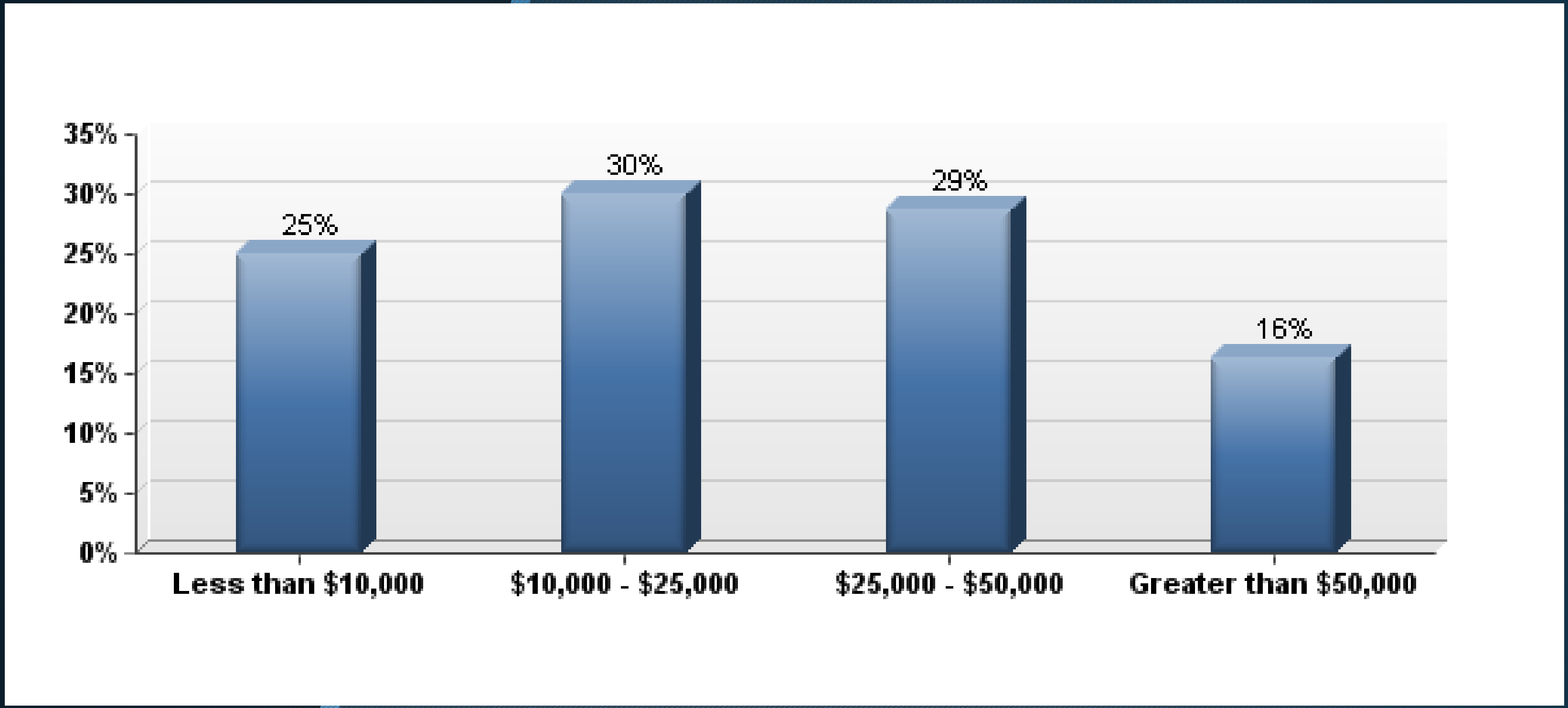
"We can't explain these findings," admits Tanenbaum

SCIENCE VOL 340 28 JUNE 2013

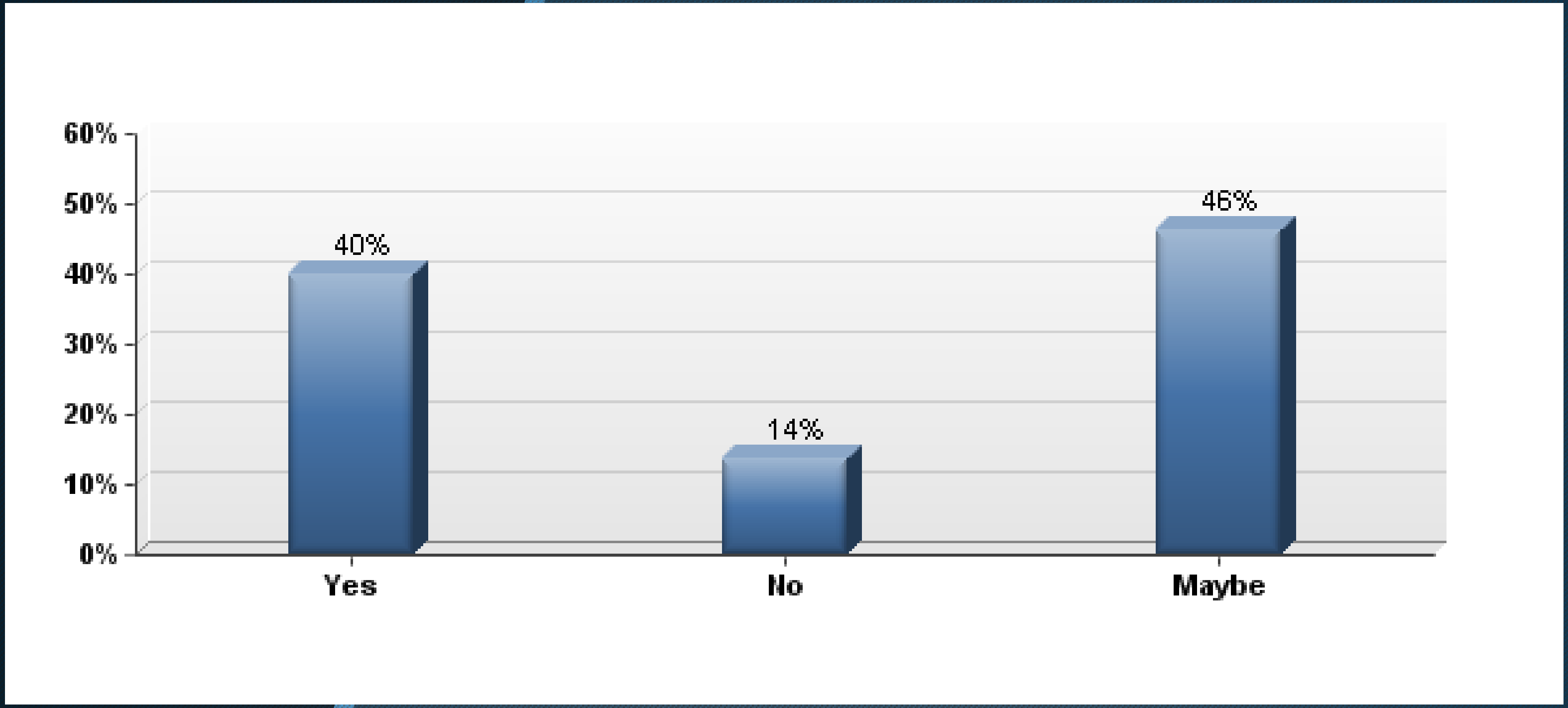
1. I did/will incur student or other loans for educational expenses for the completion of a graduate degree in plant pathology that must be paid.



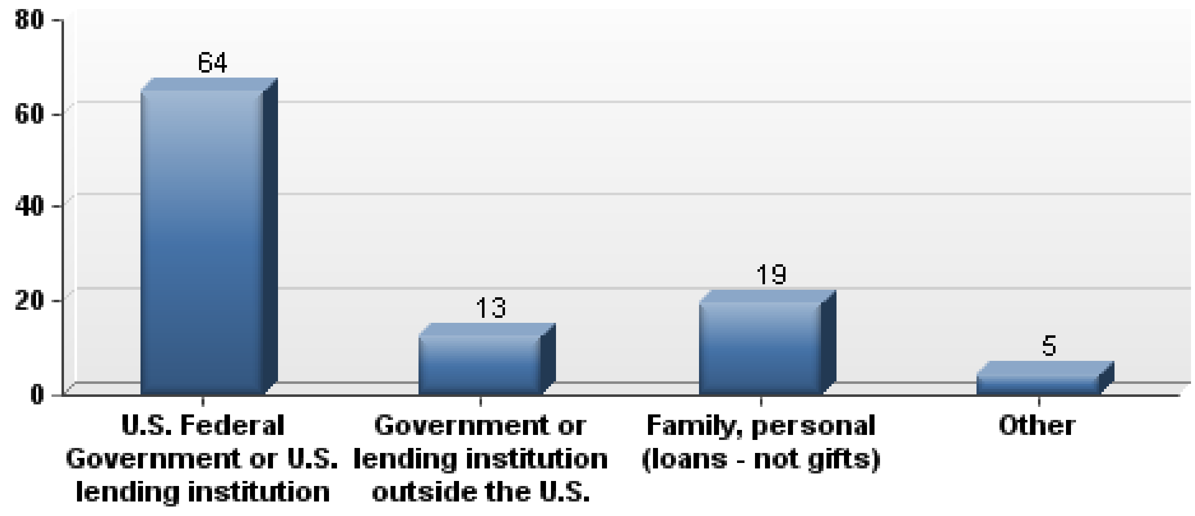
2. The total amount of the student or other loans that must be paid for my degree program(s) were/will be:



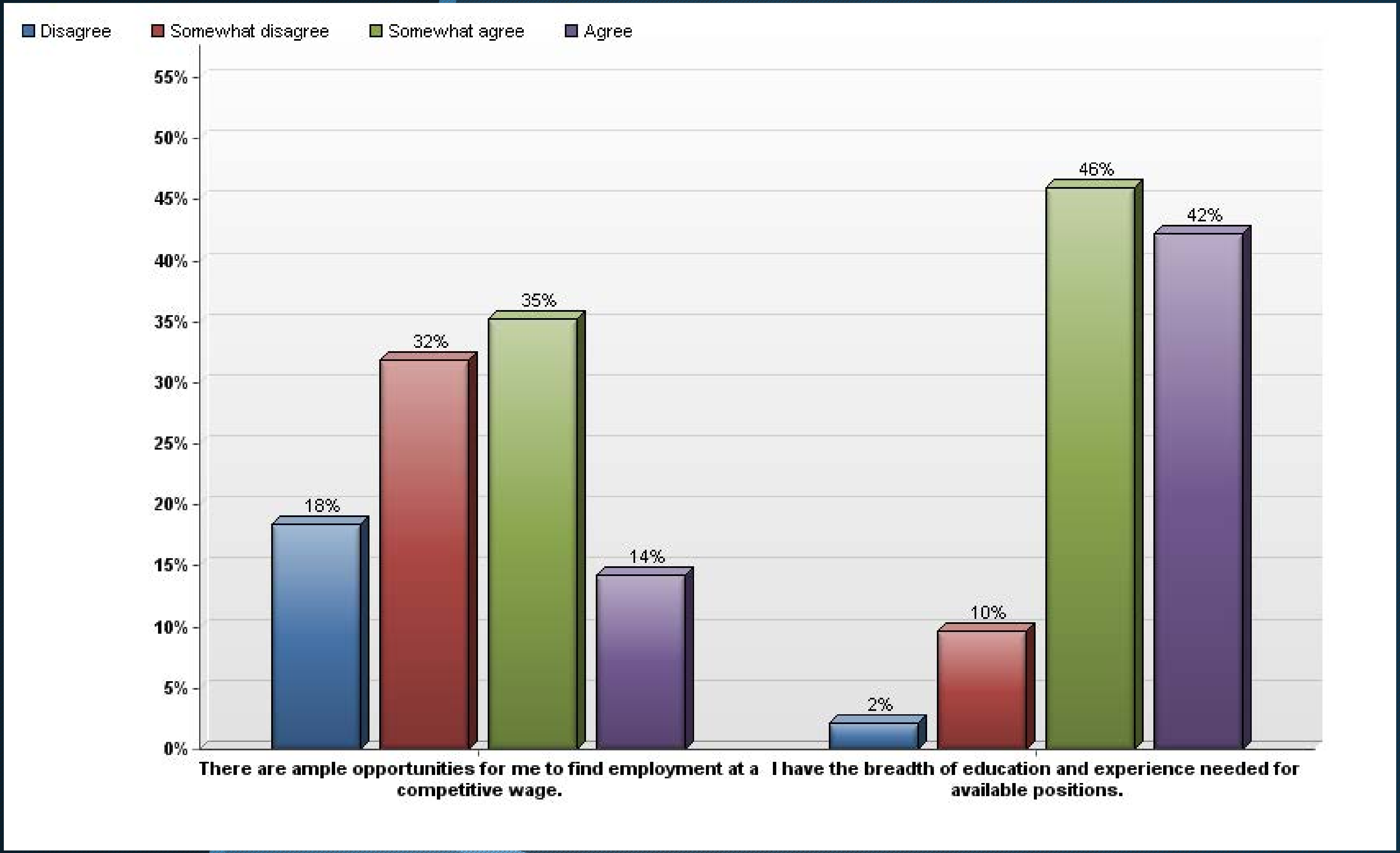
3. I am/will have a difficult time paying the loans as they become due.



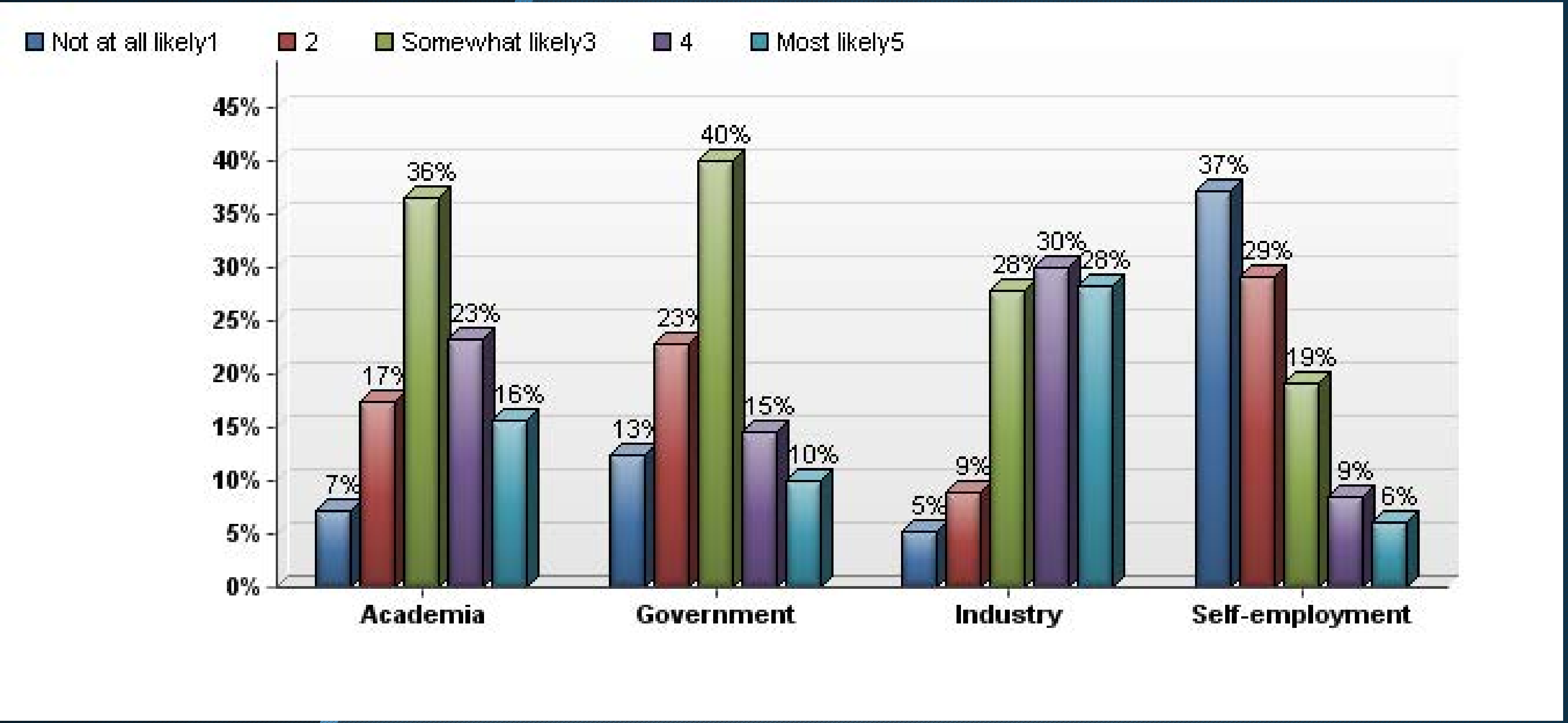
4. The source (by %) of the student or other loans that must be paid is/was approximately:



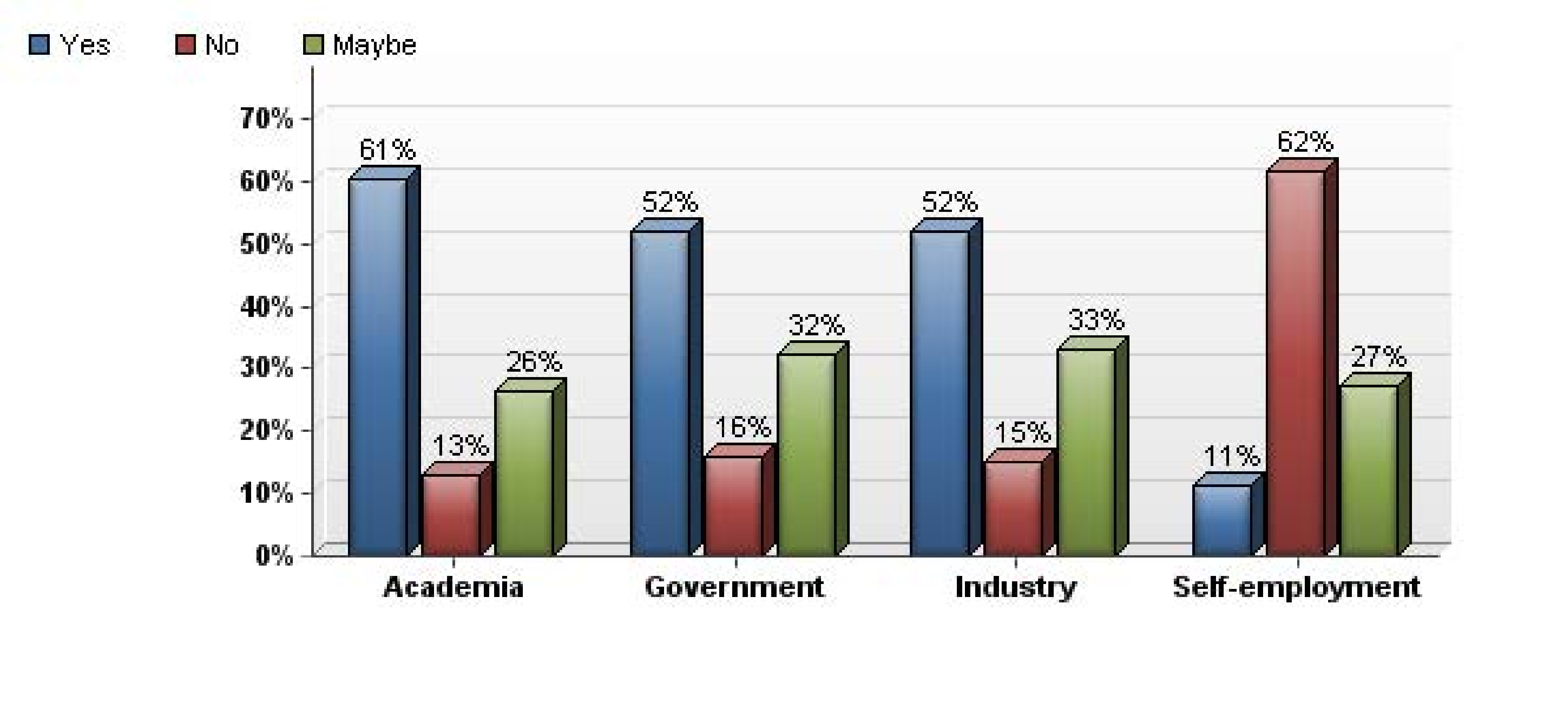
5. What is your agreement with the following statements?



6. Likelihood of job opportunities



7. Plan to pursue opportunities in that area?



Questions?

Industry Employment Needs for the Future

Preparing College Graduates for Careers in the Food and Agricultural Sciences

Josef M. Broder
Associate Dean for Academic Affairs
The University of Georgia

2013 ESS/SAES/ARD Meeting and Workshop
Columbus OH 43210
September 25, 2013

Objectives

Present the findings of a national survey of skills and experiences of importance to graduates from college of food, agricultural and related sciences
http://www.aplu.org/document.doc?id=3414

Discuss implications for experiment station research

Offer recommendations to enhance the capacity of teaching and research

Comparative Analysis of Soft Skills: What is Important for New Graduates?

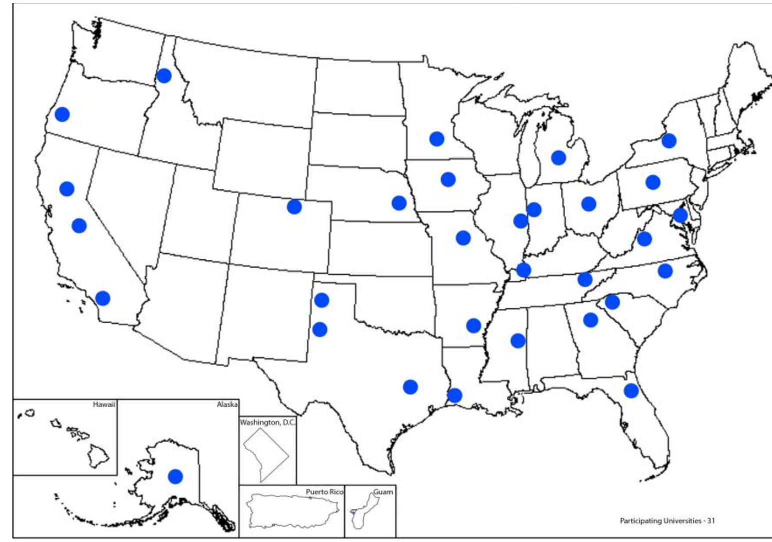
PERCEPTIONS OF EMPLOYERS, ALUM, FACULTY, AND STUDENTS

PAT CRAWFORD, SUZANNE LANG, JOSEF BRODER, WENDY FINK, ROBERT DALTON, AND LAURA FIELITZ

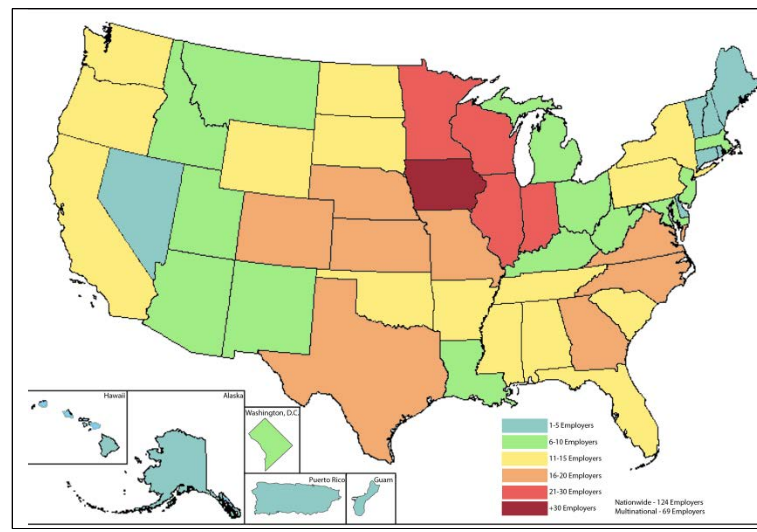
COLLEGE OF AGRICULTURE & NATURAL RESOURCES
MICHIGAN STATE UNIVERSITY

APLU - APS Soft Skills Survey

- Survey Monkey™
  March 21 – July 3, 2011
- Nationwide survey
  31 Universities
  2,700 undergraduate students
  4,000 alumi
  900 faculty
  282 Employers
- Total of over 8,000 respondents
- Findings reported at:
  AgCareers Round Table (August 2011)
  APLU Summit (August 2011)
  UIC Fall Meeting (October 2011)



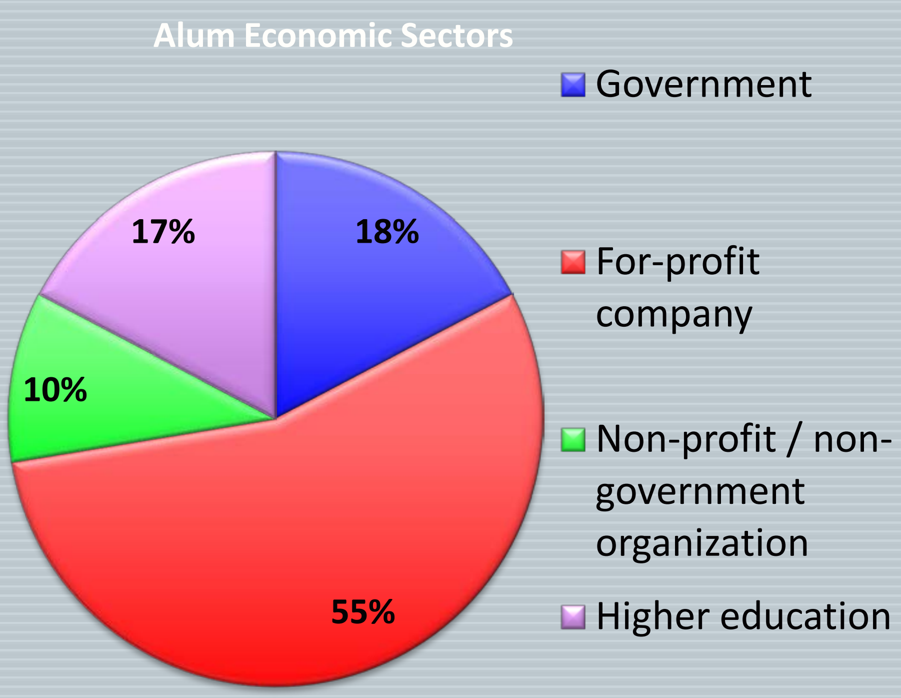
Universities



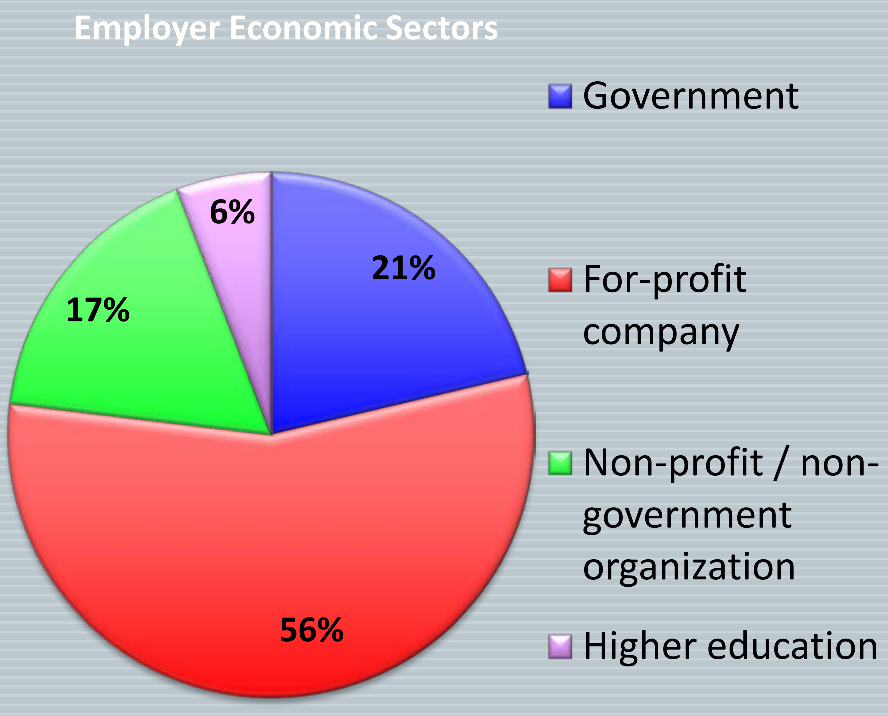
Employers

Survey Demographics

Alum Economic Sector

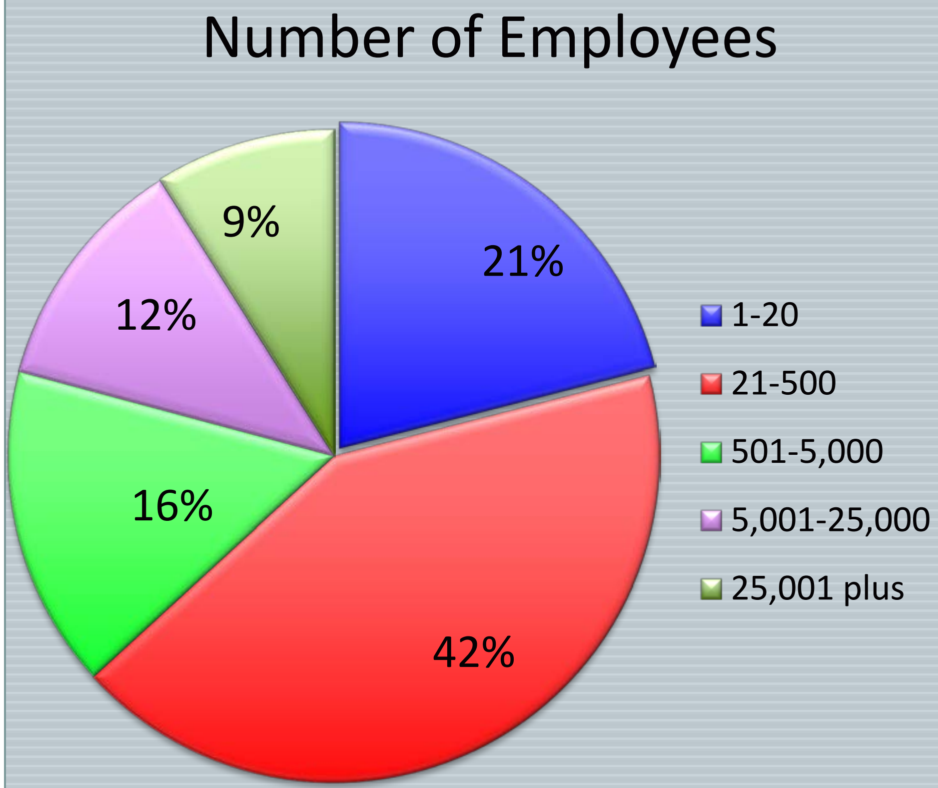


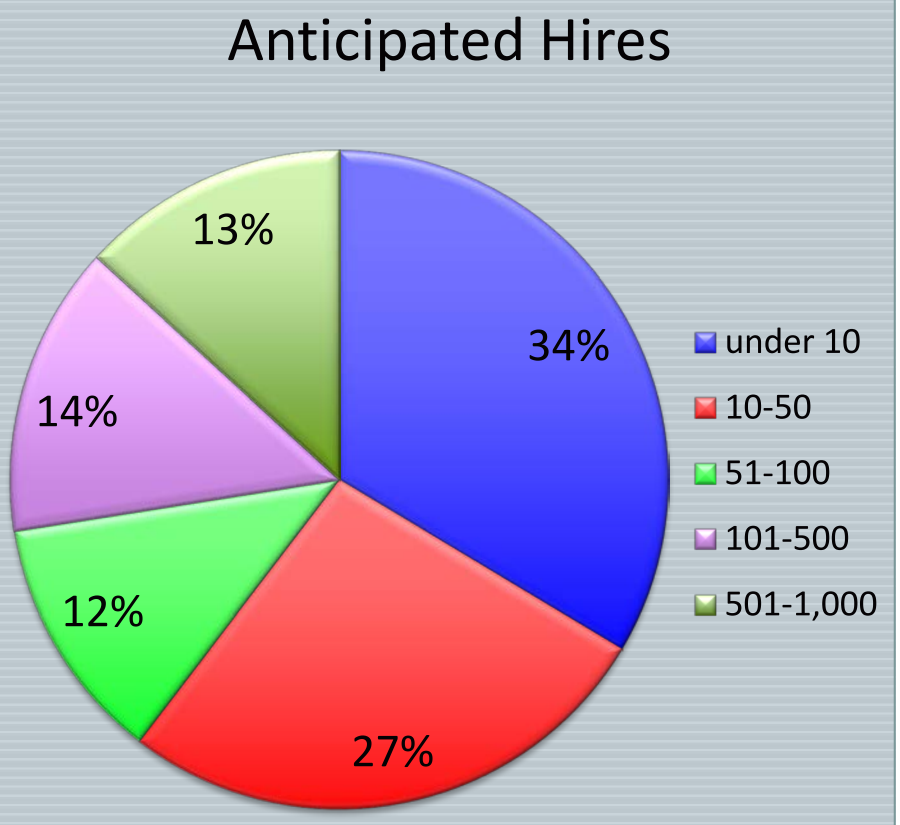
Employer Economic Sector



- The majority, 87%, of the alum respondents are employed
- Over half (56%) of the alum received their Bachelor's degree in the last 10 years

Survey Demographics





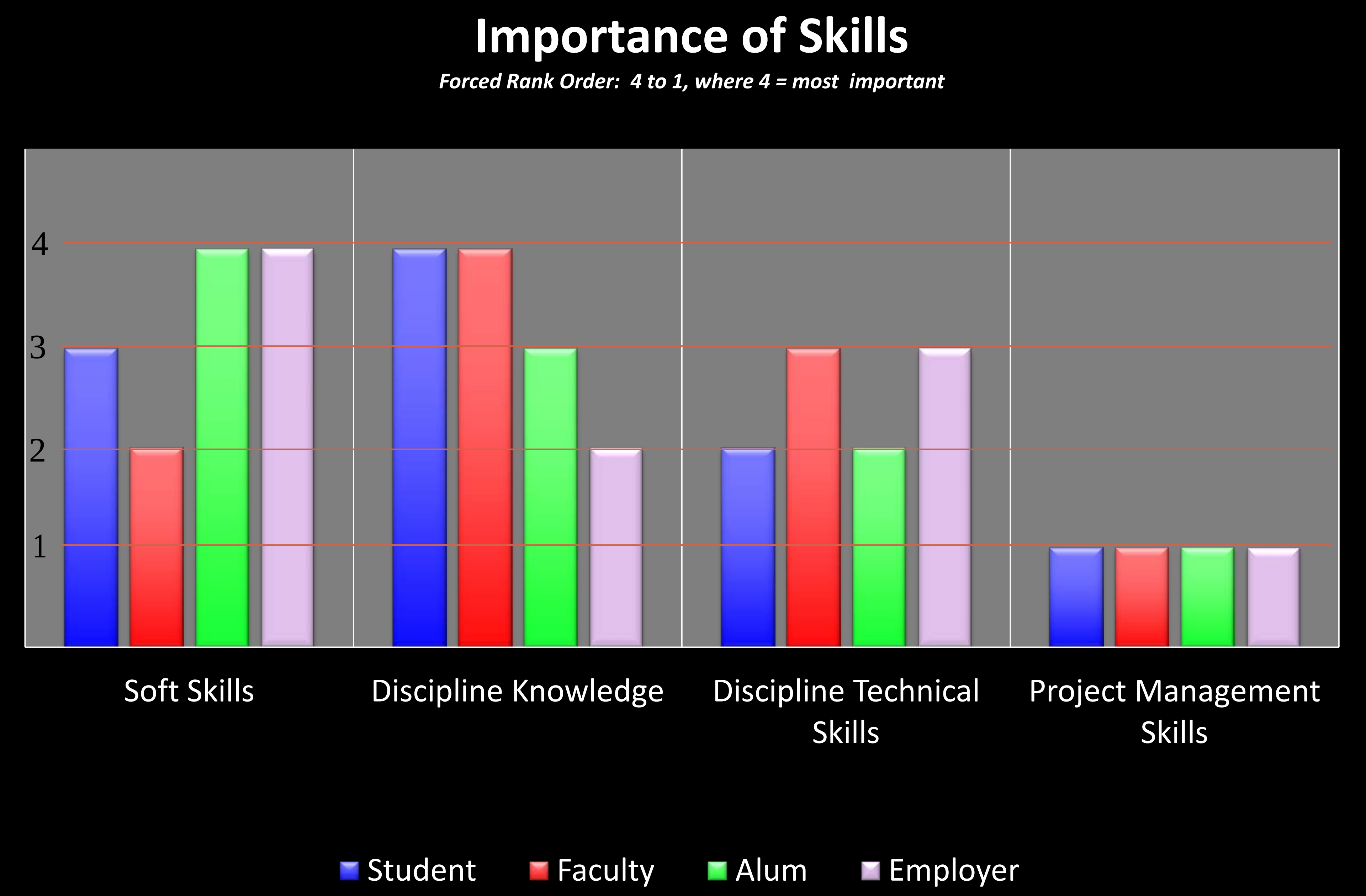
Skills important for employment

- Project management skills

- Technical skills related to discipline

- Knowledge of the discipline

- Soft skills (professional or interpersonal skills)


Importance of Skills
Forced Rank Order: 4 to 1, where 4 = most important
4
3
2
1
Soft Skills
Discipline Knowledge
Discipline Technical Skills
Project Management Skills
Student
Faculty
Alum
Employer

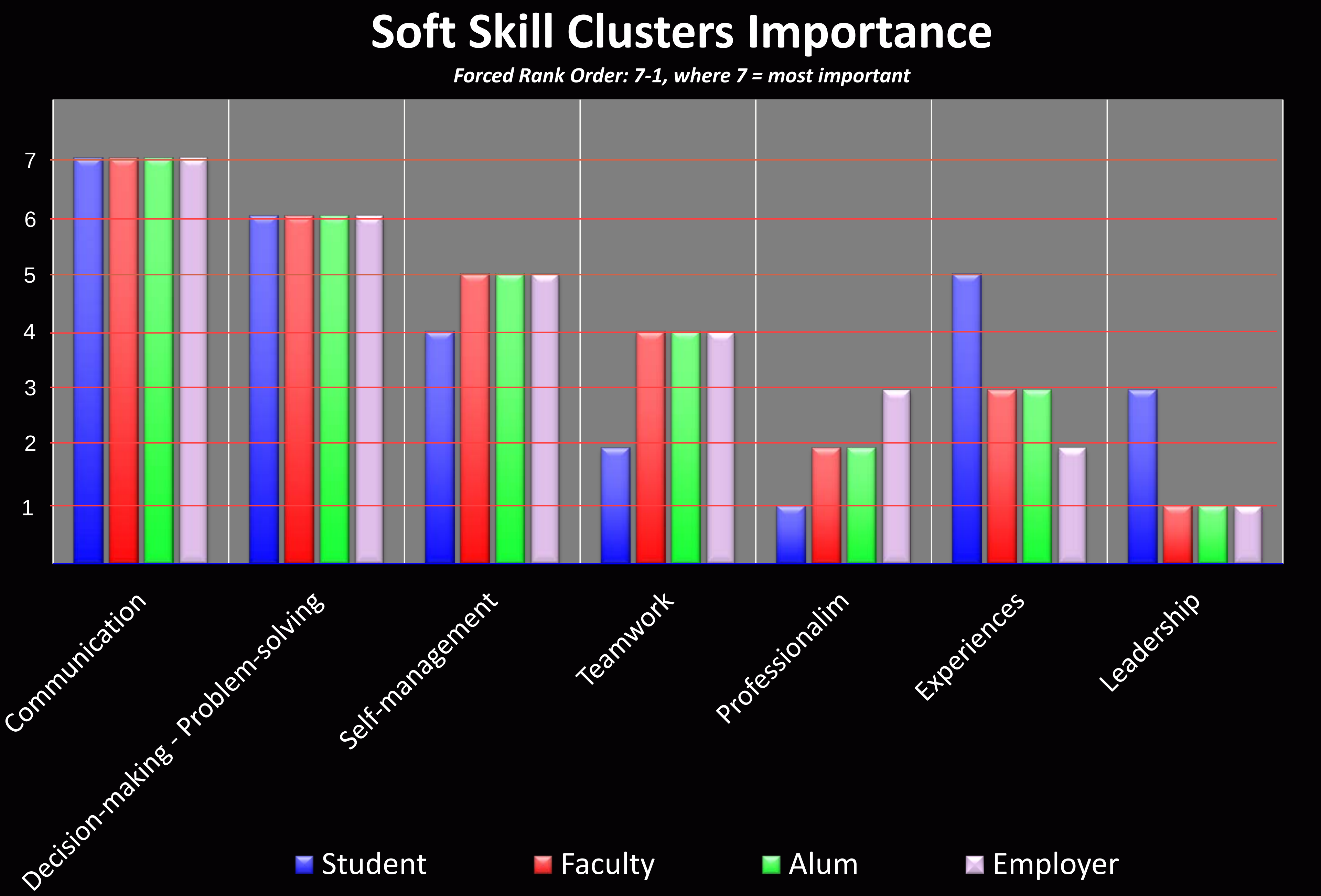
Important Soft Skills for Employment

- Experiences
- Teamwork
- Communication skills
- Leadership
- Self-management skills
- Decision-making, problem solving
- Professionalism

Based on Cluster Analysis, *all* of the soft skills are considered valuable and each descriptive phrase within the clusters represent a positive characteristic!

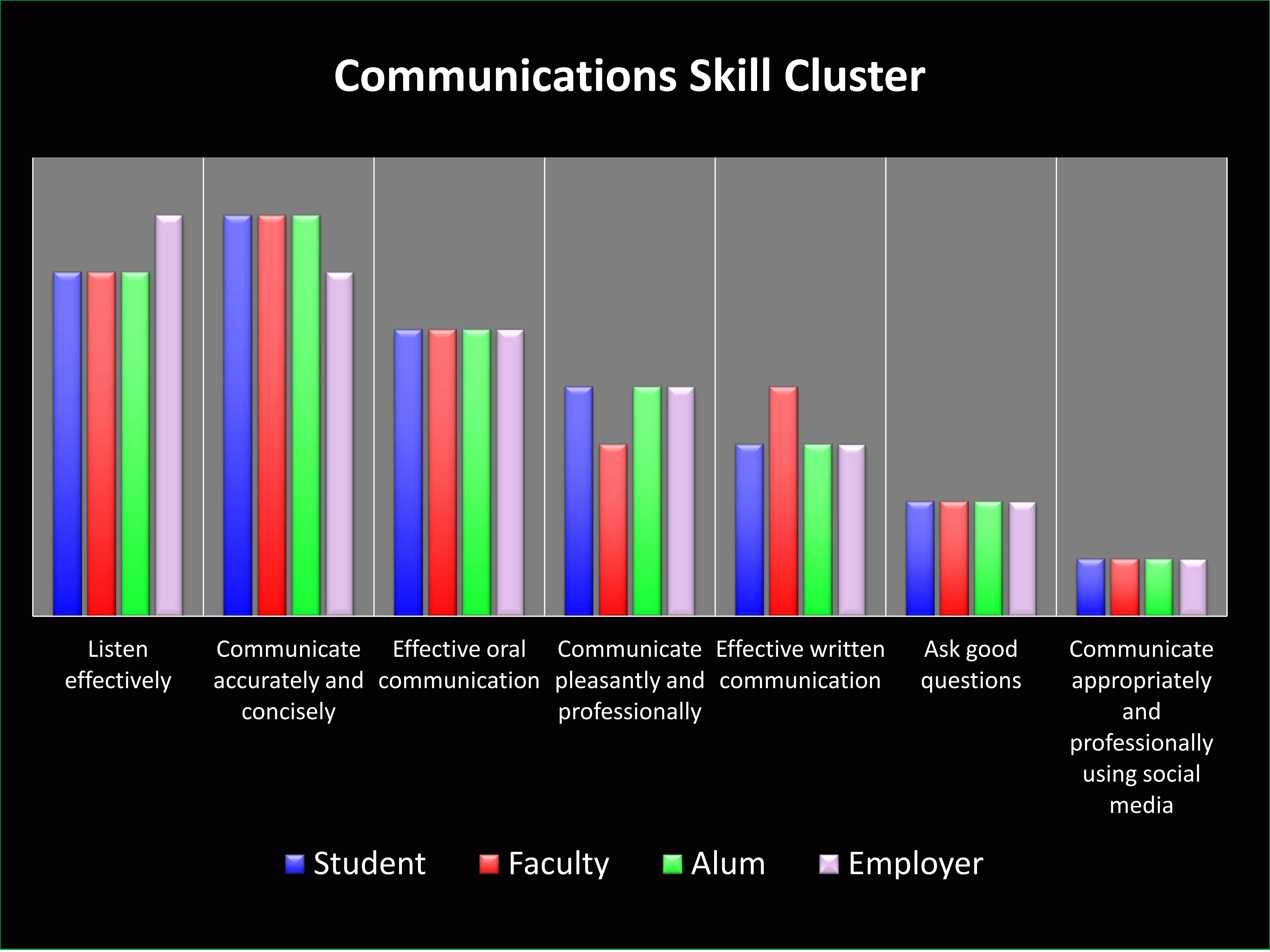
Soft Skills for Employment

- **Experiences** (internships, project management, community service, international)
- **Teamwork**
- **Communication skills** (oral and written, listener, ask good questions)
- **Leadership skills** (See the “big picture”, think strategically, motivate and lead others build professional relationships)
- **Self-management** (self-starting, work habits, integrity, loyalty)
- **Decision-making**, problem solving
- **Professionalism** (demeanor, work quality, ethics, attitude)


Soft Skill Clusters Importance
Forced Rank Order: 7-1, where 7 = most important
7
6
5
4
3
2
1
Communication
Decision-making - Problem-solving
Self-management
Teamwork
Professionalim
Experiences
Leadership
Student
Faculty
Alum
Employer

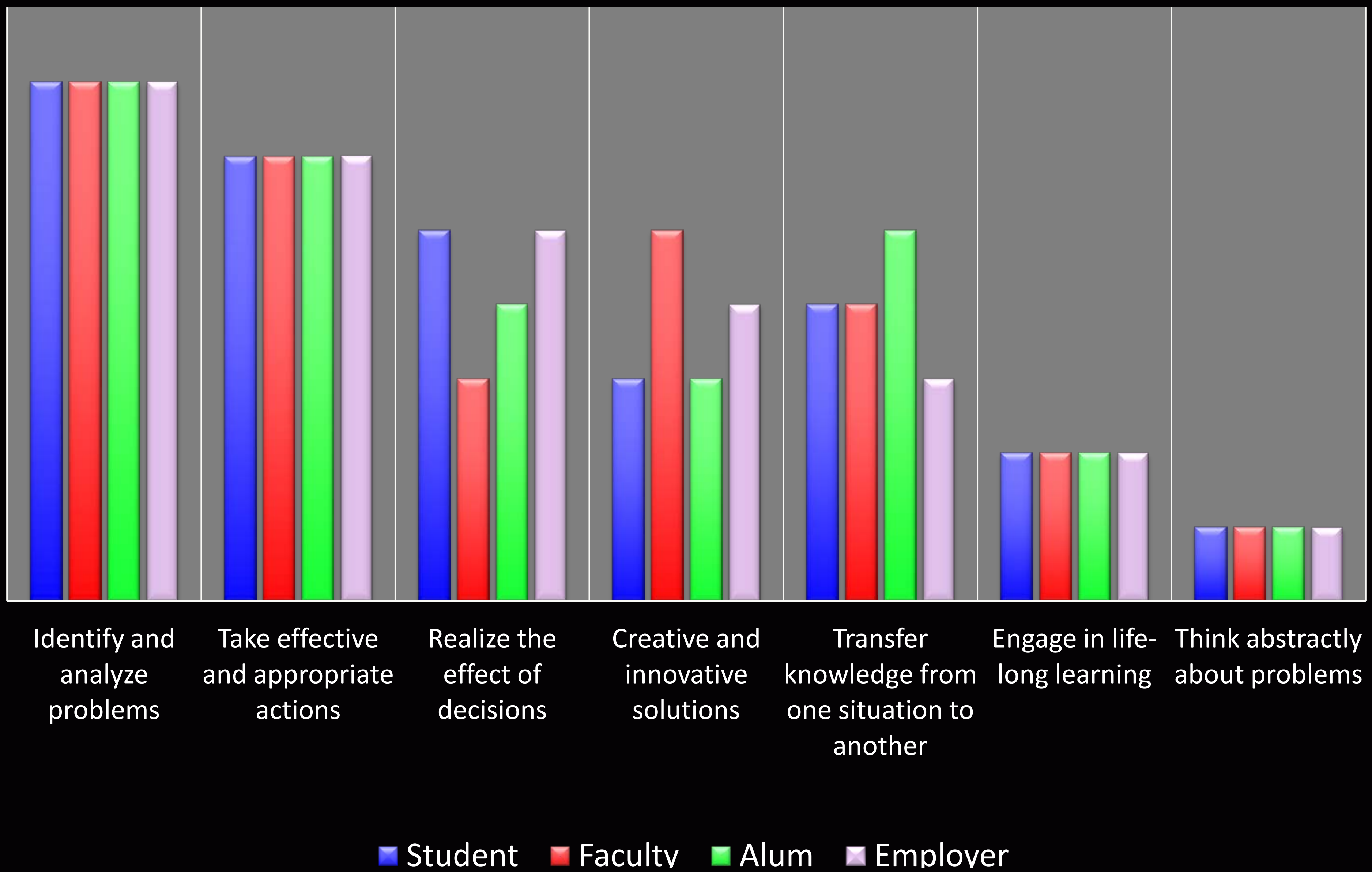
Communication Skills

- Effective oral communication
- Ask good questions
- Communicate appropriately and professionally using social media
- Listen effectively
- Communicate accurately and precisely
- Effective written communication
- Communicate pleasantly and professionally

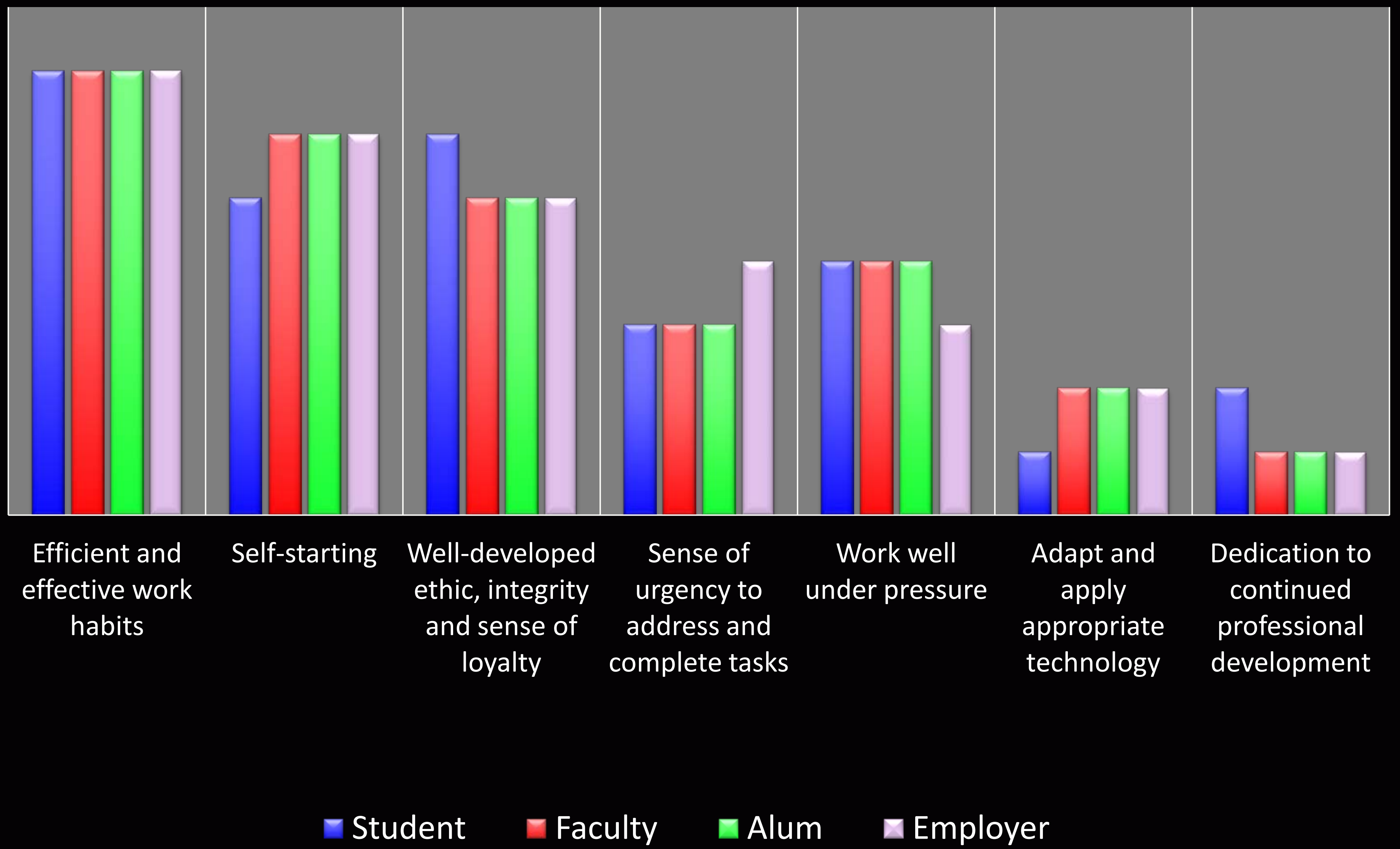


Communications Skill Cluster
Listen effectively
Communicate accurately and concisely
Effective oral communication
Communicate pleasantly and professionally
Effective written communication
Ask good questions
Communicate appropriately and professionally using social media
Student
Faculty
Alum
Employer

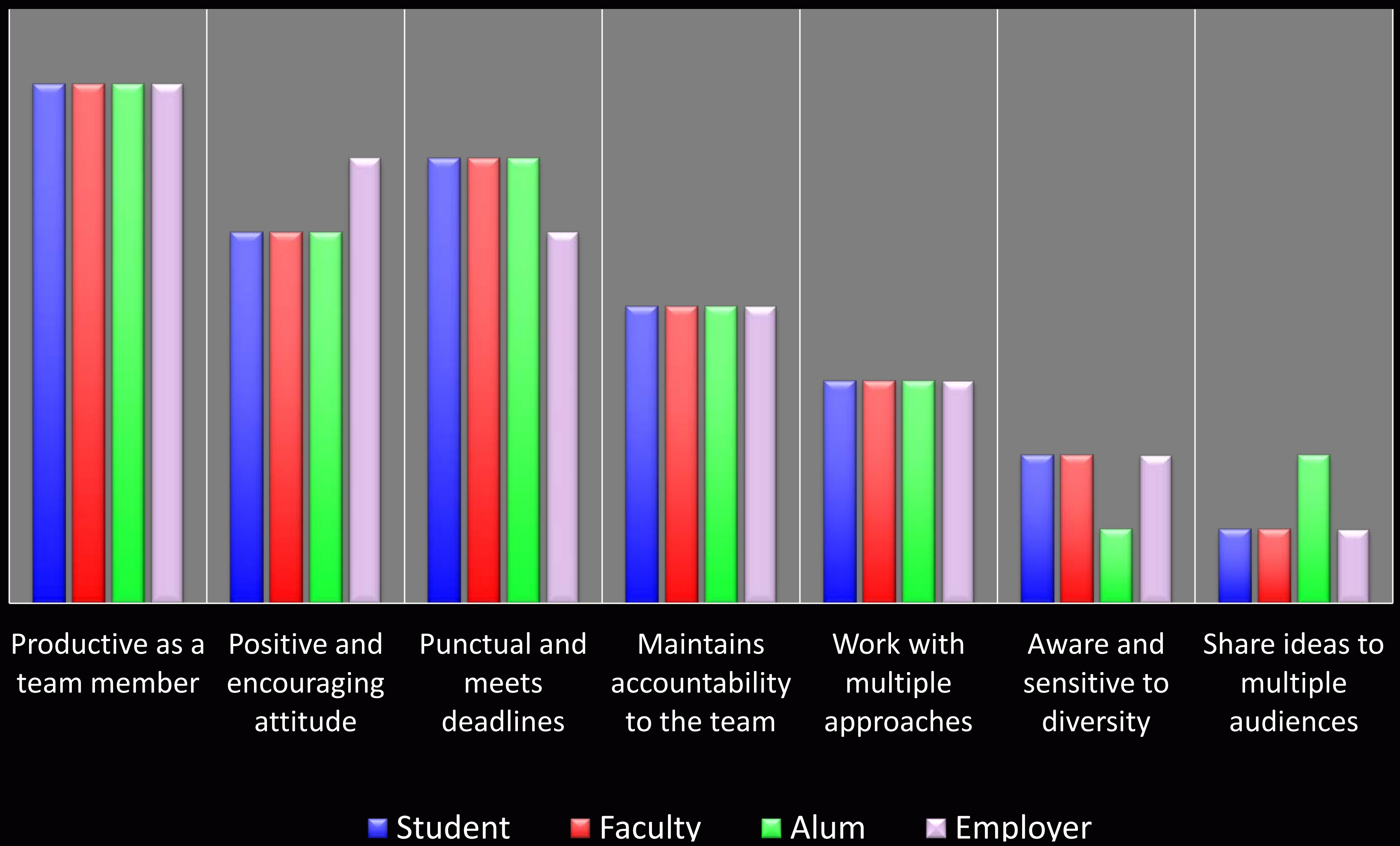
Decision-making / Problem-solving Cluster



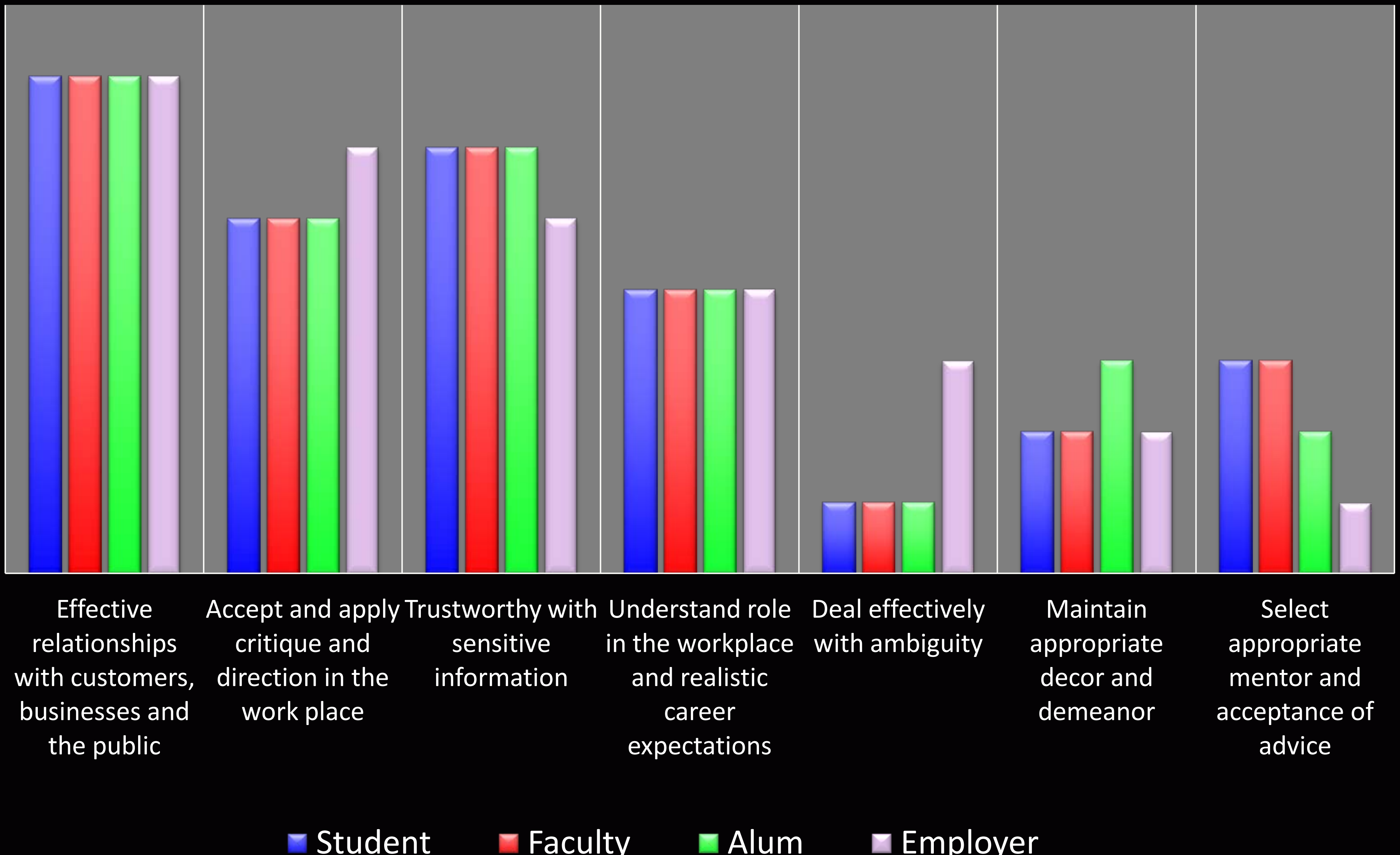
Self-management Cluster



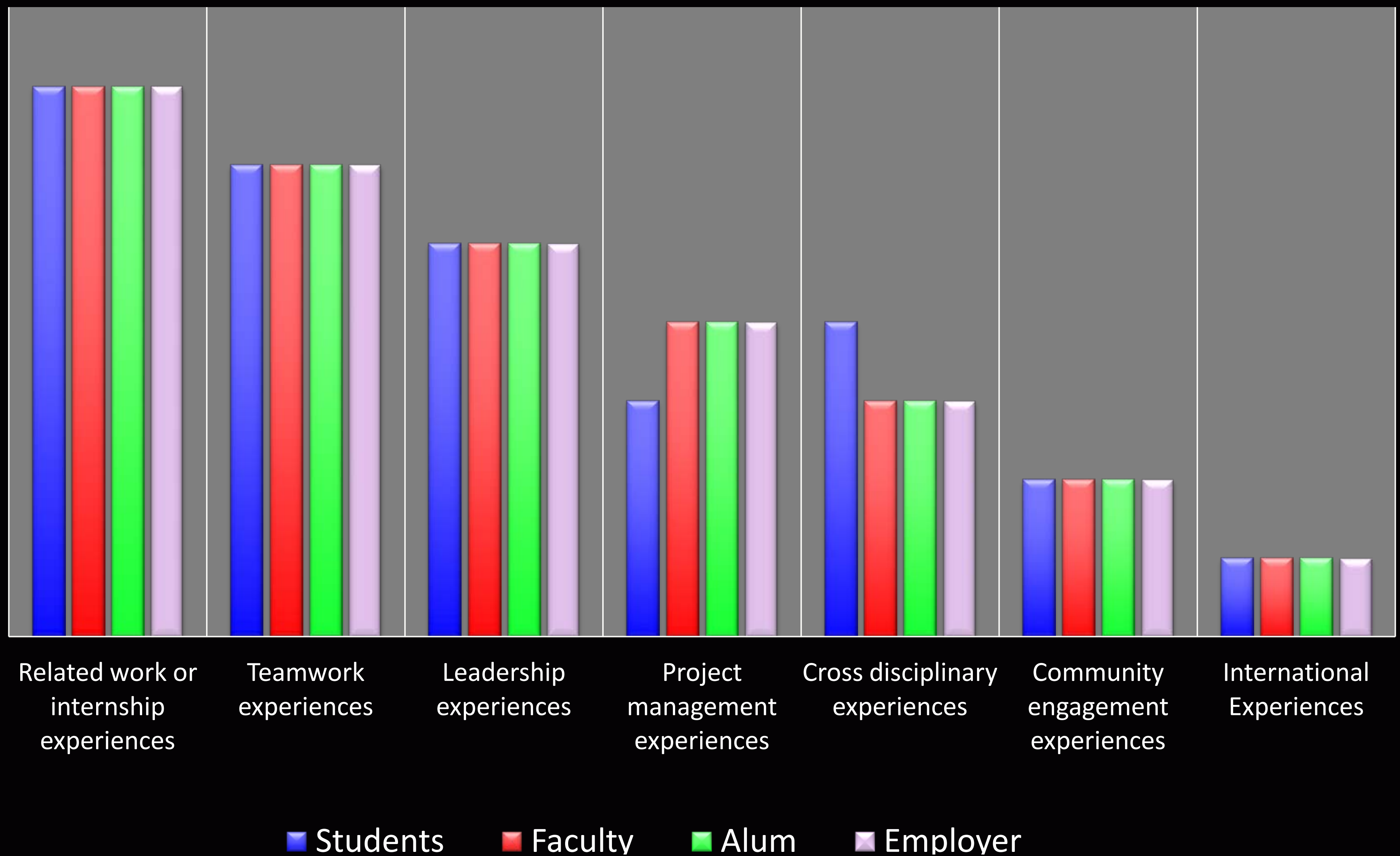
Teamwork Cluster

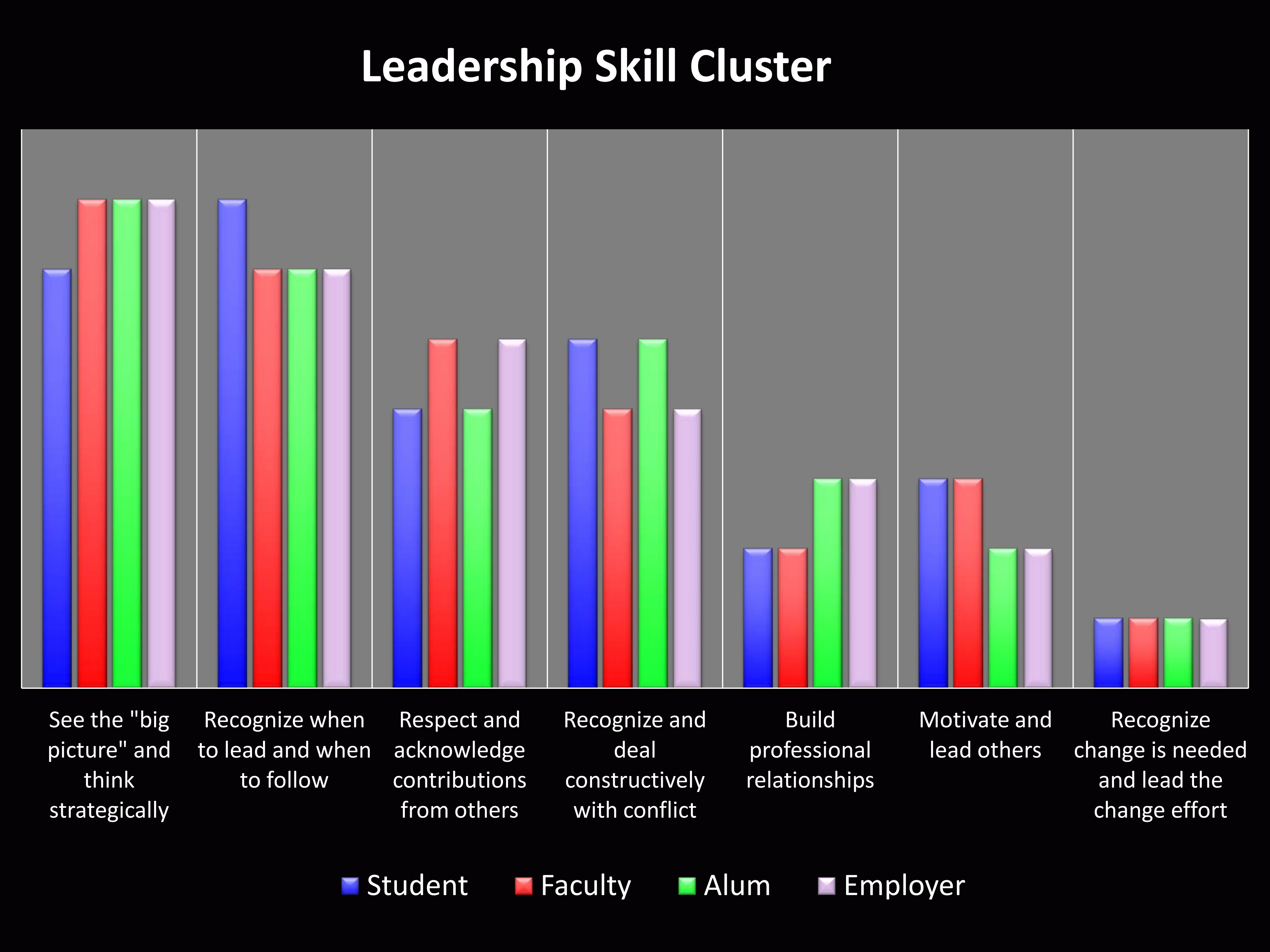


Professionalism Cluster



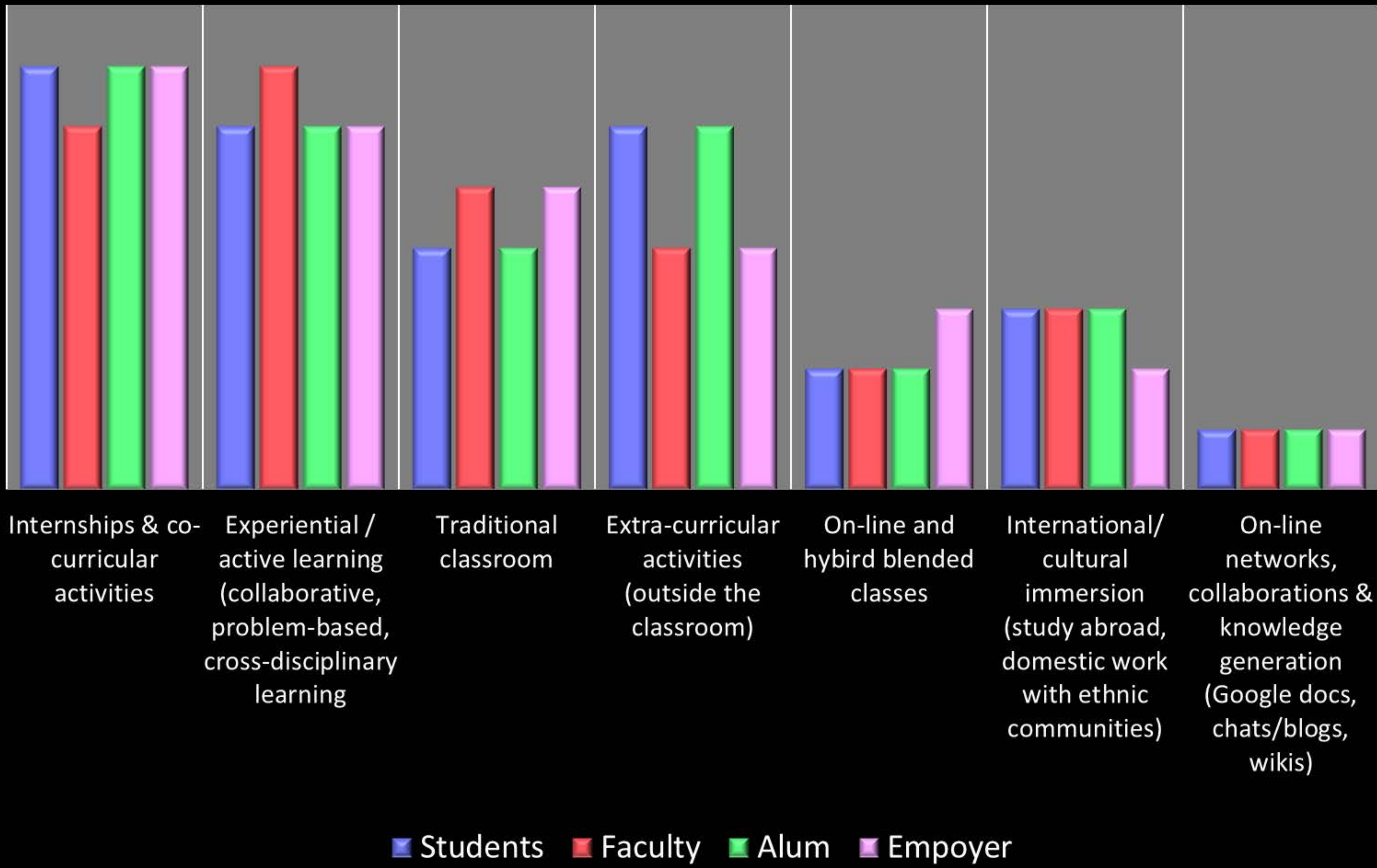
Experience Cluster





Leadership Skill Cluster
See the "big picture" and think strategically
Recognize when to lead and when to follow
Respect and acknowledge contributions from others
Recognize and deal constructively with conflict
Build professional relationships
Motivate and lead others
Recognize change is needed and lead the change effort
Student
Faculty
Alum
Employer

Effective Learning Environments



Soft Skill Clusters & Characteristics – Importance & Ranking

In Maslow's needs hierarchy:

- The base (food, water) is most important
- Needs to be in place before a person can move to the apex of self-actualization

In Soft Skills rankings:

- One may be the base on which all other skills depend
- Moving along the list, culminating with the apex of desired skills

Survey Summary

1. Soft skills are critical for career success
2. Communication skills are the most important
3. Internships are the most important type of experience
4. International experiences may be under-valued by employers
5. International experience should be integrated into and add-value to student’s education
6. Students should “unpack” their international experience on their professional resumes’

Integrating Teaching & Research

- The sum of Teaching, Research and Extension is greater than the parts. Each land-grand mission has value beyond its separate function in our universities.
- Research and Extension add value to teaching, while teaching and Extension add value to research.
- These synergies are an integral part of the land-grant missions in colleges or agricultural and related sciences.
- At the university level, these synergies were best articulated by Ernest Boyer as the scholarship of discovery, integration, application and teaching.

Successful Integration

- Central to the integration of the land grant missions are structure, incentives and rewards.

- Collaboration works best when the administrative structure is in place, when faculty (and administrators) have incentives to collaborate and when faculty are rewarded for their efforts.

Barriers to Integration

- Academic disciplines as gate-keepers to P&T
- The limitations of interdisciplinary research
- The lack of indirect costs to non-research
- Incidence of costs and benefits

Teaching - Research Nexus

Research informed teaching (RIT)

- Bringing applied disciplinary research into the classroom and undergraduate research experience
- Research on pedagogy or teaching techniques (not as relevant to this panel). May not be enough to satisfy the P&T of agricultural sciences

Teaching informed research (TIR)

- Research designed with social impacts activities
- Designing research for grad students
- Designing research for undergraduates and pre-collegiates

The Role of Experiment Stations in Teaching?

Contribute To:

Design and integrate research for students (RIT)

Give students a comparative advantage in career advancement (engaged learning)

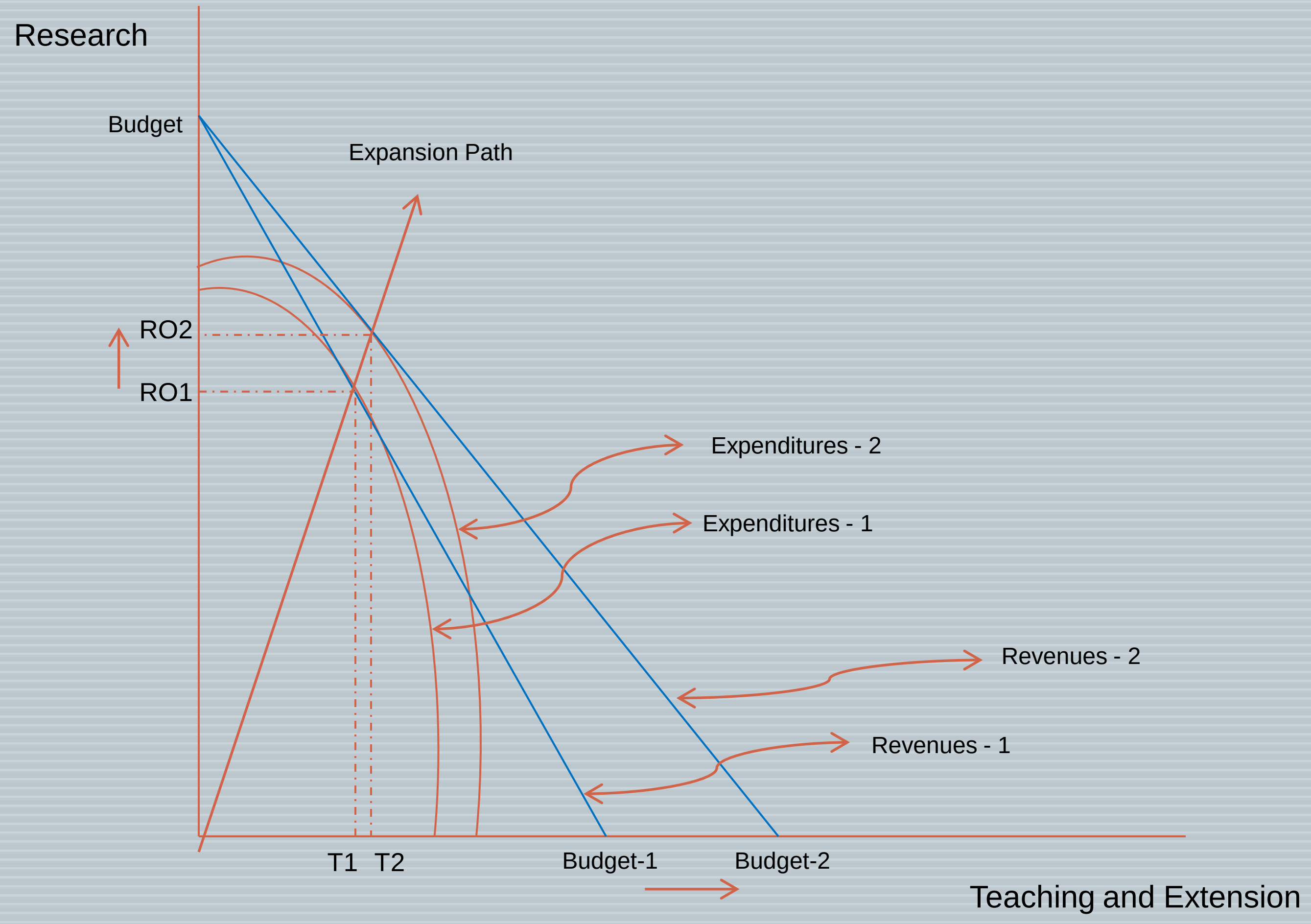
Benefit From:

Students assist with research activities (labor)

Students better understand & value experiment station research (citizen advocates)

Potential to recruit students in careers in experiment station research (future researchers)

Optimal Experiment Station Investment



Optimal Experiment Station Investment

- The inability to collect or charge for teaching and extension-related benefits of research results in an under-investment in Experiment Station Facilities

Natural Resources Roadmap: Water

Doug Parker
Director, California Institute for Water Resources
Strategic Initiative Leader, UC ANR Water Initiative
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Authors

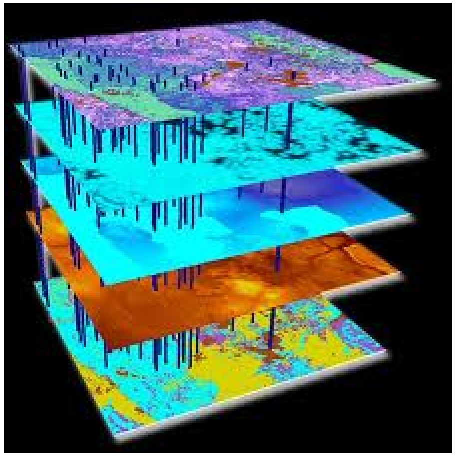
- **Doug Parker**
  - University of California
- **James T. Anderson**
  - West Virginia University
- **C. Rhett Jackson**
  - University of Georgia
- **Brian Miller**
  - Illinois-Indiana Sea Grant College Program
- **Amanda Rosenberger**
  - USGS Missouri Cooperative Fish and Wildlife Research Unit

Water Themes

- Improve understanding of linkages between land uses, extractive consumption, and watershed resistance and resilience.
- Improve understanding of risks and impacts to water supplies from extractive uses, carbon sequestration technologies, and extractive technologies.
- Improve technology to process and distribute water in a manner that ensures sustainable, high quality water for human uses and maintenance of ecosystem services.
- Develop understanding of how existing and future policies and land uses impact water security, quantity, and quality over regional and national scales.

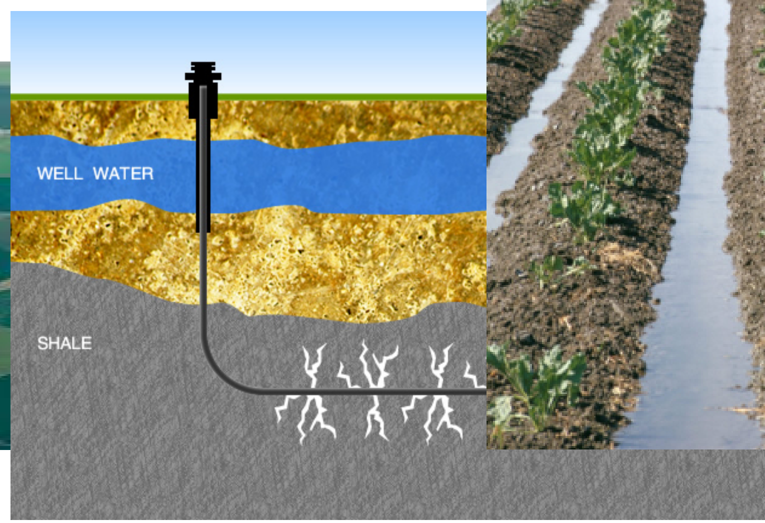
Improve understanding of linkages between land uses, extractive consumption, and watershed resistance and resilience.

- Nutrients
- Water quality thresholds
- Land use indicators
- Sub-surface flow and groundwater and surface water interactions
- Restoration for urban and agricultural streams.



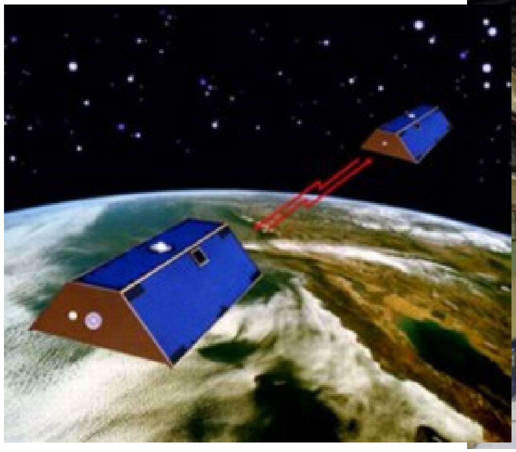
Improve understanding of risks and impacts to water supplies from extractive uses, carbon sequestration technologies, and extractive technologies.

- Agriculture use and overdraft.
- Irrigation due to drought and changing climate
- Hydrofracking.
- Carbon injection in deep water wells.



Improve technology to process and distribute water in a manner that ensures sustainable, high quality water for human uses and maintenance of ecosystem services.

- Pharmaceuticals
- Monitor and manage water systems in real-time
- Resistance and resilience of watersheds to anthropogenic hazards
- Groundwater data and modeling
- Geospatial approaches and remote sensing



Develop understanding of how existing and future policies and land uses impact water security, quantity, and quality over regional and national scales.

- Social science research and decision making processes
- Energy
- Agriculture policies and subsidies
- Residential and urban development patterns
- Transportation patterns and policies
- Balance water supply with demand and resilience of supply
- Best management practices (BMPs)
- Water pricing, policy, conservation, and management structures

Natural Resources Roadmap: Climate Change

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Authors

- **John Nielsen-Gammon** (Texas A&M University)
- **Sarah Karpanty** (Virginia Polytechnic Institute and State University)
- **William Lauenroth** (University of Wyoming)
- **Timothy Martin** (University of Florida)
- **Jens Nejstgaard** (Skidaway Institute of Oceanography)
- **Kevin B. Strychar** (Grand Valley State University)
- **Pete D. Teel** (Texas A&M University)
- **Reagan Waskom** (Colorado State University)
- **JunJie Wu** (Oregon State University)

Climate Change Themes

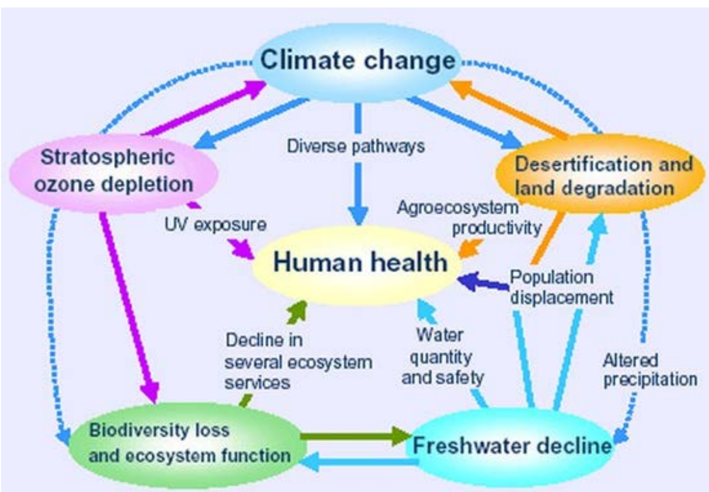
- Observational and Experimental Approaches to Climate Change
- Simulations and Modeling of Climate Change
- Management, Risk and Uncertainty

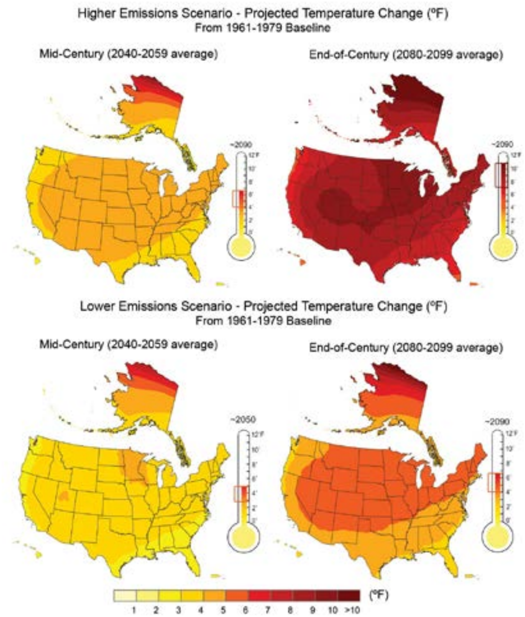
Observational and Experimental Approaches to Climate Change

- Signals of climate change
- Nature-human interactions
- Measuring, analyzing, and assessing environmental responses
- Understudied areas where changes appear to be the most rapid
- Global and economic impacts

Simulations and Modeling of Climate Change

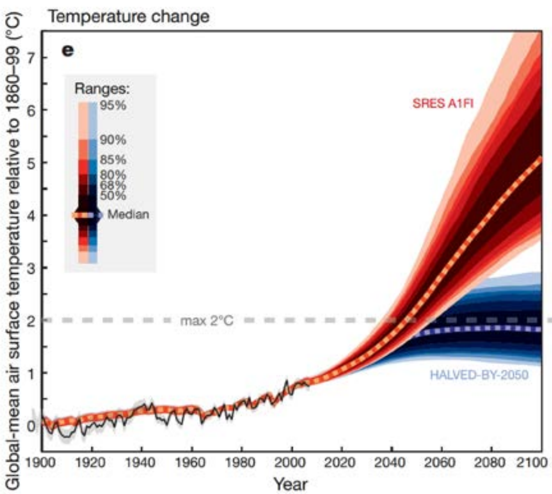
- Ecosystem models and ecosystem management
- Models for key insects, diseases and disease vector dynamics
- Human, animal and plant health impacts
- Changing hydrologic regime and natural and managed ecosystems
- Carbon pools and fluxes





Management, Risk and Uncertainty

- Uncertainties of future climate parameters
- Location-specific climate drivers
- Uncertainty, irreversibility, management strategies and public policy
- Improve communication language
- Best-practice tools
- Assess risk under natural and uncertain future scenarios



Challenge 1 (Sustainability):

We need to conserve and manage natural landscapes and maintain environmental quality while optimizing renewable resource productivity to meet increasing human demands for natural resources, particularly with respect to increasing water, food, and energy demands.

Sustainable Systems

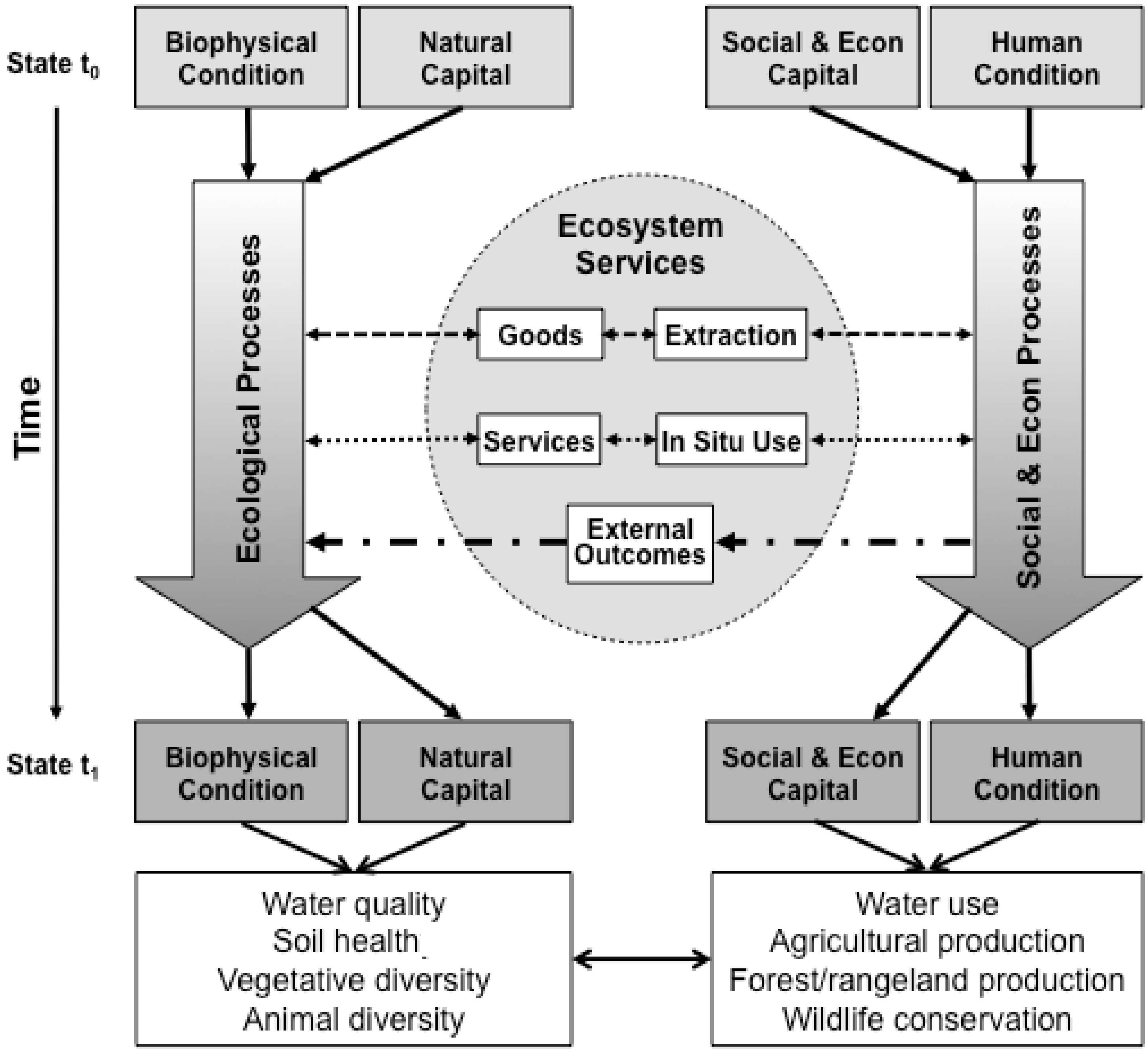
Coupled Human-Natural Systems

Soils & Freshwater

Forestlands

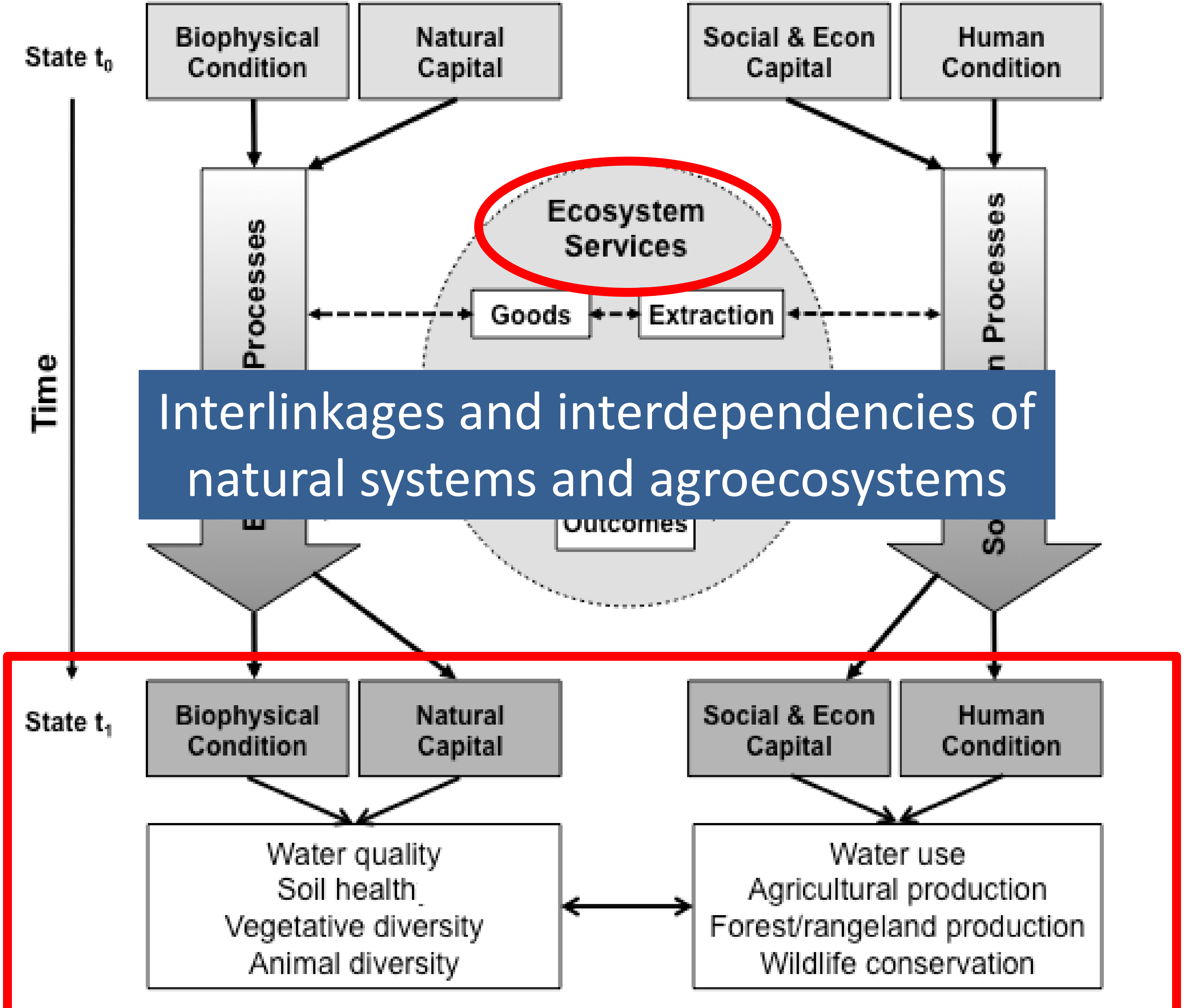
Rangelands

Marine and Coastal Ecosystems



State t0
Biophysical Condition
Natural Capital
Social & Econ Capital
Human Condition
Time
Ecological Processes
Ecosystem Services
Goods
Extraction
Services
In Situ Use
External Outcomes
Social & Econ Processes
State t1
Biophysical Condition
Natural Capital
Social & Econ Capital
Human Condition
Water quality
Soil health
Vegetative diversity
Animal diversity
Water use
Agricultural production
Forest/rangeland production
Wildlife conservation

Interlinkages and interdependencies of natural systems and agroecosystems



“The sustainable management and maintenance of *natural resources* cannot be decoupled from *agricultural activities*.”

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The converse is equally true…

The sustainable management and maintenance of *agricultural activities* cannot be decoupled from *natural resources*.

A significant opportunity for linking agricultural and natural resource roadmaps and programs

"The sustainable management and maintenance of *natural resources* cannot be decoupled from *agricultural activities*."

The converse is equally true…

The sustainable management and maintenance of *agricultural activities* cannot be decoupled from *natural resources*.

A significant opportunity for linking agricultural and natural resource roadmaps and programs

As highlighted in the Agricultural Roadmap, water is a critical element of "Sustainable Environment and Natural Resources."

A significant opportunity for linking agricultural and natural resource roadmaps and programs

As highlighted in the Agricultural Roadmap, water is a critical element of "Sustainable Environment and Natural Resources."

But there are many other critical services…

Pollination Services
"Natural" Pest Control
Carbon Storage
Biodiversity
Genetic Resources
And more…

Select Research Needs and Priorities…

COUPLED HUMAN-NATURAL SYSTEMS

More thoroughly apply Life Cycle Analysis to major materials and natural resources used.

Evaluate how food production, freshwater availability, and natural landscapes can coexist in a sustainable manner while facing a growing human population.

Select Research Needs and Priorities…

SOILS & FRESHWATER

Determine the capacity of soil and water reserves to meet current and future demands for agricultural and forest products.

Apply systems-level analytics to understand the complex feedbacks between humans, soil, and water and to identify key leverage points for policy makers in order to optimize the efficiency of public and private conservation expenditures.

Select Research Needs and Priorities…

FORESTLANDS

Integrate forest management practices with overall environmental sustainability and ecosystem services protection goals.

Increase understanding of the integrated effects of forest management and harvesting practices on the integrated soil, water and biodiversity protection needs.

Select Research Needs and Priorities…

RANGELANDS

Promote trans-disciplinary research to address crosscutting social and biophysical factors that influence the dynamics of rangelands and tradeoffs resulting from changing demands for potentially competing ecosystem services.

Develop more integrated research and outreach programs that bridge rangelands, pastures and hayfields.

Select Research Needs and Priorities…

MARINE AND COASTAL ECOSYSTEMS

Assess the coupled impacts of resource use and extraction (e.g., fisheries, aquaculture, ocean mining, tourism, energy) and systemic change.

Understand and forecast the distribution, abundance, prevalence, and ecological roles of commercial and invasive species, marine disease, and pathogens in response to ocean acidification, severe weather, and changing climates.

Challenge 5: (Energy)

We must identify new and alternative renewable energy sources and improve the efficiency of existing renewable resource-based energy to meet increasing energy demands while reducing the ecological footprint of energy production and consumption.

Select Research Needs and Priorities…

Improve understanding of costs and benefits of energy development and use and public perceptions related to energy to better inform policy and advance environmentally and economically friendly renewable energy.

Conduct full life-cycle analyses of costs and benefits of different energy sources at local, regional and national scales.

Quantify trade-offs among land/sea-use alternatives (i.e., fisheries, forestry, grazing) in areas that may be developed for energy production.

Select Research Needs and Priorities…

Identify new and alternative renewable resources.

Identify and test new biofuel products especially from waste streams of existing land management activities.

Identify and test new or more efficient energy extraction methods from existing biofuel products.

Select Research Needs and Priorities…

Minimize impacts of increasing energy demands on natural resources.

Quantify biodiversity impacts of energy development and use

Quantify behavioral changes and mortality of organisms associated with energy development and use.

Select Research Needs and Priorities…

Maintain available energy and increase efficiency to reduce ecological footprint.

Increase water-use efficiency in steam production and cooling systems to reduce water use.

Increase efficiency and use of existing energy sources and infrastructure.

APLU NATURAL RESOURCES ROADMAP

Presented by Wendy Fink, Doug Parker, and John Hayes at the AES Meeting, Columbus, OH, 9/26/13

Association of Public and Land-grant Universities

Overview of Presentation

- Background
- Chapters
- Crosswalk
- Discussion
  - How can the Agricultural and Natural Resources sectors of our universities partner to best advance the two road maps together?
  - Are there specific actions that the Board on Natural Resources can take to advance the two roadmaps within the structure of APLU?

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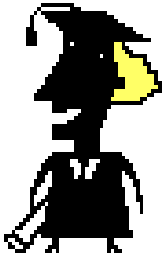
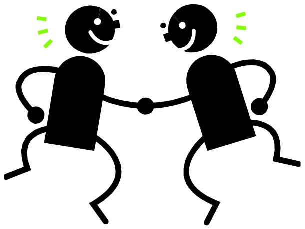
Background to NR Roadmap

- Impetus was 2010 ESCOP Roadmap for Agricultural Science





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The Delphi Survey

- Received grant from USDA NIFA to conduct Delphi Survey
- 78 experts from fields of economics, fisheries and wildlife, forestry, rangelands, recreation, water resources and atmospheric, climate, marine, and energy sciences
- Completed five rounds, with original question of “What are the grand challenges in research and teaching in and about natural resources over the next 10 years?” 576>18>8>6

The Chapters

- Sustainability (Land Use, Sustainability, Population)
- Water
- Climate Change
- Agriculture
- Energy
- Education

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The Chapters

- Water
- Climate Change
- Agriculture
- Energy
- Land Use
- Sustainability
- Education
- Population

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Agriculture

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Develop a sustainable, profitable, and environmentally responsible agriculture industry

- See ESCOP's "A Science Roadmap for Food and Agriculture"

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Sustainability

Energy

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Water

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Climate Change

Education

Education Priorities

- Include Natural Resources in K-12 Education by Incorporation into STEM Curriculum and Activities
- Strengthen Natural Resources Curricula at the Higher Education Level
- Improve the scientific literacy of the Nation's citizens.

Education Priorities Continued

- Communicate Scientific Information to the General Public in Efficient and Effective Ways
- Promote Natural Resource Stewardship
- Promote Diversity in the NR Profession

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Crosswalk – Sustainability

Sustainability Challenge	Couple Human-Natural Systems	Soils & Freshwater	Forestlands	Rangelands	Marine and Coastal Ecosystems	Development of Sustainable Managemment Practices
	Understand more thoroughly and apply more widely the concept of socioecology: human and natural systems are linked and should thus be studied as one broad human-natural system.	Emphasize technological innovation. Precision technologies (e.g. micro-irrigation) can enhance the sustainability of how humans use water and soil.	Integrate forest management practices with overall environmental sustainability and ecosystem services protection goals. Currently this is only guaranteed by using sustainability non-mandatory guidelines. Guidelines require regular development and upgrade to meet the current more intensive resource use.	Emphasize and promote an integrated systems approach to research and outreach to improve policy formulation that supports the long-term sustainable management of dynamic rangeland ecosystems, which are affected by changing climatic, economic and social conditions.	Understand the status and trends of resource abundance and distribution through more accurate, timely assessments.	Reduce the Use of Nonrenewable Inputs in Agricultural Production
	Increase environmental justice	Determine the capacity of soil and water reserves to meet current and future demands for agricultural and forest products.	Increase understanding of the integrated effects of forest management and harvesting practices on the integrated soil, water and biodiversity protection needs.	Expand spatial and temporal scales of research to address heterogeneous biophysical factors as well as response lags to management practices that influence rangeland productivity and the ecosystem services they provide.	Understand interspecies and habitat-species relationships to support forecasting of resource stability and sustainability.	Assess the Capacity of Agricultural and Other Managed Systems to Deliver Ecosystem Service, Including Trade-offs and Synergies Among Ecosystem Services
	More thoroughly apply Life Cycle Analysis to major materials and natural resources used by Americans.	Evaluate the effectiveness of policies and incentives that promote soil and water conservation.	Increase awareness towards reducing the extraction of wood material from sensitive sites due to their long term effect on reduced productivity.	Promote trans-disciplinary research to address crosscutting social and biophysical factors that influence the dynamics of rangelands and tradeoffs resulting from changing demands for potentially competing ecosystem services.	Understand human-use patterns that influence resource stability and sustainability.	Enhance Internal Ecosystem Services That Support Production Outcomes So That Chemical Inputs Can Be Reduced
	Recognize and account for external costs not internalized in prices.	Increase the spatial and temporal precision of climate simulations in order to improve the capability of climate-dependent natural resource models to predict outcomes under future climate scenarios (e.g. water availability; forest, rangeland, and crop response to drought persistence; and soil erosion).	Develop realistic economic assessments of the long term effect of current utilization rates on the resource and ecosystem productivity.	Emphasize and promote integrative social science research that addresses both science-based data interpretation and experience-based land manager/resource user knowledge.	Advance the environmental sustainability of ocean energy technologies.	Assess Food Animal Production in Relation to Ecosystem Services
	Improve agricultural and fisheries production through more efficient use of land, water, energy, and chemicals to meet the 9 Billion Challenge.	Predict and evaluate how a growing and urbanizing human populace with an overall increase in standard of living will affect how soils are managed and how water is allocated.	Promote alternative practices that are less environmentally taxing.	Document and assess contributions of management decisions to short- and long-term outcomes of conservation programs.	Develop sustainable fishing practices and technologies.	Develop Innovative Waste Management Technologies
	Simultaneously increase the generation of renewable energy while reducing the impacts of infrastructure (e.g. wind farms, wells, pipelines) on fisheries and wildlife.	Apply systems-level analytics to understand the complex feedbacks between humans, soil, and water and to identify key leverage points for policy makers in order to optimize the efficiency of public and private conservation expenditures.	Promote understanding of the reasonable scale and utilization rates of resources to reduce negative environmental effects.	Develop protocols and programs aimed at generating systematic and standardized evidence-based assessments of conservation investments in rangelands.	Understand resiliency and adaptation to a changing climate.	Pursue Systems-Oriented and Science-Based Policy and Regulation for Agricultural and Other Managed Systems
	Evaluate how food production, freshwater availability, and natural landscapes can coexist in a sustainable manner while facing a growing human population.		Promote/manage forests for sustainable use of non-forest timber products	Develop more integrated research and outreach programs that bridge rangelands, pastures and hayfields.	Understand the interactions between coastal and marine operations/use and the environment.	
	Evaluate how different policy and economic scenarios might alter the future availability, utility, and resilience of natural resources.					

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Crosswalk –Sustainability

- Improve ag and fisheries production through more efficient use of land, water, energy, and chemicals to meet the 9 Billion Challenge.
- Evaluate how food production, freshwater availability, and natural landscapes can coexist in a sustainable manner while facing a growing human population.
- Emphasize technological innovation to enhance the sustainability of water and soil use.

Crosswalk –Sustainability

- Determine the capacity of soil and water reserves to meet current and future demands for ag and forest products.
- Integrate forest management practices with overall environmental sustainability and ecosystem service protection goals.
- Increase understanding of the integrated effects of forest management and harvesting practices on the integrated soil, water and biodiversity protection needs.
- Promote/manage forests for sustainable use of non-forest timber products.

Association of Public and Land-Grant Universities

Crosswalk – Water

Water Challenge	Improve understanding of mechanistic linkages between land uses, extractive consumption of water resources, and watershed resistance and resilience to better inform policy	Improve understanding of risks and impacts to water supplies from extractive uses, carbon sequestration technologies, and extractive technologies.	Improve technology to process and allocate water that ensures sustainable, high quality water for human uses and maintenance of ecosystem services.	Develop understanding of how existing and future policies and land uses impact water security, quantity, and quality over regional and national scales.	Water use efficiency and productivity	Groundwater management and protection.	Wastewater reuse and use of marginal water for agriculture.	Agricultural water quality.	Water institutions and policy.
	Quantify loads and impacts of nutrients in watersheds. Identify methods to reduce loads while maintaining healthy economies.	Quantify current agriculture use and overdraft.	Develop techniques and processes for removing pharmaceuticals from wastewater.	Increase social science research that identifies decision making processes that are necessary for watershed solutions.	Develop crop and livestock systems that require less water per unit of output.	Develop new management and institutional arrangements to sustain groundwater systems, including real-time data networks and decision support systems to optimize conjunctive use of surface water and groundwater.	Develop cropping systems and irrigation strategies that use impaired and recycled water while protecting soil health and quality.	Develop new approaches to reduce nutrients, pathogens, pesticides, salt, and emerging contaminants in agricultural runoff and sediments.	Develop river basin-scale institutional and planning approaches that integrate land use, water, and environmental and urban interests for robust management solutions.
	Identify meaningful water quality thresholds related to biological and human health.	Quantify the impacts of increased irrigation due to drought and changing climate in agricultural areas and define sustainable use limits.	Develop technology that allows us to monitor and manage water systems in real-time.	Identify water impacts resulting from existing energy policy (production of biofuels, hydrofracking, oil drilling, atmospheric deposition from coal fired power plants, pipelines, mineral extraction, carbon injection, acid mine drainage, valley fill from mountaintop removal mining) and potential solutions.	Develop systems with increased resilience to both flooding and drought as well as interruptions in supply.	Develop watershed management systems that are more effective in capturing water during increasingly intense precipitation events and storing it for use during droughts.	Address institutional barriers to the use of non-conventional waters.	Determine socioeconomic barriers to adoption of new water quality practices and develop innovative approaches to encourage and sustain adoption.	Investigate policy needs to sustain agricultural water supplies and increase institutional and administrative flexibility.
	Determine the undeveloped footprints needed in watersheds to sustain biodiversity, water quality, or water quantity (to buffer hydrologic and water quality changes).	Improve understanding of the presence of introduced chemicals and resulting byproducts resulting from hydrofracking.	Identify spatially-explicit landscape and groundwater features that provide mechanisms of resistance and resilience to natural and man--caused hazards, particularly in our most disaster-prone areas (e.g., coastal habitats, areas prone to wildfire and mass-wasting, and areas of high-seismic activity).	Identify regional and national water impacts resulting from existing agriculture policies and subsidies (water allocation laws, existing national cropping and grazing patterns resulting from farm bill incentives relative to local supplies and resiliency) and potential solutions.	Develop institutional arrangement to facilitate water sharing across sectors.		Assess public health issues related to pathogens and heavy metal contamination.	Develop methods for onsite treat of tile drainage water.	
	Identify the land use variables (indicators) that impact watershed biodiversity and associated thresholds (tipping points) beyond which watersheds are impacted or degraded.	Improve understanding of the presence of introduced chemicals and resulting byproducts resulting from carbon injection in deep water wells.	Increase precision of groundwater data and modeling to better manage lands that recharge aquifers to increase aquifer yield and prevent groundwater quality degradation from agricultural and other sources.	Define water impacts resulting from existing regional and national residential and urban development patterns and identify potential alternatives and solutions.	Develop water pricing and other market-based approaches.		Explore marginal water treatment technologies and methods to reduce energy requirements for treatment.	Explore new methods to reduce water quality impacts from animal waste.	
	Define components of natural regimes (flow, temperature, natural vegetation) required to maintain ecosystem services, and develop regime-based standards for water quality and quantity that are necessary to maintain ecosystem function and biological diversity, from headwater streams to estuaries.		Apply geospatial approaches such as modeling and remote sensing technologies to better model water quality and quantity future water supply and demand at a regional and national scale.	Examine water impacts resulting from existing transportation patterns and policies (impervious surface, sprawl, habitat loss, introduction of metals and salts into aquatic ecosystems,) and analyze effects of potential solutions (mass transit, high speed rail, cluster development, etc).			Investigate use of brackish water to supplement freshwater resources.		
	Improve understanding of sub-surface flow and groundwater and surface water interactions (including recharge, contaminant fate, and transport), which can be crucial for biological communities and provide mechanisms for resilience to drought, climate warming, and disturbance.		Use satellite and advanced information technologies to predict potential water conflict at all scales (inter- and intra-basin) and inform policy and management.	Analyze inter and intra basin policy alternatives required to ensure a balance of water supply with demand and resilience of supply in the face of unexpected disaster and ongoing climate change.			Consider new approaches to reduce costs for desalination.		
	Define achievable restoration targets for urban and agricultural streams.			Analyze the importance of scale for watershed management and BMPs implementation to maximize cost effectiveness and ecological lift.			Develop salt-tolerant crops.		
				Assess the optimal places to focus future production of commodity crops, fruits and vegetables, and livestock grazing within sustainable water use limits.					
				Assess the regional and national future water pricing, policy, conservation, and management structures needed to balance national water demand with sustainable supply					

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Crosswalk –Water

- Identify methods to reduce nutrient loads while maintaining healthy economies.
- Increase precision of groundwater data and modeling to better manage lands that recharge aquifers to increase aquifer yield and prevent groundwater quality degradation from agricultural and other sources.

Crosswalk –Water

- Increase social science research that identifies decision making process that are necessary for watershed solutions.
- Identify water impacts and potential solutions resulting from the following: existing energy policy; agriculture policies and subsidies; existing regional and national residential and urban development patterns; existing transportation patterns and policies.

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Crosswalk –Water

- Analyze inter and intra basin policy alternatives required to ensure a balance of water supply with demand and resilience of supply in the face of unexpected disaster and ongoing climate change.
- Assess the regional and national future water pricing, policy, conservation, and management structures needed to balance water demand with sustainable supply.

Crosswalk – Climate Change

Climate Change Challenge	Observation and Experimental Approaches	Simulations and Modeling	Mangement, Risk, and Uncertainty	Climate Science	Crop, Livestock, Weed, and Pest Models	Improved Economic Assessments of Climate Change Impacts and	Decision Science	Conceptualizing and Modeling Complex Systems	Adaptive Strategies and Management	Greenhouse Gas Mitigation and Soil Carbon Sequestration and Monitoring	Communication	Policy Analysis
	Identify signals of climate change that inform short-, intermediate-, and long-term predictions, forecasting, and early warning involving whole-system structure and function.	Develop mechanistic ecosystem models with predictive power comparable to statistical models, suitable for ecosystem management planning under uncertain or novel climatic futures.	Identify uncertainties of future climate parameters as a function of spatial scale, given uncertainties in model accuracy, future anthropogenic forcing, natural variability, and	Development of climate change scenarios relevant at local to regional scales and time horizons. These might include factors ranging from unique physical features not captured	Improve and evaluate existing models for their use in climate change and weather variability studies; for addressing carbon, nitrogen, and water changes in response to climate; and for	Quantify costs and benefits of adaptation at the farm level and for specialty crops and livestock as well as grain crop production systems.	Risk perception, investment decision making under uncertainty, and the role of temporal discounting.	Characterizing and analyzing climate uncertainty and how it impacts: system productivity; demand for water, nutrients, and other resources; and the environment.	Develop adaptive strategies for livestock, including managing weather extremes; taking into account costs of and constraints to renovation or relocation of facilities; information on breeds	Systems and best management practices to reduce greenhouse gas emissions for crops, animals and animal waste systems, and food processing and other food system activities beyond the	Identification of gaps in knowledge, socioeconomic biases, and other factors constraining effective communication to various target audiences.	Economic impacts of mitigation policies on agriculture and the food sector, including impacts on costs of energy and other inputs, environmental impacts, and regional and social equity.
	Define effects of predicted climate change on nature-human interactions.	Improve climate-based models for areas where we presently are expecting the most rapid global impacts, such as for the melting tundra where present models predict a third of the global soil carbon may be released as CO2 within decades (e.g. Dorrepaal et al 2009).	Identify and estimate location-specific climate drivers and their uncertainties under a range of future scenarios.	Improvement and development of physical and empirical downscaling techniques tailored to agriculturally relevant variables. Examples of these variables may include leaf wetness, livestock heat stress, and drought and freeze risk. Many current methods are too	Develop and test new crop models beyond those currently available, including those for perennial fruit crops, vegetables, and other "specialty" food crops, wood products; and biofuel crops.	Assess economic impacts and costs of adaptation beyond the farm gate for entire foods systems.	The role of participatory processes in scenario development.	Spatial and temporal dynamics of production systems.	Develop new, more tolerant crop varieties through conventional breeding, molecular-assisted breeding, and genetic engineering. University emphasis should be on specialty crops and other categories not currently being addressed by commercial seed	Systems and practices to offset emissions by sequestering carbon in trees and soil and also methods to quantify offsets, taking into account measurement uncertainty.	Evaluation of framing of issues for optimum communication effectiveness for various target audiences.	Evaluation of various policy mechanisms, including tax incentives, environmental and land use regulation, agricultural subsidy and trade policies, insurance policies and disaster assistance, soil and water conservation policies, and energy policies
	Define interactions and effects of climate and habitat changes to population, meta-population, and community dynamics and change at ecosystem boundaries, along habitat gradients, and within ocean current systems, at local to regional scales.	Improve climate-based models for key insects, diseases, disease vector dynamics, and potential human, animal and plant health impacts.	Define the impacts of uncertainty and irreversibility associated with climate change and their impacts on management strategies and public policies for mitigating climate change impacts.	Work on methods to spatially interpolate climate data. Validation of gridded downscaled climate model data as well as tuning of empirical downscaling techniques will benefit from gridded observed data, as the stations themselves do not represent elevation or coastal influences adequately.	Develop and test new livestock models focused on heat stress and greenhouse gas mitigation in livestock facilities.	Integrate economic with environmental and social impacts of climate change and adaptation. Examples include valuation of ecosystem service, impacts on farm structure, and rural livelihoods, and equity and social justice issues.	Extensive testing and design of decision support tools for adaptation and mitigation measures appropriate for different producers and consumers.	Systems characterization, including a comprehensive coverage of farm sizes and types, commodity transportation and storage systems, and food processing and distribution.	Develop new, rapid breeding technologies that can be used to quickly respond to emergent vulnerabilities as microclimates become suitable for previously nonthreatening diseases and pests.	Greenhouse gas and carbon accounting tools for farmers and food system users.	Use of new technologies and social networking tools for communication selected target audiences.	
	Develop practical technologies for measuring, analyzing, and assessing environmental responses to climate change, especially on full ecosystem levels.	Improve methods for quantifying carbon pools and fluxes suitable for use by resource managers and incorporation into ongoing inventory programs such as for fisheries, forestry etc.	Develop improved communication language and education from the scientists/researcher to the decision maker/politician, and public at-large.	Development of sophisticated real-time weather-based systems for monitoring and forecasting stress periods, pest and weed pressure, and extreme events. Current guidelines for many agricultural practices are based on outdated observations and the assumption of a stationary climate.	Develop and test new insect, pathogen and weed models to project future range shifts, population dynamics, and epidemiology.				Develop improved water management systems and irrigation scheduling technology.	Policy mechanism design for greenhouse gas mitigation.		
	Develop early warning systems (e.g. real-time analyses) that utilize confluences of modeling technologies in predicting changes and are informative to governments, agencies, and the public at large.	Improve models for predicting changing hydrologic regime impacts on natural and managed ecosystems – e.g. range or forest health and yield under warmer scenarios with increased evapotranspiration.	Define best-practice tools and processes for quantifying and assessing risk under typical natural resource management scenarios, and for better managing under uncertain future conditions.						Develop adaptive strategies for weed and pest control, such as improving regional monitoring and IPM communication regarding weed and pest range shifts and migratory arrivals; enhancing real-time weather-based systems for weed and pest control; developing nonchemical options for new pests; and developing rapid-response action plans to control invasive species.			
	Prioritize resources for research to previously understudied areas where changes presently appear to be the most rapid and may have the largest global and economic impacts, such as at high latitudes.	Coordinate climate and ecosystem researchers and data for improved modeling of weather variability and extreme cyclical events (wildfire, insect and disease; cyclonic storms; etc.) and their alteration by predicted or forecast climate change.	Understanding ecosystem change and degration; individual behavior and community resilience						Develop adaptive strategies for storage and transport systems, such as redesign and relocation of infrastructure, and assess impacts of rises in sea levels on port facilities.			
									Develop adaptive strategies for food processing and marketing systems			

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Crosswalk – Climate Change

- Develop climate change scenarios relevant at local and regional scales and horizons.
- Develop sophisticated real-time weather-based systems for monitoring and forecasting stress periods, pest and weed pressure, and extreme events.
- Improve and evaluate existing models for their use in climate change and weather variability studies; for addressing carbon, nitrogen, and water changes in response to climate; and for assessing resource needs and efficiencies.

Crosswalk – Climate Change

- Develop and test new crop models beyond those currently available.
- Develop and test new insect, pathogen and weed models to project future range shifts, population dynamics, and epidemiology.
- Extensive testing and design of decision support tools for adaptation and mitigation measures appropriate for different producers and consumers.

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Crosswalk – Climate Change

- Design policy mechanism for greenhouse gas mitigation.
- Identification of gaps in knowledge socioeconomic biases, and other factors constraining effective communication to various target audiences.
- Evaluation of framing of issues for optimum communication effectiveness for various target audiences.

Crosswalk – Energy

Energy Challenge	Improve Understanding of Costs and Benefits of Energy Development and Use and Public Perceptions Related to Energy to Better Inform Policy and Advance Environmentally and Economically Friendly Renewable Energy	Identify New and Alternative Renewable Resources.	Minimize Impacts of Increasing Energy Demands on Natural Resources.	Maintain Available Energy and Increase Efficiency to Reduce Ecological Footprint.	Education	Energy Security and the Bioeconomy
	Conduct full life-cycle analyses of costs and benefits of different energy sources at local, regional and national scales.	Identify and test new biofuel products especially from waste streams of existing land management activities.	Develop uniform indicators of environmental effects of energy development and use.	Increase water-use efficiency in steam production and cooling systems to reduce water use.	K-12 Science Programs to engage young minds in renewable energy and also provide teacher support. Educational programs that explain the social, political and environmental challenges associated with reliance on fossil fuels and the challenges and opportunities for transitioning to renewable sources are critical needs for K-12 science programs.	Devise agricultural systems that utilize inputs efficiently and create fewer waste products.
	Quantify trade-offs among land/sea-use alternatives (i.e., fisheries, forestry, grazing) in areas that may be developed for energy production.	Identify and test new or more efficient energy extraction methods from existing biofuel products.	Quantify biodiversity impacts of energy development and use (e.g., slash and coarse woody debris removal for biofuels; fish passage and hydrological changes at hydropower facilities; land conversion for fuel production and facility siting).	Increase efficiency and use of existing energy sources/infrastructure (e.g., hydrofracking for natural gas production).	College and Post-Graduate programs to help develop a capable and diverse workforce for the future through mentored research internships and fellowships. Energy development and production in the U.S. and globally will require well-trained scientists from diverse STEM-related disciplines ranging from math and physics to geology and biology to agriculture and forestry. The need for graduate degrees is likely to increase in this sector, necessitating increased funding for internships and fellowships.	Assess the environmental, sociological, and economic impacts of the production of biofuels and coproducts at local and regional levels to ensure sustainability.
	Quantify public perceptions regarding energy development and land/sea-use alternatives.	Develop marine renewable energy sources.	Quantify behavioral changes and mortality of organisms associated with energy development and use (e.g., bird and bat mortality at wind turbines; marine mammal and fish attraction or avoidance of tidal energy facilities; relationship of animal movements to electromagnetic field changes; animal use of shade at solar energy facilities).	Increase fuel conversion efficiency for biofuels.	Renewable energy outreach programs through the university land-grant system throughout the U.S. Outreach and engagement programs can enable the public to better understand the sustainability and environmental impacts of their energy choices within a region and increase energy conservation practices.	Develop technologies to improve production-processing efficiency of regionally appropriate biomass into bioproducts (including biofuels).
	Conduct economic analyses regarding present and forecasted future energy production costs as compared to the projected costs of renewable energy types.	Identify and develop markets for renewable energy. Many such markets are similar to existing markets but require process, transportation, or combustion modifications.	Identify sources and quantify water and air pollution associated with energy production.			Expand biofuel research with respect to non-arable land, algae, pest issues that limit biofuel crop yields, and emissions of alternative fuels.
			Quantify water demand for steam production and cooling of geothermal, biofuels, solar and traditional energy sources (coal, natural gas, nuclear).			Restructure economic and policy incentives for growth of the next generation domestic biofuels industry.
			Understand public's perceptions of alternative energy sources and barriers to adoption of energy conservation practices.			

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Crosswalk –Energy

- Quantify trade-offs among land/sea-use alternatives in areas that may be developed for energy production.
- Identify and test new biofuel products especially from waste streams of existing land management activities.
- Identify and test new or more efficient energy extraction methods from existing biofuel products.

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Crosswalk –Energy

- Identify and develop markets for renewable energy. Many such markets are similar to existing markets but require process, transportation, or combustion modifications.
- Increase fuel conversion efficiency for biofuels.

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Discussion

- What lessons were learned from the use and distribution of the Agriculture Roadmap that the Natural Resources Roadmap might benefit from?
- How can the Agricultural and Natural Resources sectors of our universities partner to best advance the two road maps together?
- Are there specific actions that the Board on Natural Resources can take to advance the two roadmaps within the structure of APLU?

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OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER

New Budget/Management Strategies for Dealing with Austerity

Terry Snoddy

The Ohio State University
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Presentation Outline

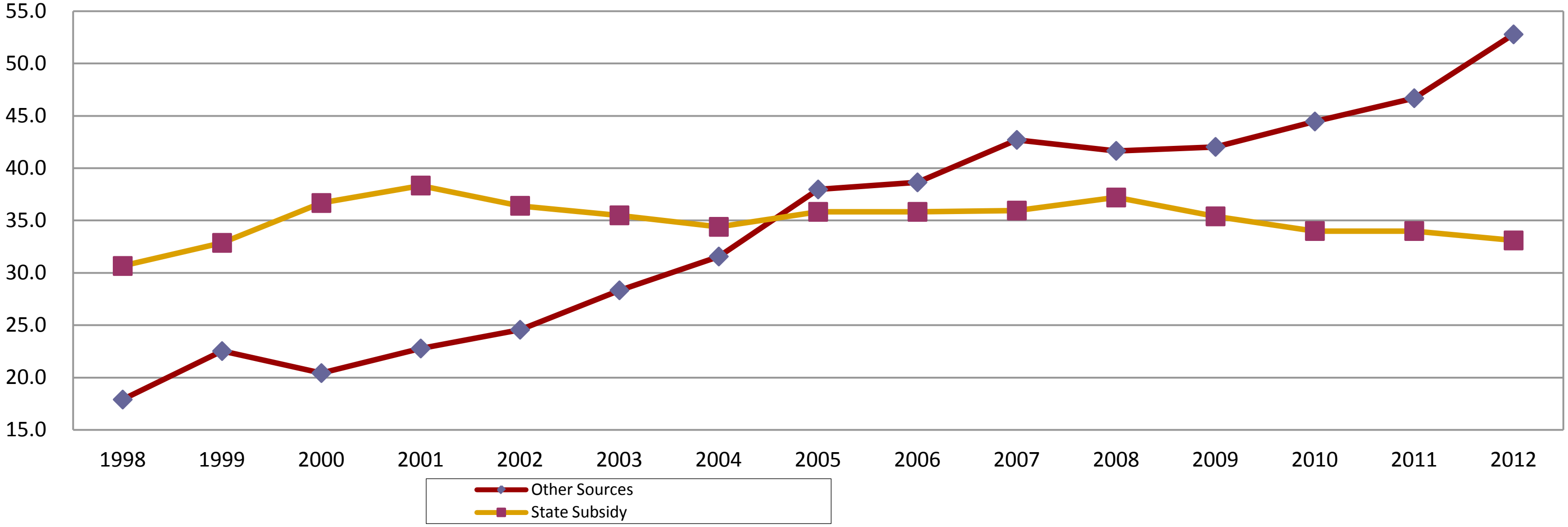
- Budget Climate
- General Budget Strategies
- Best Practices
- Practical Examples

Budget Climate

Financial Climate

- Increasing budget pressures since 2008
- Budget pressures felt across all states in both state and federal funding
- Opportunity – Availability and focus on external fund sources

Leverage State Investment in Millions



Various Funding Models Across States

- State Support – How does this state support make it’s way to your organization?
- Use of Federal Funds – Salaries/Grant Programs/Equipment
- Carry over policy – Limitation in some states for carry over of state funds
- Organizational Structure – Varies from highly centralized to highly decentralized

General Budget Strategies

Budget Planning Strategies

- Short term reactions to budget pressures
  - Required in some cases
  - Create anxiety among faculty/staff
- Preferable long term approach/Forecasting
  - How much time do we spend on long term planning?
  - Much less painful
  - Time to gain support and create effective communication plan

General Budget Reduction Strategies

- Budget Freeze
  - Temporary solution
  - Discretionary spending freeze (Reduction in non essential expenditures, Travel Equipment etc)
  - Hiring put on hold – only fill critical positions

General Budget Reduction Strategies

- Across-the-Board Cuts
  - Advantages
    - Simplest and most expedient way to manage a budget reduction
    - Provides flexibility to individual unit manager/chairs/directors
    - Equitable – All units treated alike
  - Disadvantages
    - Does not differentiate between units that have more or less budget flexibility
    - Programs critical to the mission are not protected

General Budget Reduction Strategies

- Targeted Reductions
  - Targeted reduction in specific expense categories (Travel, Equipment Replacement, minor construction) – Justification needed
  - Targeted reduction in a program or service
  - Advantages
    - Can choose to protect mission critical functions
    - Align activities with strategic plan
  - Disadvantages
    - Reduces flexibility for unit leader

General Budget Reduction Strategies

- Program Eliminations
  - Careful consideration of the resulting impacts
    - What services does the unit provide that can be procured elsewhere
    - Are there significant stakeholder impacts?
    - What is the one time cost of the elimination

Best Practices

Useful Budget Reduction Strategies

- Use less dramatic means first
    - Avoid Reduction in Force if possible (Attrition, reduced salary improvement programs, etc)
- Share Information
- Ask for suggestions

Useful Budget Reduction Strategies

- Use contingency funds first
  - Any budget should have contingency funds built in
  - If making difficult decisions, contingency funds should be considered for the short term
- Ask for voluntary cutbacks
  - There could be creative solutions that have not been considered
- Make few promises
  - Credibility is important throughout this process – Keep all options on the table

Useful Budget Reduction Strategies

- Consider Outsourcing
  - Is the service to be outsources part of the strategic vision?
  - Will outsourcing result in an increase in revenue or reduction of cost?
  - Can the quality of the service be maintained or improved?
  - Do the institutional polices (wage scales, personnel, financial) cause costs to be higher than if the service was contracted?
  - What will be the impact to employee morale?
  - Will the institution still maintain an adequate degree of control?

Practical Examples

Budget Planning - What can be done?

↑ Revenue

↓ Expenses

75% to over 90% in some cases is in Salary and Benefits

Increase Revenue?

- **Little to no control on state / federal funding**
  - Our control rests with the services we provide and the ability to communicate this to decision makers
- **Grants and Contracts**
  - Generational shift – Expectation of grants and contracts to run program
- **Adding fees for services that were formerly free (Internal and External)**
  - Internal fees are not just a shell game
  - Lab testing fees
- **New Sources of Revenue**
  - Land/Crop management
- **Development/Advancement focus**

Decrease Expense

- Operating Expense Budget
  - Utilities
    - Use capital funds to Invest in energy saving upgrades
  - Pooling University Purchasing Power (OSU - 1.3B Spend)
    - Equipment Maintenance Agreements – REMI – 25% Lower Cost
    - Office Supply – Office Max
    - Maintenance, Repair and Operations preferred vendors
    - Preferred Travel Vendors

Decrease Expense

- Salary and Benefits
  - Early Retirement Packages
    - Comes with significant up front cost
    - You cannot choose who takes advantage of the early retirement
    - Will replacements be rehired strategically?
  - Furloughs – Temporary solution
  - Changes to Benefit Plans
  - Limited Merit Increases

Decrease Expense

- Consolidation of Functions
  - Can economies of scale be generated by centralizing functions?
  - Can resources be reallocated to more strategic functions?
- OSU Examples
  - Farm Consolidation
  - Fiscal and HR Service Centers

Questions

North Carolina A&T State University

Budget Leadership When Dealing with Austerity

aus·ter·i·ty

noun \ȯ-ˈster-ə-tē, -ˈste-rə- *also* -ˈstir-ə-\

: a situation in which there is not much money and it is spent only on things that are necessary

Bill Randle, Dean & Director

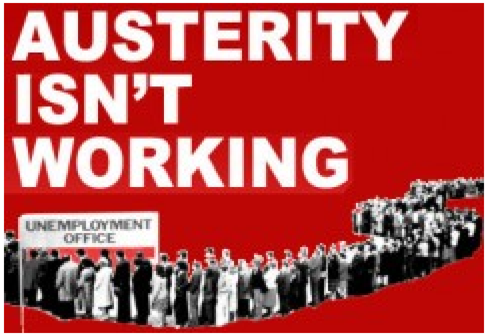
North Carolina Agricultural and Technical State University

Explore. Discover. Become.

Leading during Austere Times

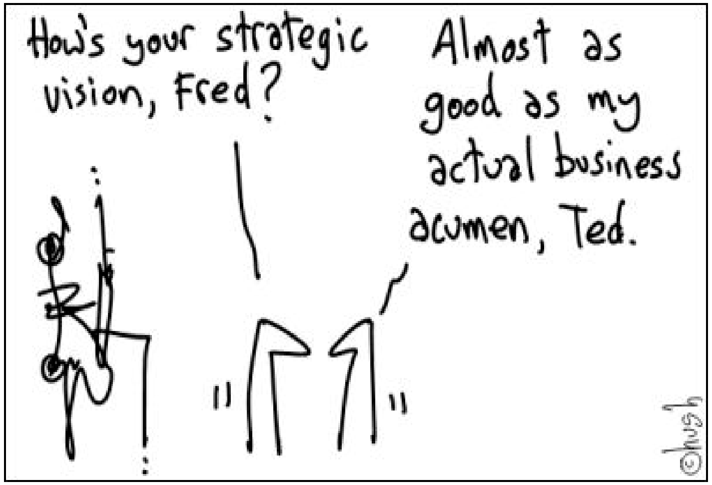
Expectations From Leadership

1. The Importance of a Strategic Plan/Vision
2. The Importance of Communication
3. Crafting the Budget
4. Strategic Partnerships



The Strategic Plan/Vision

- Make sure your Strategic Plan/Vision fit the Economic Forecast
- What you do well, what is unique, what fits mission
- Takes time/continually reviewed
- Vet widely/feedback
- Faculty & Staff by-in
- Budget investments/cuts are guided by strategic Plan/Vision



Strategic Vision/Focus
COMMUNITY FOOD/HEALTH

VISION

New Academic Programs (experiential)
- -Sustainable Land Management
- -Urban and Community Food
- -Agribusiness and Food Management

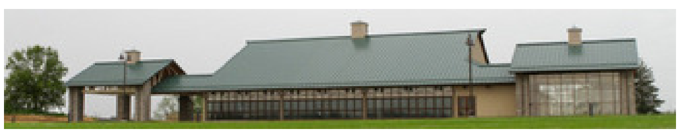
(focused on local and urban food systems)

OUR MISSION

Limited Resource Farmers
Underserved
Under-represented

Urban and Community Food Complex

Pavilion



Model Urban Farm

Processing Center

Community Gardens

Amphitheater

Student run Farm

Frequent /Transparent Communication

- Explain the process of budget allocation (faculty/staff mistrust)—Upper Admin to Deans to Chairs to Department
- Share budget numbers as much as possible
- REPEAT, REPEAT, REPEAT (rule of 7)

Crafting the Budget

- Skilled budget manager worth weight in gold
- Expand the circle of knowledge
- Create Environment where risk is OK
- Create a budget which allows you to be nimble
- Target reductions, across-the-board weaken organization

The Money Dog

Strategic Partnerships/Investments

- We can no longer be everything to everyone
- Develop strategic partnerships to fill in gaps in capability
- Local, regional, national
- Allows for focused investment into core mission/vision of College/School

A&T Dairy

KSU Aquaculture

Discussion

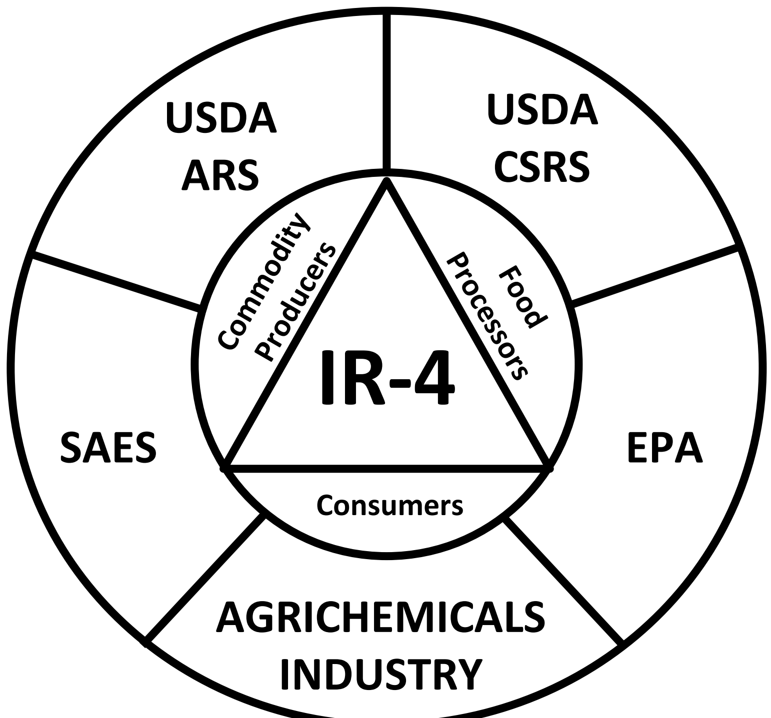
IR-4 Project

50 Years of Providing Pest Management Technology for Specialty Crop Agriculture

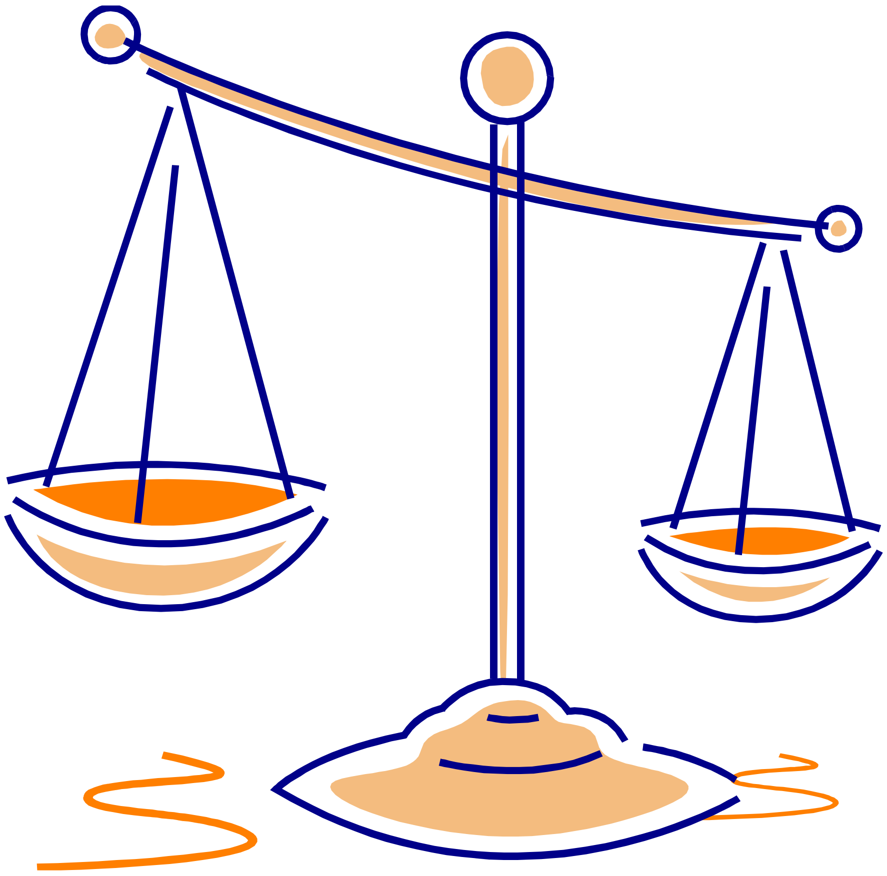
Jerry Baron
Executive Director

IR-4 Mission

To facilitate registration of sustainable pest management technology for specialty crops and minor uses



Minor Use Pesticide Problem



Specialty Crops Include:

Most: Vegetables

- Fruits
- Nuts
- Herbs
- Spices
- Floral
- Nursery
- Landscape
- Christmas trees

Other Minor Uses

Minor Uses on Major Crops

Corn, Soybean, Cotton, Rice, Forestry

Crops for Processing

Sweet corn, tomato products, legumes, etc,.

The IR-4 Project

50th

USDA ARS
USDA NIFA
SAES
EPA
COMMODITY PRODUCERS
FOOD PROCESSORS
IR-4
CONSUMERS
CROP PROTECTION INDUSTRY

ANNIVERSARY-2013

The IR-4 Project

Evolution of IR-4

1963

Food Program

1970 and 80's

- Ornamentals
- Regional Offices
- ARS program
- Biopesticides

1990 – 2008

- FIFRA 88
- Reduced risk
- Crop group updates

2009 - current

- International Maximum Residue Levels (MRLs) to support US exports
- Invasive pests
- Organic Agriculture
- Plant Incorporated Protectants (PIPs)
- Public Health Pests

Keeping IR-4 Relevant

- Strategic Planning*
- USDA Peer Review*
- NRSP Project Statement
- NIFA Competitive Grant Process*
- Priority Setting Workshops*

*Indicates direct involvement from primary stakeholders

IR-4 Leadership

Project Management Committee

- IR-4 Executive Director*
- (4) Regional Directors*
- USDA-ARS Minor Use Coordinator*
- Commodity Liaison Committee Chair*
- (5) Administrative Advisors
- NIFA Program Manager

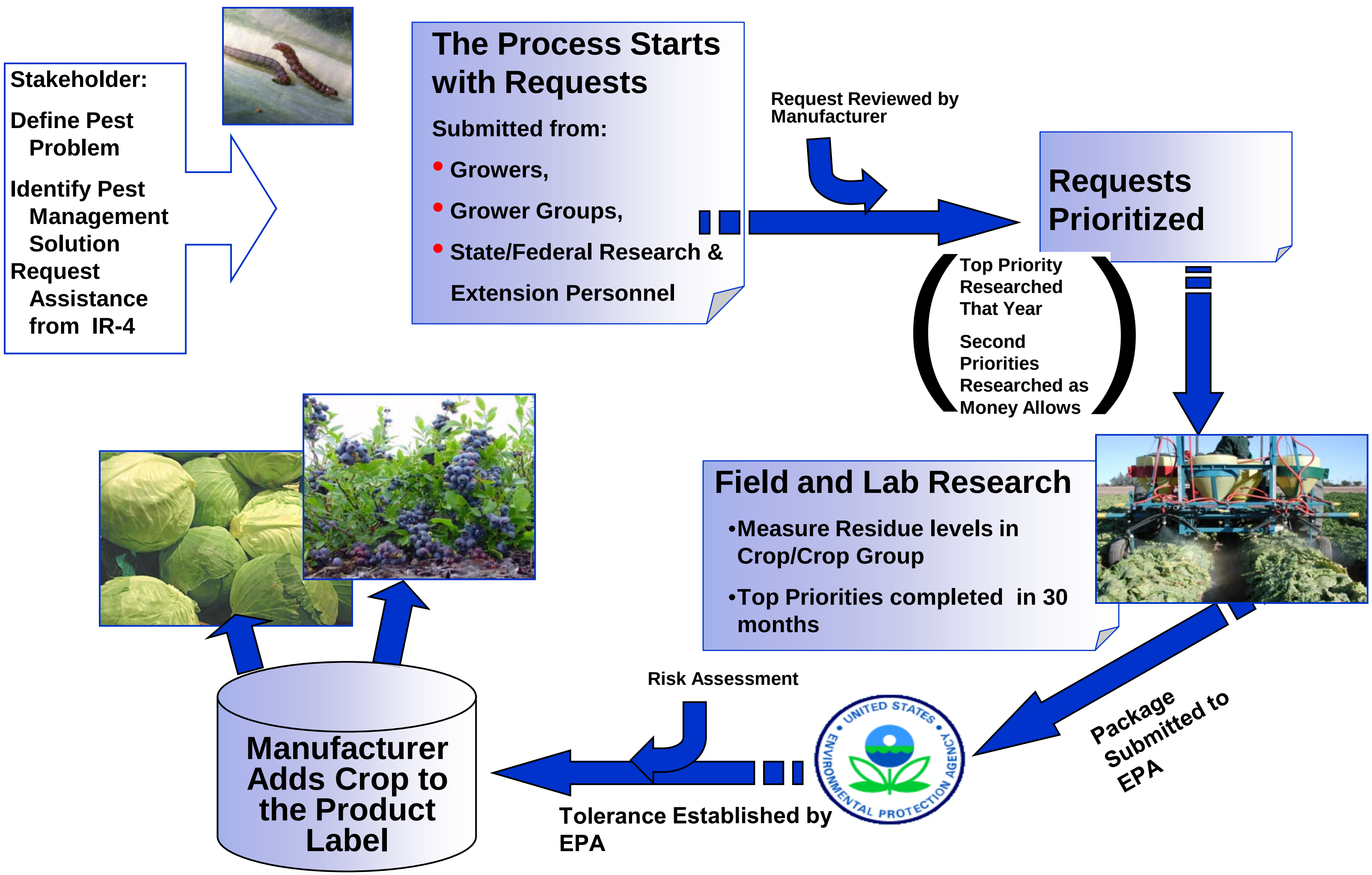
*Voting Members

IR-4 Core Objectives

- **Food Crop Program**
- **Ornamental Horticulture Program**
- **Biopesticide & Organic Support Program**
- **Public Health Pesticides**

IR-4 Food Program

The Food Use Program



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DuPont
Crop Protection

SUPPLEMENTAL LABELING

DUPONT™ TANOS® FUNGICIDE FOR DISEASE SUPPRESSION IN CANEBERRIES AND CONTROL IN GRAPES (EAST OF THE ROCKY MOUNTAINS) AND HOPS

DUPONT™ TANOS® FUNGICIDE

EPA Reg. No. 352-604

FOR DISEASE SUPPRESSION IN CANEBERRIES AND CONTROL IN GRAPES (EAST OF THE ROCKY MOUNTAINS) AND HOPS

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with it's labeling.

Read and follow all manufacturer label recommendations found on the Section 3 Federal Label.

(See Tables on Pages 2-4)

IMPORTANT

BEFORE USING TANOS®, READ AND FOLLOW ALL APPLICABLE DIRECTIONS, RESTRICTIONS, AND PRECAUTIONS ON THE EPA-REGISTERED LABEL.

This bulletin contains new or supplemental instructions for use of this product which do not appear on the package label. Follow the instruc- tions carefully. This labeling must be in the posses-sion of the user at the time of pesticide application.

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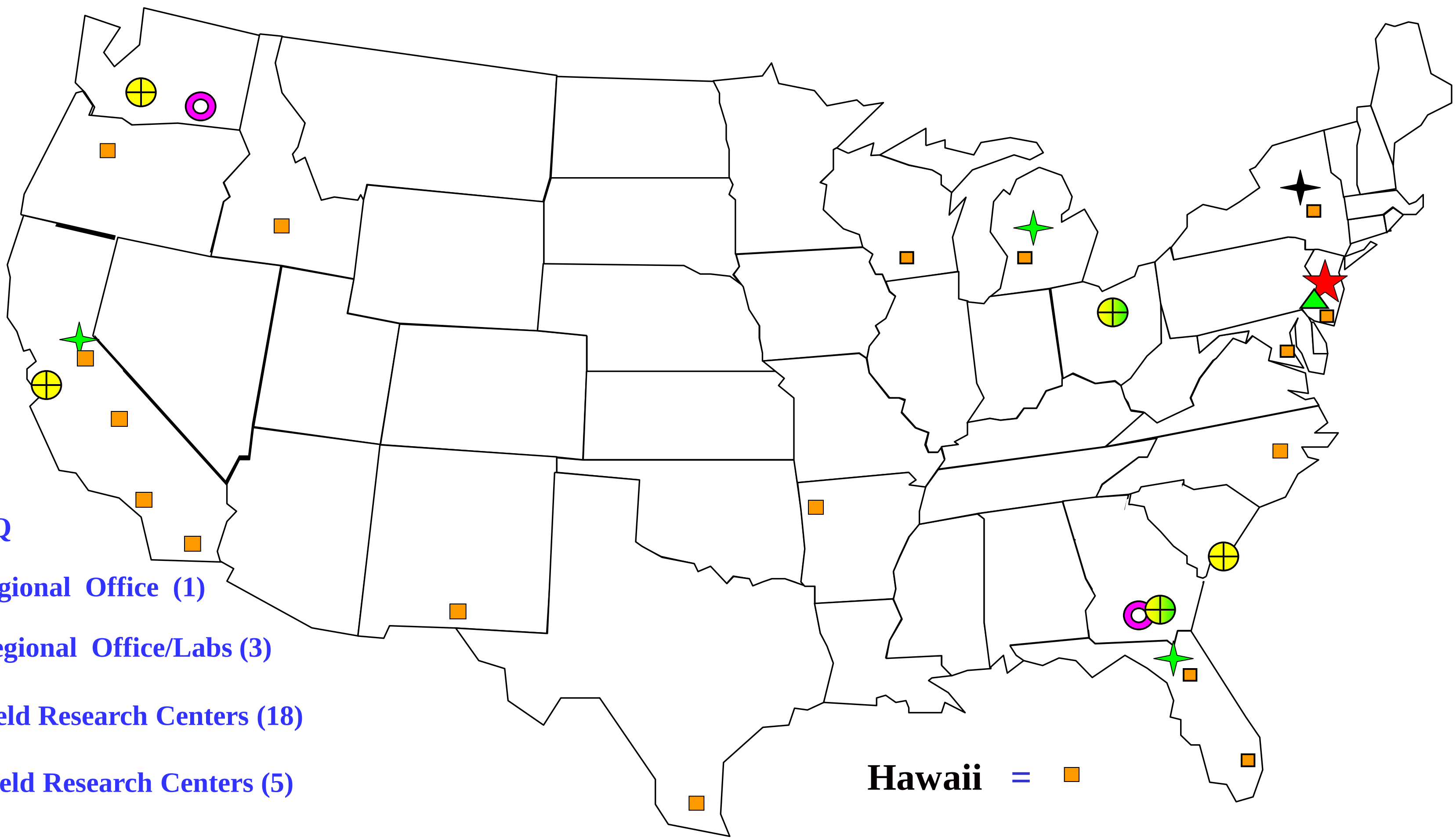
IR-4 Project Food Program Infrastructure



IR-4 HQ

IR-4 Regional Office (1)

IR-4 Regional Office/Labs (3)

State Field Research Centers (18)

ARS Field Research Centers (5)

ARS Labs (2)

Deliverables Food Program

	2008	2009	2010	2011	2012
New Registrations	999	952	786	382	**1085**
Data Packages submitted	151	126	57	179	159
New Residue Studies	93	109	84	90	80
Field Trials	573	553	604	512	523
Product Performance Projects	-	-	24	26	23

Enhanced Food Program

- Comparative Product Performance
  - Find solutions for pest management voids
- Make sure tolerances/clearances transition into registrations-develop necessary data
- Assist with removing pesticide residues in crops as barrier of exports - US growers cannot use products unless MRLs are established by importing country

Why have MRLs become more of an issue?

With the increased international trade:

- there has been an increased amount of testing by importing countries.
- more governments setting their own MRL standards / less use of global (Codex) process
  - show their populace that they are protective
- the lack of harmony or the lack of MRLs is inhibiting the use of new plant protection materials
- is a hurdle to international trade

International Leadership

- Cooperation with Canada
- Global Minor Use Summits
- Research supporting global harmonization of pesticides
- Capacity building ASEAN, Africa and Latin America

IR-4's Vision

Global network of capable minor use programs working together to solve the MUP

- Help establish and mentor these minor use programs
- Partner with other data development groups

Crop Grouping

Crop Groups - allow for extrapolation of data from a few crops to many, efficient use of resources.

The IR-4 Project

50th ANNIVERSARY-2013

Ornamental Horticulture Program

- Established 1977
- 10% of the Project's efforts and resources
- Predominantly crop safety testing and efficacy, including invasive pests

Deliverables Ornamental Program

	2008	2009	2010	2011	2012
Field Trials	1323	1212	1473	1199	772
Reports	12	16	21	21	21
Labels	8	6	6	11	6
Impacted crops*	3095	614	2367	2572	644

* Number of ornamental crops affected by new labels

Invasive Species

- Q Biotype Whitefly
- Gladiolus Rust*
- Chili Thrips
- Chrysanthemum White Rust*
- Shipping of Invasive Arthropods*
- Boxwood Blight*
- Impatiens Downy Mildew*
- Spotted Winged Drosophila
- Brown Marmorated Stink Bug

* Funded by USDA-APHIS

Biopesticide & Organic Support Program

- Regulatory support for “public owned” technology
- Small grants program for efficacy data development
- Focus work with integration of biopesticide into conventional production systems
- Support for organic markets
- Regulatory assistance for biotechnology

Deliverables Biopesticide Program

	2008	2009	2010	2011	2012
Grants					
Early	6	4	5	6	7
Advance	15	20	21	12	7
Demonstration	9	10	10	4	5
Submissions	3	5	9	3	1
Labels	18	7	776	8	12

Public Health Pesticides

Provide regulatory support to USDA & Department of Defense activities with Public Health Pesticides

Work Plan

- Expand registrations for existing PHP
- Facilitate registrations for new technology and novel pesticides
- Register products outside US to protect deployed US military personnel

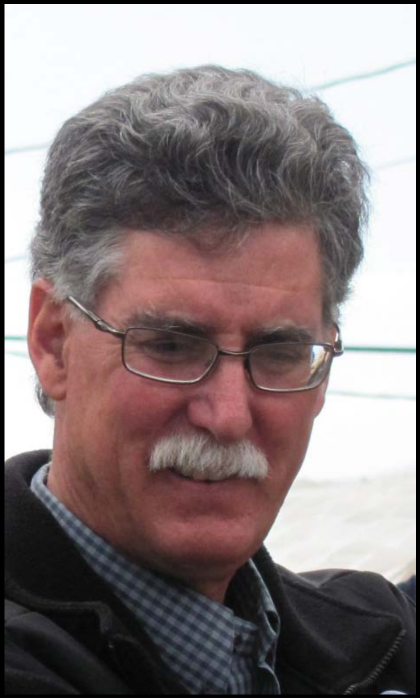
Filling the Toolbox

- Over 2000 pesticides registered but less than 50 available for mosquito management
- Even less tools available for other PH arthropods

Who Benefits from IR-4

- Growers of specialty crops/minor uses-Have tools to protect crops
- Food Processors/Food Industry-Keep supply chain open
- Society-Consistent and affordable supply of safe fruits & vegetables, ornamentals to enhance environment

IR-4 adds $7.2 BILLION annually to the gross domestic product & supports >104,000 jobs



Over the years I know that IR-4 has been very important and instrumental in helping bring some of the minor use crop materials forward for our operations. Sometimes the work goes unrecognized because it happens behind the scenes without much fanfare. I view the IR-4 program as critically important especially to those of us in the "super specialty crop" area of agriculture because it is often times difficult or unprofitable for a manufacturer to register materials for our uses. IR-4 gives us the opportunity to broaden our arsenal against the ever increasing range of pests that challenge our farming operations. Without IR-4's efforts our job would be much more difficult if not impossible.

– Mike A. Mellano, Mellano & Company

Actual funding-2013

GROUP	***AMOUNT***	***PROGRAM(S) SUPPORTED***
USDA-NIFA	$11,006 000	Food, Ornamental, & Biopesticide
USDA-ARS	$ 3,570,000	Food & Ornamental
USDA-ARS/DoD	$ 253,000	Public Health
USDA-FAS	$ 500,000	Food (International)
USDA-APHIS	$ 950,000	Ornamental (Invasive pests)
NRSP-4	**$ 444,536**	Food, Ornamental & Biopesticide
STDF	$ 180,000	Food (International)
Grants from Industry	$ 1,100,000	All
TOTAL	$18,003,536*	

*Does not include in-kind contributions that are provided by **State Agricultural Experiments Stations**, Canada, EPA, growers and the crop protection industry. In-kind contribution valued at over $18 million annually

The IR-4 Project

IR-4's Next Strategic Plan

- Important piece of 5-year IR-4 Project reauthorization by the State Agricultural Experiment Station Directors and USDA
- Enhancement in Project Mission and Objectives – can/should IR-4 be doing something additional to provide better service and deliverables to stakeholders?
- Help provide justification for IR-4 to obtain an increase in funding to adequately cover core mission

Input Process

Web based survey to capture input from numerous stakeholder/stakeholder groups

- – Grower/Commodity Representative
- – Manufacturer / Registrant
- – Government
- – State or Federal Research/Extension
- – IR-4 State Liaison Representative
- – Others?

https://rutgers.qualtrics.com/SE/?SID=SV_eKCVsU2zxzMPmgB

Future IR-4 Efforts?

- Monitor and/or mitigate pest resistance to pesticides
- Integrate biopesticides into conventional pest management systems
- Pollinator health/protection
- FSMA
- Biotechnology approval for specialty crops
- External arthropod parasites on minor animal species
- Other

Future

Proposed Consolidation of IR-4 with USDA-NIFA Integrated Pest Management Programs

http://www.saveir-4.org/index.html# Save IR-4
Google Search More Sign In
Big Daddy Chokemasters ... Staff Details About EPA ... Agrow - The leading onlin... Running Strong Professio... Page Safety Tools

SAVE THE IR-4 PROJECT

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These organization are supporters of IR-4

Ag Matters, LLC
American Farm Bureau Federation
American Mushroom Institute
American Nursery & Landscape Association
Ball Horticultural Company
Brewers Association
California Apple Commission
California Asparagus Commission
California Blueberry Commission
California Garlic and Onion Research Advisory Board
Cape Cod Cranberry Growers
Cherry Marketing Institute, Inc.
Center for Applied Horticultural Research
Cranberry Institute
Dill Growers of Oregon and Washington

NC Commercial Blackberry & Raspberry Growers Association
NC Pickles Packers Association
NC Strawberry Association/North American Raspberry & Blackberry Association
NH Vegetable & Small Fruit Growers Association
New England Vegetable and Berry Growers Association
North American Blueberry Council
National Christmas Tree Assocaition
National Greenhouse Manufacturers Assocaition
National Onion Association
National Potato Council
National Watermelon Growers Association
NC Commercial Blackberry & Raspberry Growers Association

IR-4 Supporters

The Friends of IR-4 are a group of commodity groups, allied agricultural interests and individuals who support the IR-4 Project in its current form and funding levels. We do not support any plan to fundamentally change its current method of operation. The following organizations support keeping IR-4 as a separate line item and funding it at it's current level.

For more information on this topic, contact:

Alan Schreiber

aschreib@centurytel.net
509 266-4348

To Be added to the list of supporters please contact

Alan Schreiber

These individuals support IR-4

Allison L H Jack

Andy Biancardi

Camille Holladay

Current Status

Oct. 2012 - FY 2013 Continuing Resolution funding maintains an independent IR-4

Nov. 2012 - IR-4 removed from BAA Pest Management Plan

April 2013 - USDA FY 14 budget proposal removes IR-4 from modified consolidation plan

May-July 2013 – US House & Senate Appropriations Committees follows USDA recommendation

Now What?

NIFA Administrator Dr. Sonny Ramaswamy vision is for a limited number of broad funding lines from Congress to fund NIFA administrated programs

“Rising Tide Lifts All”

Some Questions

- Is it possible to double Ag Research Funding?
- How would NIFA Administrators “cut the pie”
- Would IR-4 commodity champions be able to assist IR-4?

U.S. OLYMPIC DIVING TEAM.
FISCAL CLIFF

The IR-4 Project

Thank You!