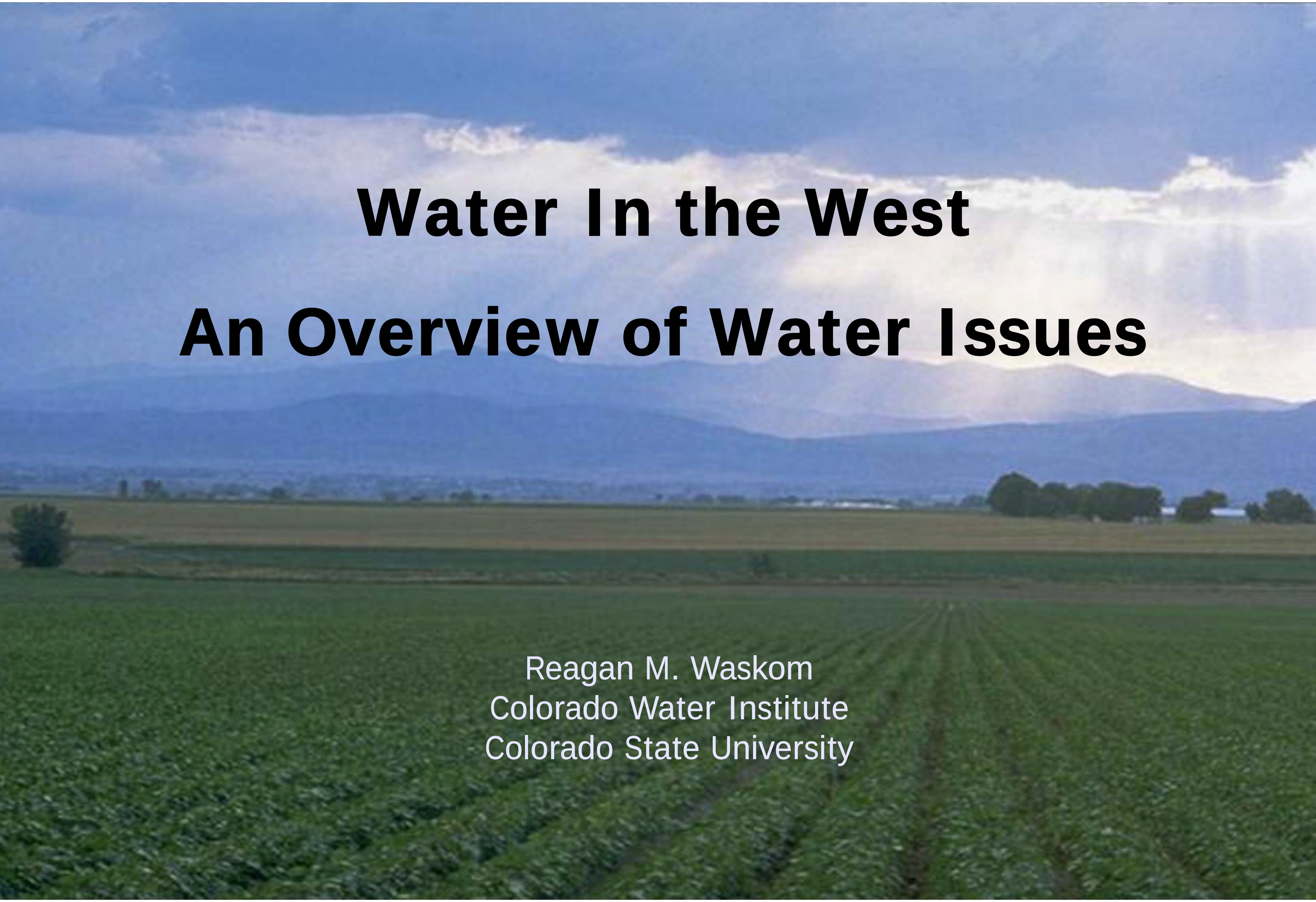
2011 ESS/SAES/ARD Meeting and Workshop Schedule
September 26 - 29, 2011
Estes Park, CO

Monday, September 26, 2011	
1:00 P.M.	**Registration - Hotel Lobby**
3:00 - 6:00 P.M.	**Regional Meetings** • ARD - Pinion • NCRA - Ranch • NERA - Library • SAAESD - Billiard • WAAESD - Manor Hall
6:30 P.M.	**Opening Reception - Concert Hall**
Tuesday, September 27, 2011	
7:00 A.M.	**Registration - Hotel Lobby**
7:00 - 8:00 A.M.	**Breakfast - Pinion/Billiard**
8:00 A.M.	**Welcome - Macgregor Ballroom** • Lee Sommers, Colorado State University • Dr. Tony Frank, President, Colorado State University
	Water in the West
8:15 A.M.	**Overview of water issues** • **Reagan Waskom, Director, Colorado Water Institute, Colorado State University**
8:45 A.M.	**Economic impact of water** • **James Pritchett, Department of Agricultural and Resource Economics, Colorado State University**
9:15 A.M.	**Agricultural production systems and water** • **Neil Hansen, Department of Soil and Crop Sciences, Colorado State University**
9:45 A.M.	**Agricultural research and water from a legal perspective** • **Bill Paddock, J.D., Hill and Robbins, Denver, CO**
10:30 - 11:00 A.M.	**Break - Macgregor Ballroom**
11:00 A. M. - noon	**ESS Business Meeting - Macgregor Ballroom**
Noon - 1:30 P.M.	**Luncheon with Speaker - Pinion/Billiard**
1:30 - 3:00 P.M.	**ESS Business Meeting (continued) - Macgregor Ballroom**
3:00 - 3:30 P.M.	**Break - Macgregor Ballroom**
3:30 - 5:00 PM	**Discussion Session I: Climate Change - Impacts on the future of Agriculture and Natural Resources - Macgregor Ballroom** • **John P. Oliver , President, Maple Leaf Bio-Concepts, Oshawa, Ontario** • **Mike Hoffman, Cornell University** • **Karen Plaut, Purdue University** • Combined Group DIscussion
	Dinner on your own

Wednesday, September 28, 2011	
7:00 - 8:00 A.M.	**Breakfast - Pinion/Billiard**
8:00 - 9:00 A.M.	**Discussion Session II: One line Budget Proposal - Macgregor Ballroom** • Steve Pueppke, Michigan State University • Combined Group Discussion
9:00 - 10:00 A.M.	**Best Practices Session 1: Sustainable Campus Operations - Macgregor Ballroom** • **Mike Hoffmann, Cornell University** • **Steve Hultin, Interim Director, Facilities Management Colorado State University** • Combined Group Discussion
10:00 -10:30 A.M.	**Break - Macgregor Ballroom**
10:30 - noon	**Discussion III: Operationalizing the Science Roadmap - Macgregor Ballroom** • **Dan Rossi ED, NERA - Welcome, Overview of Roadmap Development** • **Mike Harrington ED, WAAESD - Results of Roadmap Priorities Survey** • Combined Group Discussion • **Evan Vlachos, Professor Emeritus Colorado State University - The Science Roadmap - Shaping the Future Food and Agriculture System**
12:00 - 1:30 P.M.	**Lunch - Pinion/Billiard**
1:30 - 3:00 P.M. Crockett	**Discussion IV: Marketing the ESS in the 21st Century - Macgregor Ballroom** • Jerry Arkin, University Of Georgia - Retrospective Perspective: Going Forward • Hunt Shipman, Cornerstone Gov?t Affairs - Changing Budget and Political Landscape: Going Forward • **Jeffry Morris, Vice President, K-Global - Introduction, Communication and Marketing Strategy: Going Forward** • Hunt Shipman - Strategy for Collaboration • Nancy Cox, University of Kentucky - Opportunities for Messaging • Arlen Leholm ED, NCRA - Implementation: Going Forward
3:00 -3:00 P.M.	**Break - Macgregor Ballroom**
3:30 - 5:00 P.M.	**Best Practices Session 2: Structuring University-Wide Centers and Institutes; Issues and Solutions - Macgregor Ballroom** • **Bob Shulstad, University of Georgia** • **Colin Kaltenbach, University of Arizona** **The speakers will open this session with 5-10 minute presentations on their experiences with structuring university-wide centers and/or institutes. The remaining time will be available for anyone who would like to sharing their experiences or request guidance from those present. Some of the questions that have come up this topic are:** • How are faculty assigned to the C/I? • What is their relationship to the C/I vs their home department? • How are tenure/promotion decisions made and by whom? • How are IP and royalty issues handled? • What is/are the funding mechanism(s)? • How are departments given credit for their faculty's outputs who are assigned to the C/I; grants, publications, patents, etc? • Do departments share in funds generated by their faculty, such as grant overhead? • If graduate or undergraduate students are involved in the C/I that generate student credit hours, how is that credited? • Do departments receive salary release funds to assist in teaching when a research/teaching faculty is assigned to a C/I?
6:00 - 9:00 P.M.	**Hosted Dinner - Concert Hall**
Thursday, September 29, 2011	

7:00 - 8:00 A.M,	**Breakfast on your own**
8:00 - 10:00 A.M.	**Meeting room available if needed**



Water In the West

An Overview of Water Issues

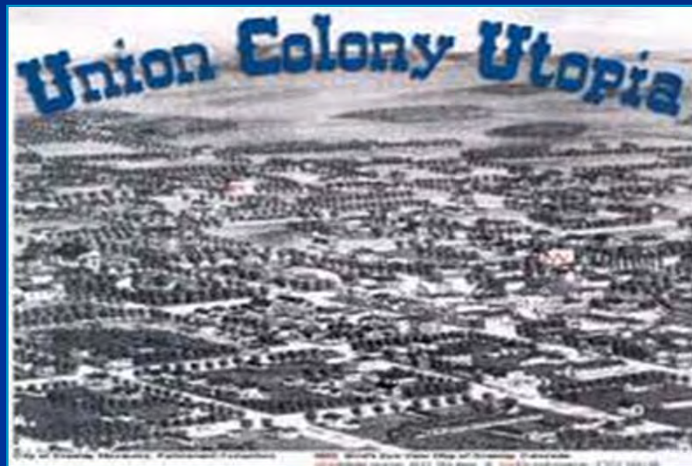
Reagan M. Waskom
Colorado Water Institute
Colorado State University

Water Rights in the West…

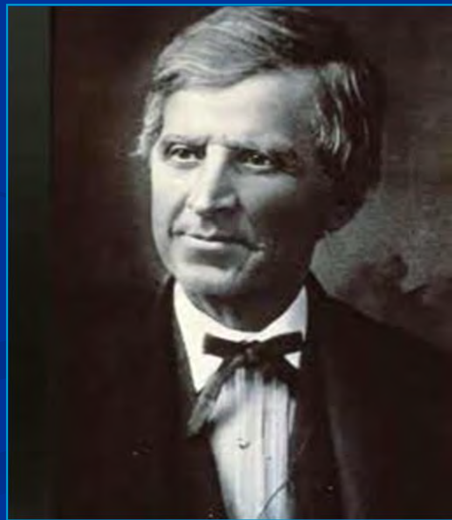
Discussing Water Rights, A Western Pastime

A Little History…

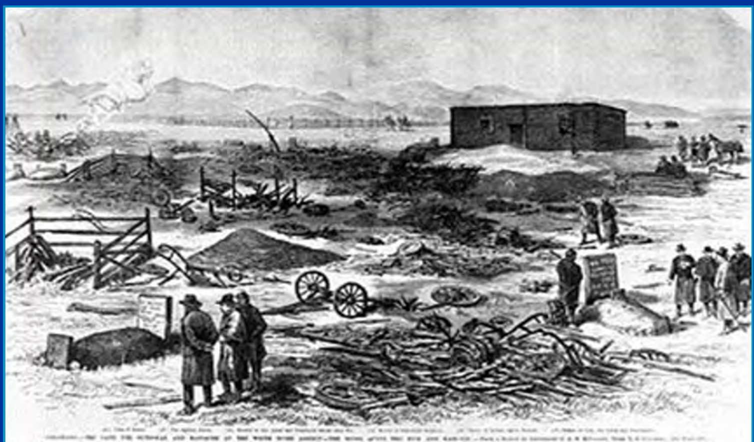
Horace Greeley



Union Ditch

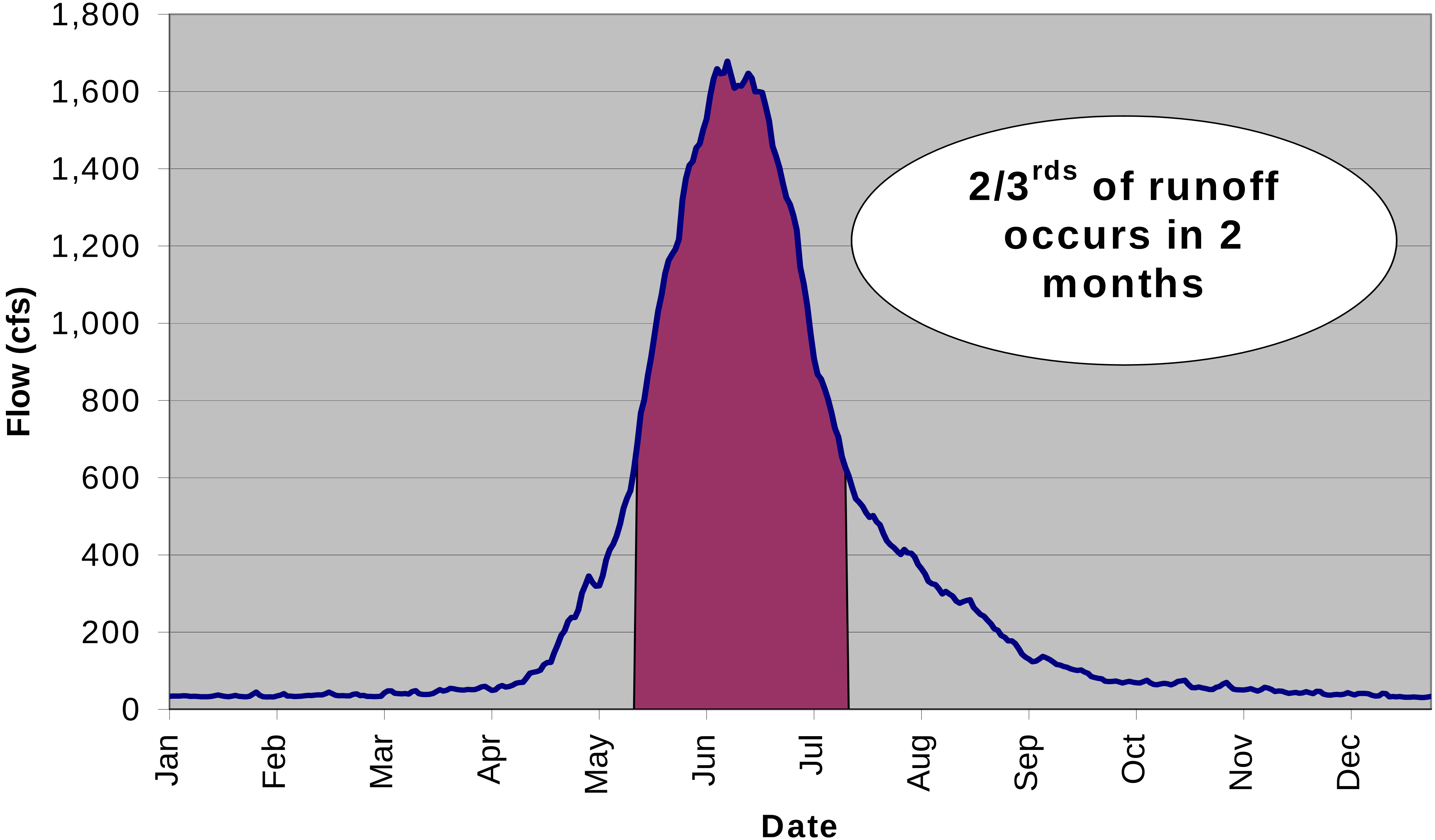


Nathan Meeker



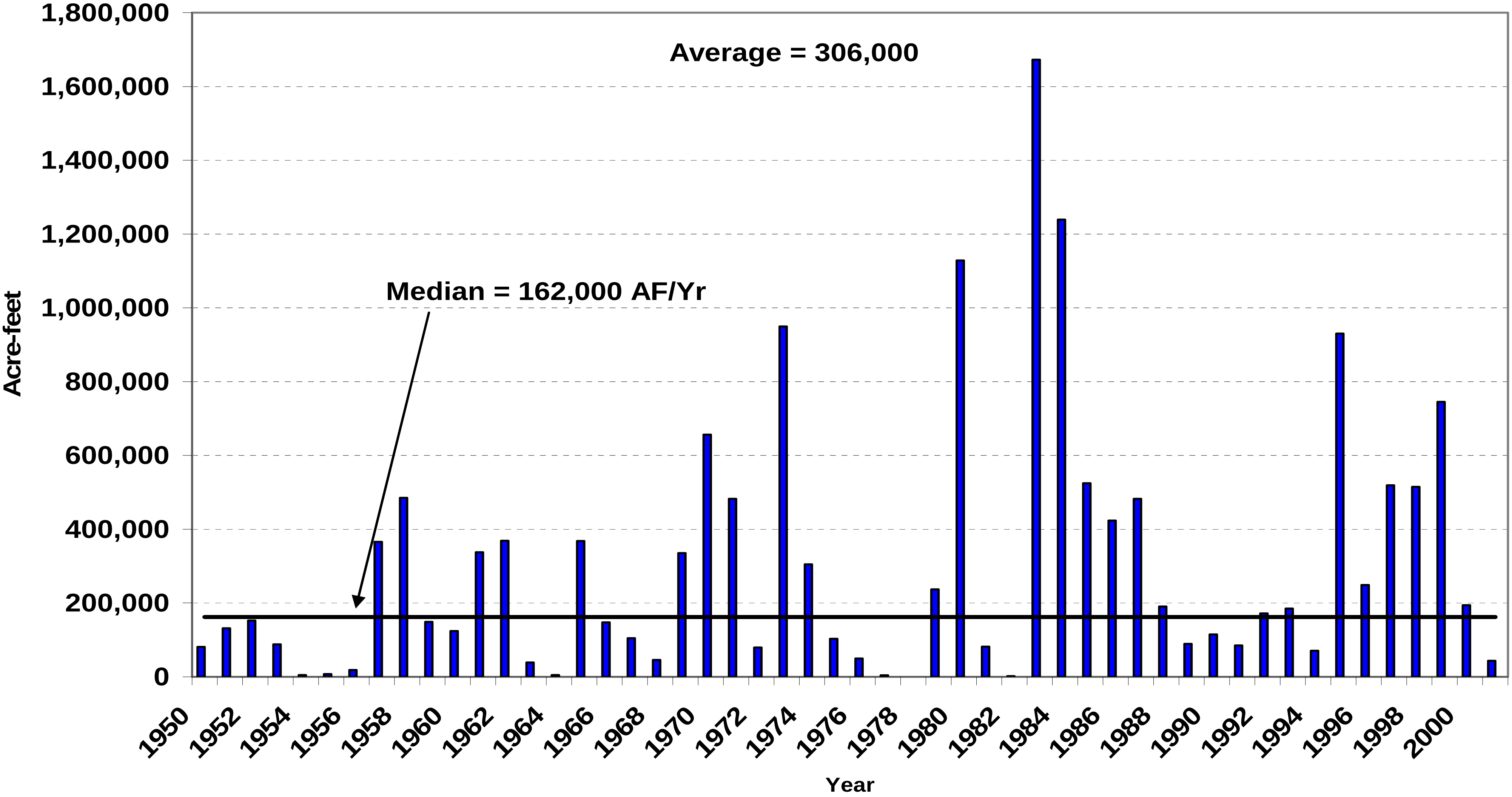
1870 Union Colony

Average Poudre River Flows



Source: Cache la Poudre River at the Mouth of the Canyon Gage (USGS 06752000)

Available Flow for the South Platte River at Kersey Gage
1950-2001
(Source NCWCD Northern Integrated Supply Study)

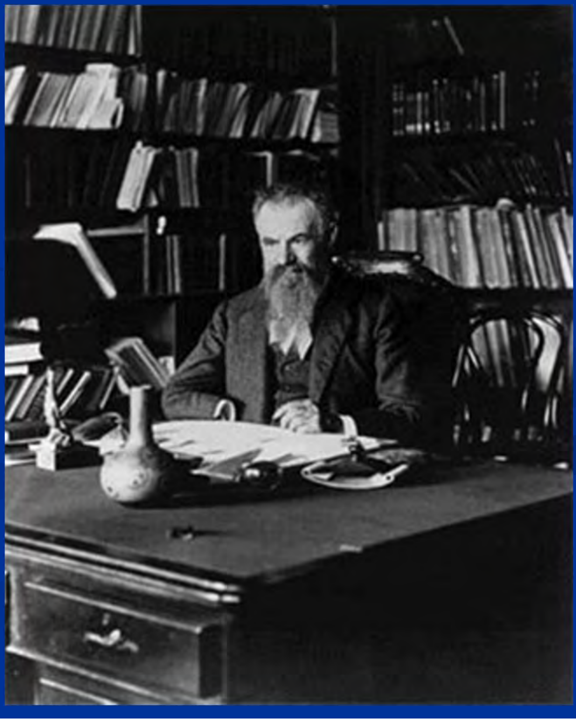


Prior Appropriation Doctrine

- Earliest appropriators have the highest priority, “First in time, first in right.”
- Security of supply depends on priority
- Right of use can be forfeited by nonuse “Use it or lose it
- Water must be diverted and put to beneficial use without waste

John Wesley Powell
at the 1893 International Irrigation Conference

"I tell you gentlemen, you are piling up a heritage of conflict and litigation over water rights, for there is not sufficient water to supply the land."



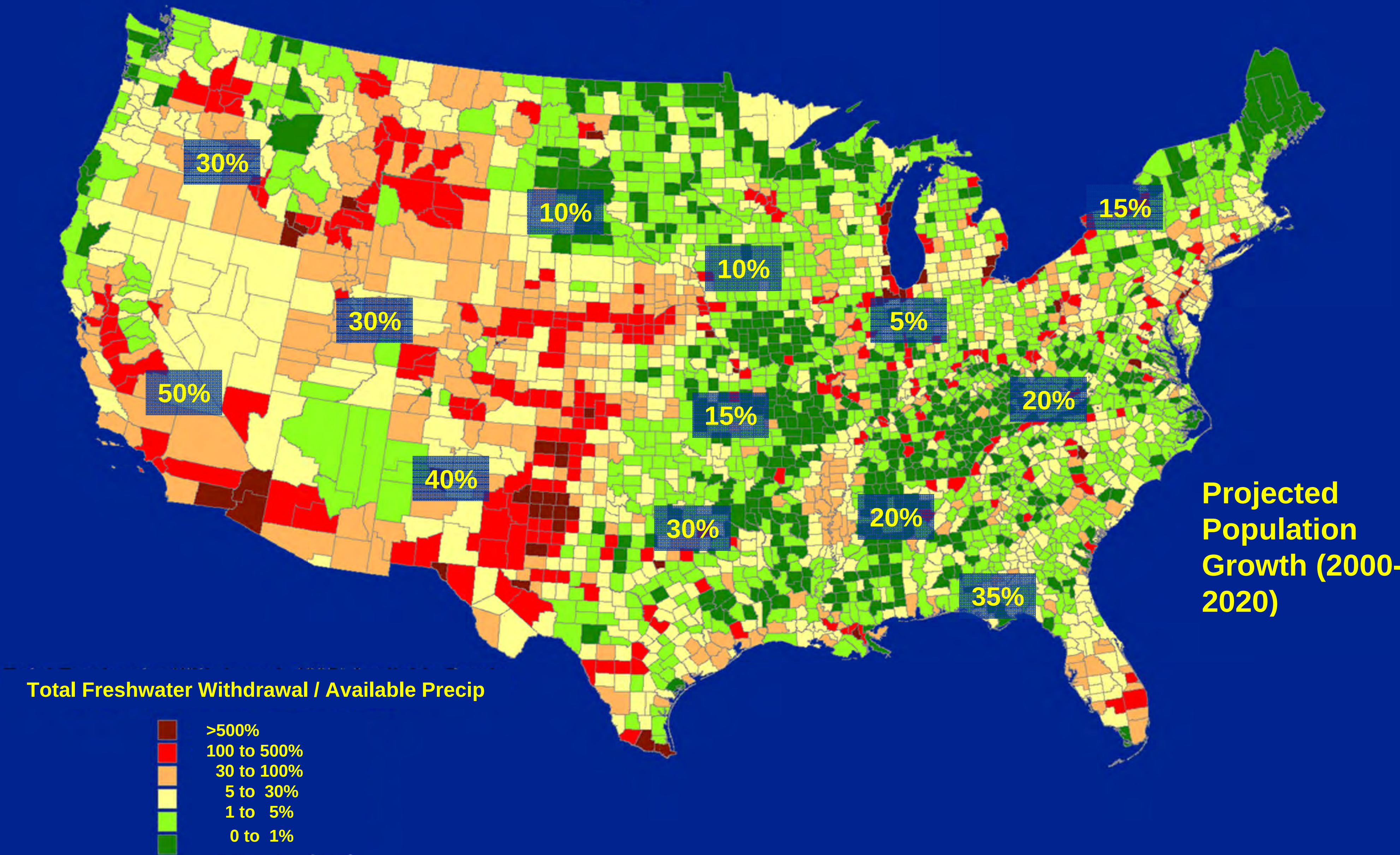
Significance of irrigated agriculture

- 56 million irrigated acres (24 million in the 11 western states) out of 400 million acres of crops in USA
- 15% of total US crop acres are irrigated, producing almost half of total crop value

Ag water is being managed unsustainably across much of the US

- Fully appropriated river systems and over-drafted groundwater aquifers
- Poorly managed irrigation and drainage water results in off-site transport of sediments, nutrients, pathogens, emerging contaminants and leads to salinization in arid regions
- Fresh water ecosystems are threatened in many basins

Water challenges are nationwide



External Factors create Ag Water Vulnerability

- Urban growth & competition
- Interstate water disputes
- Energy needs and costs
- Endangered species
- Periodic drought
- Changing climate

Voice of the Rocky Mountain Empire

THE DENVER POST

WEDNESDAY, SEPTEMBER 17, 2008 · CHANCE OF RAIN ▲ 84° ▼ 51° »14B • DENVERPOST.COM • © THE DENVER POST • 50 CENTS PRICE MAY VA

Years of record drought plus cattle-killing blizzards have left farmers in 22 counties

HIGH, DRY AND DEVASTATED

By Howard Pankratz *The Denver Post*

It's hard to imagine from the look of the lush lawns of metro Denver, but from the plains to the Front Range, much of eastern Colorado is a disaster area.

On Monday, the U.S. Agriculture Department designated 22 Colorado counties as "primary natural disaster areas" because of what the agency described as drought conditions since Jan. 1.

The declaration is the latest in a string of hard times for ranchers and farmers in an area stretching roughly from Interstate 25 east to the Kansas border and from the New Mexico border north to Lincoln County.

"Southeast Colorado had unprecedented drought in 2002, 2003, 2004, 2005. We just had continual drought," said Chuck Hanagan, the executive director for the Otero-Crowley Farm Service Agency, a branch of the U.S. Department of Agriculture.

DROUGHT » 10A

CROPS

August rain has helped, but crop yields have been lower and some ranchers worry they will not be able to grow enough feed.

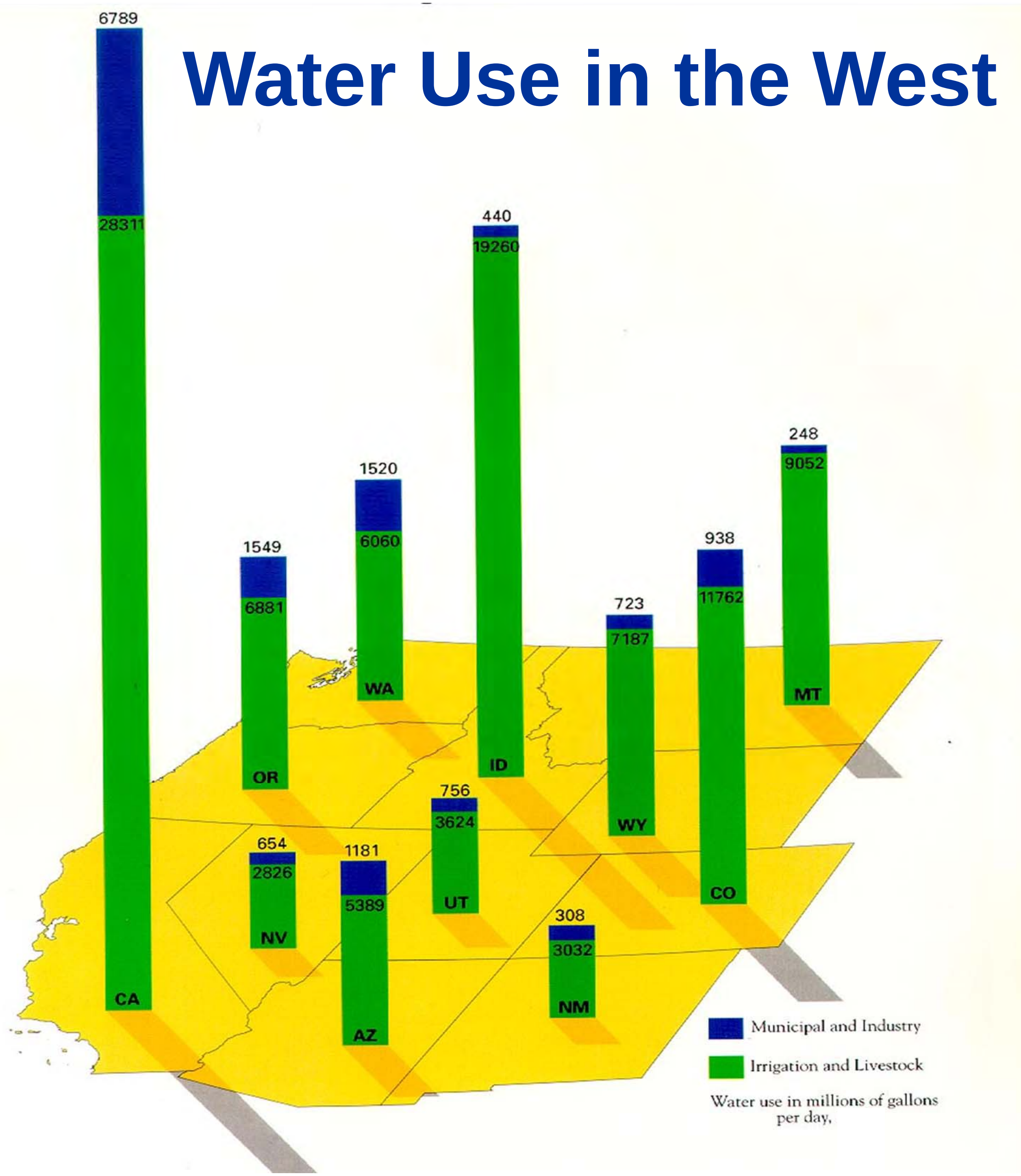
CATTLE

The blizzards of late 2006 killed more than 10,000 cattle. Ranchers have not been able to rebuild herds.

CLIMATE

Southeast Colorado experienced unprecedented drought in 2002, 2003, 2004 and 2005. Then the drought returned in 2007 and 2008. *The Denver Post file photos*

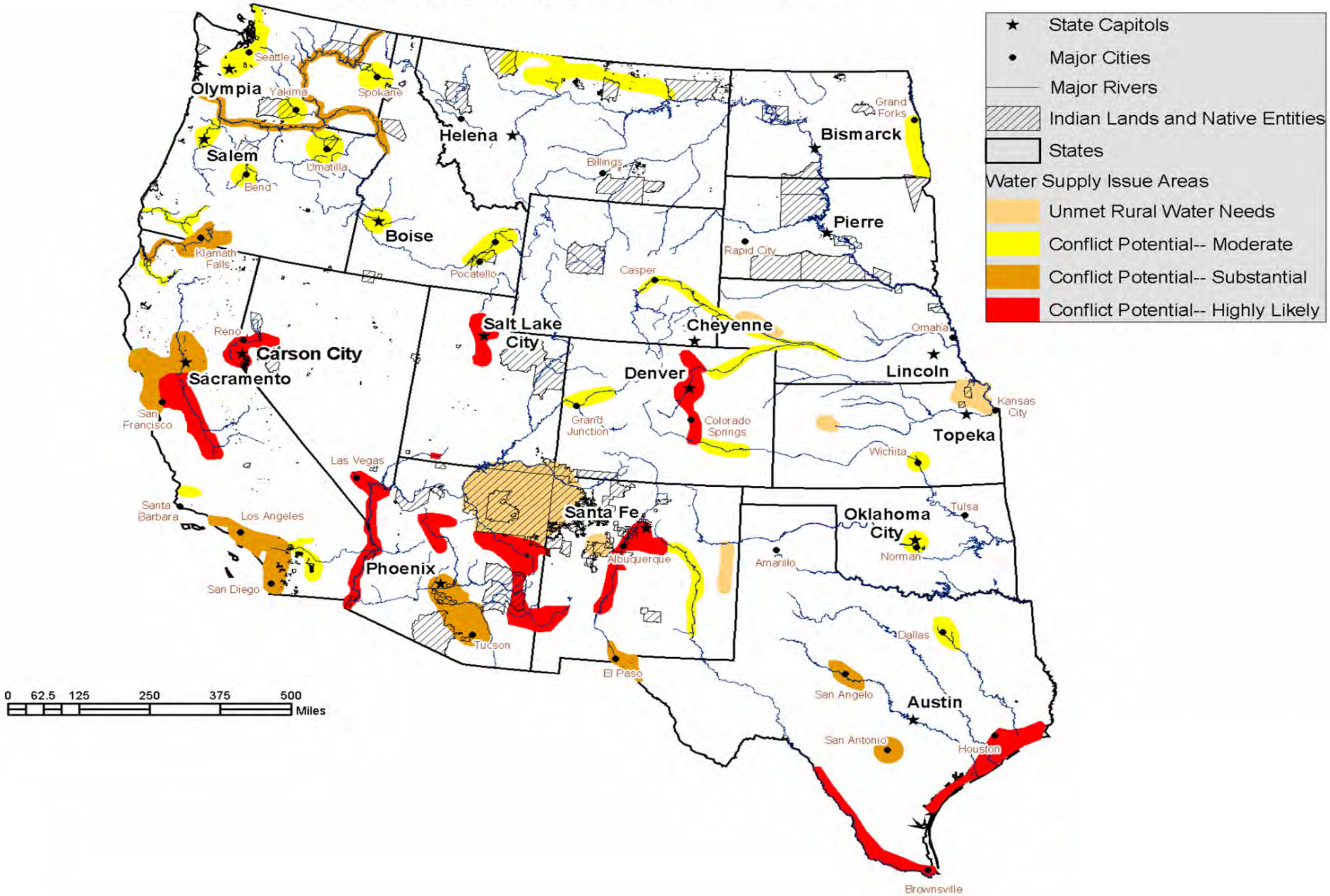
Water Use in the West



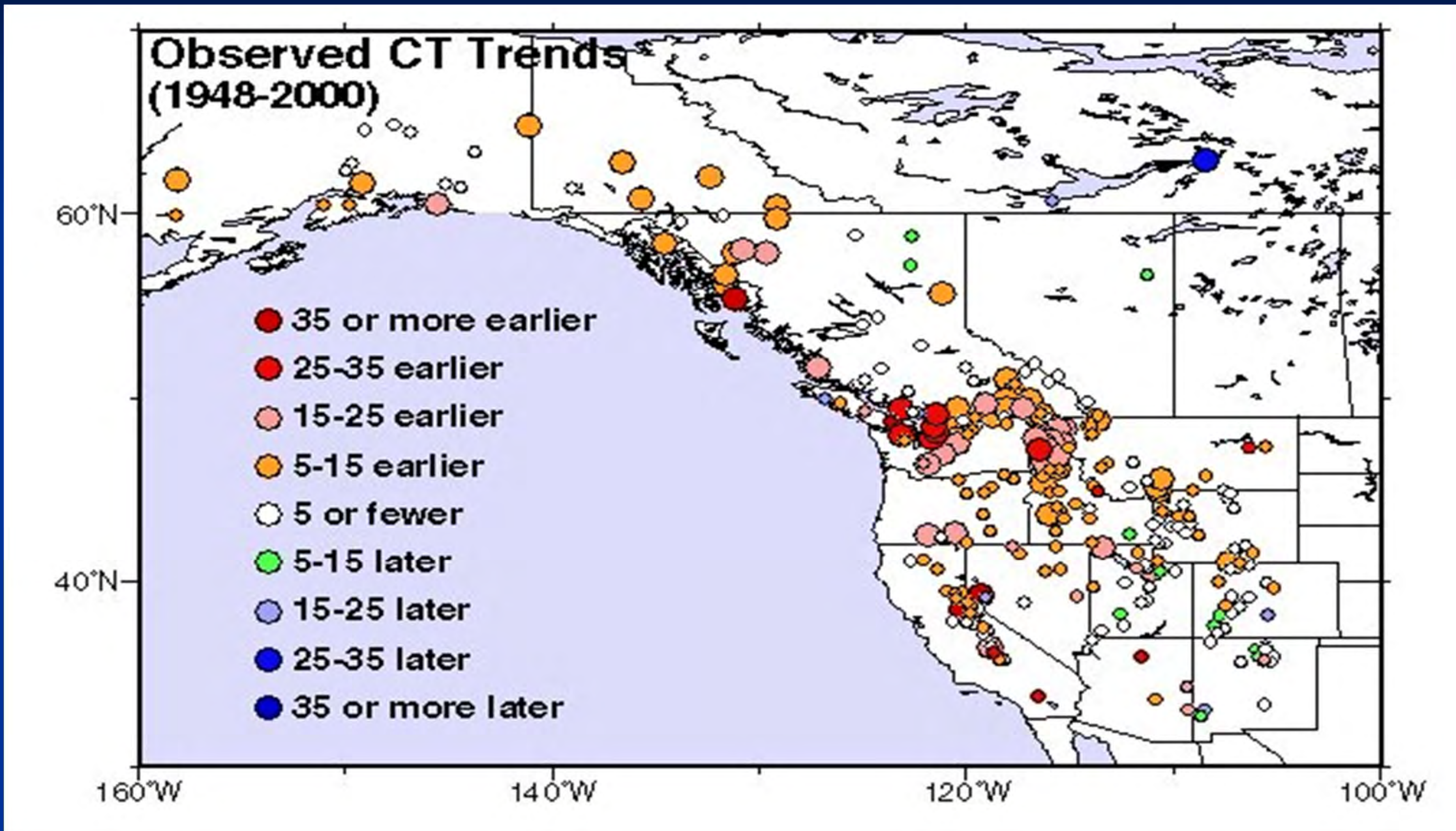
- Food production is water intensive
- 73% of water withdrawals for irrigation; food production consumes 80 - 90% of total
- Value of water in agriculture is ~ order of magnitude lower than value of water for M&I uses

Potential Water Supply Crises by 2025

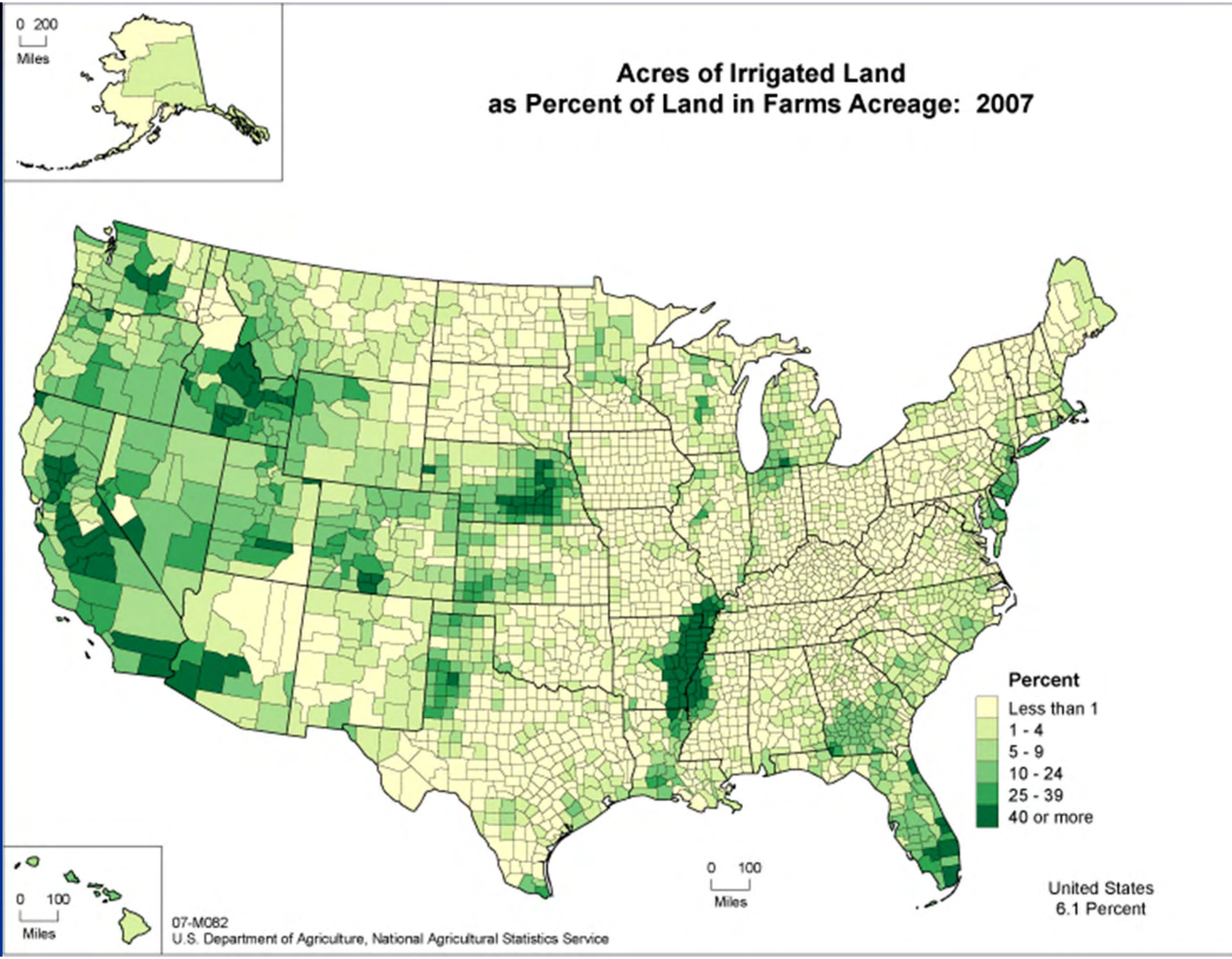
(Areas where existing supplies are not adequate to meet water demands for people, for farms, and for the environment)



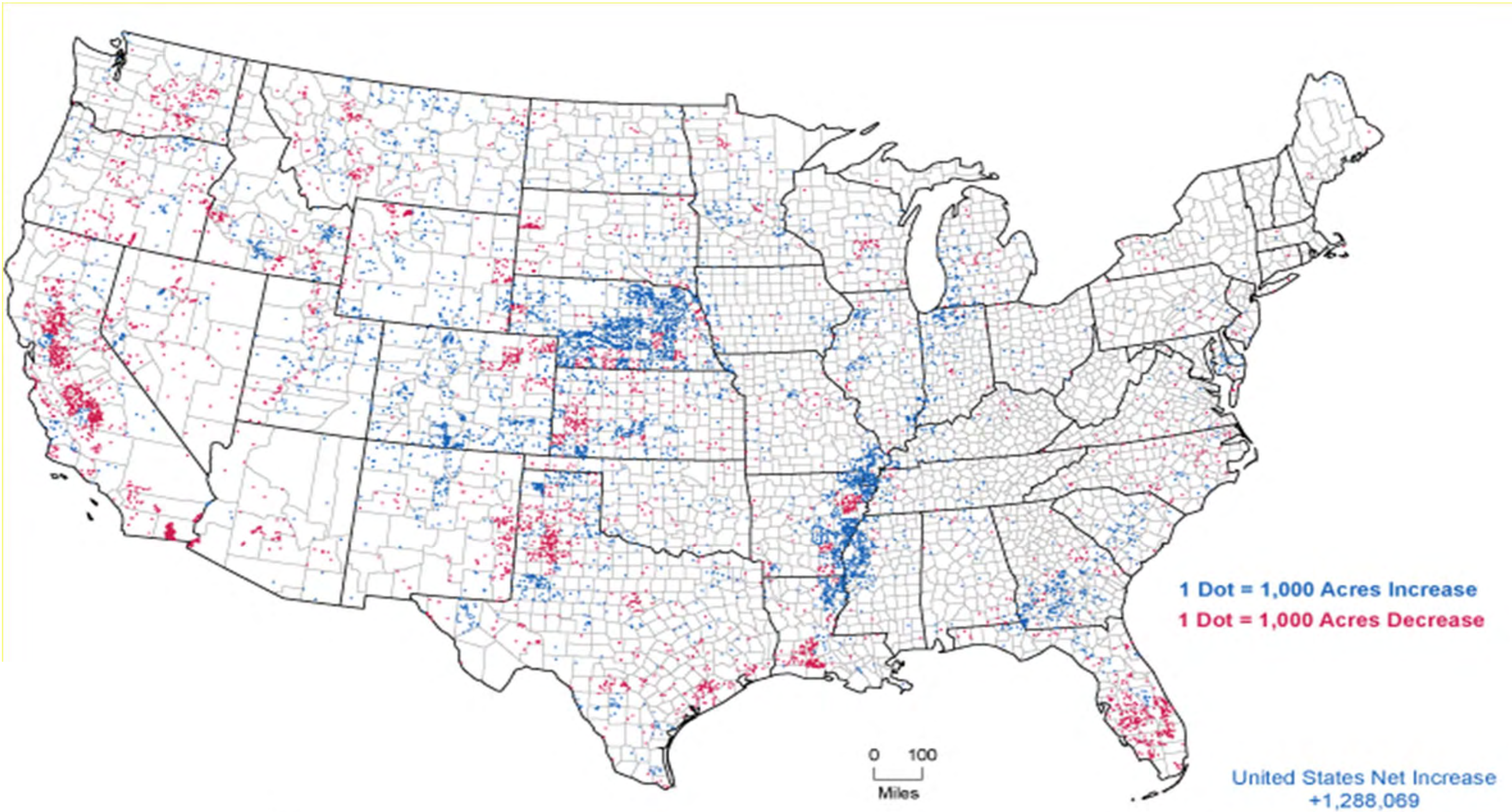
Western runoff is occurring earlier



Trends in center of mass of runoff


0 200
Miles
Acres of Irrigated Land
as Percent of Land in Farms Acreage: 2007
Percent
Less than 1
1 - 4
5 - 9
10 - 24
25 - 39
40 or more
0 100
Miles
United States
6.1 Percent
0 100
Miles
07-M082
U.S. Department of Agriculture, National Agricultural Statistics Service

Irrigated Land – Change in Acreage: 2002 - 2007



Data from USDA NASS, 2007

Western Food Production and Water

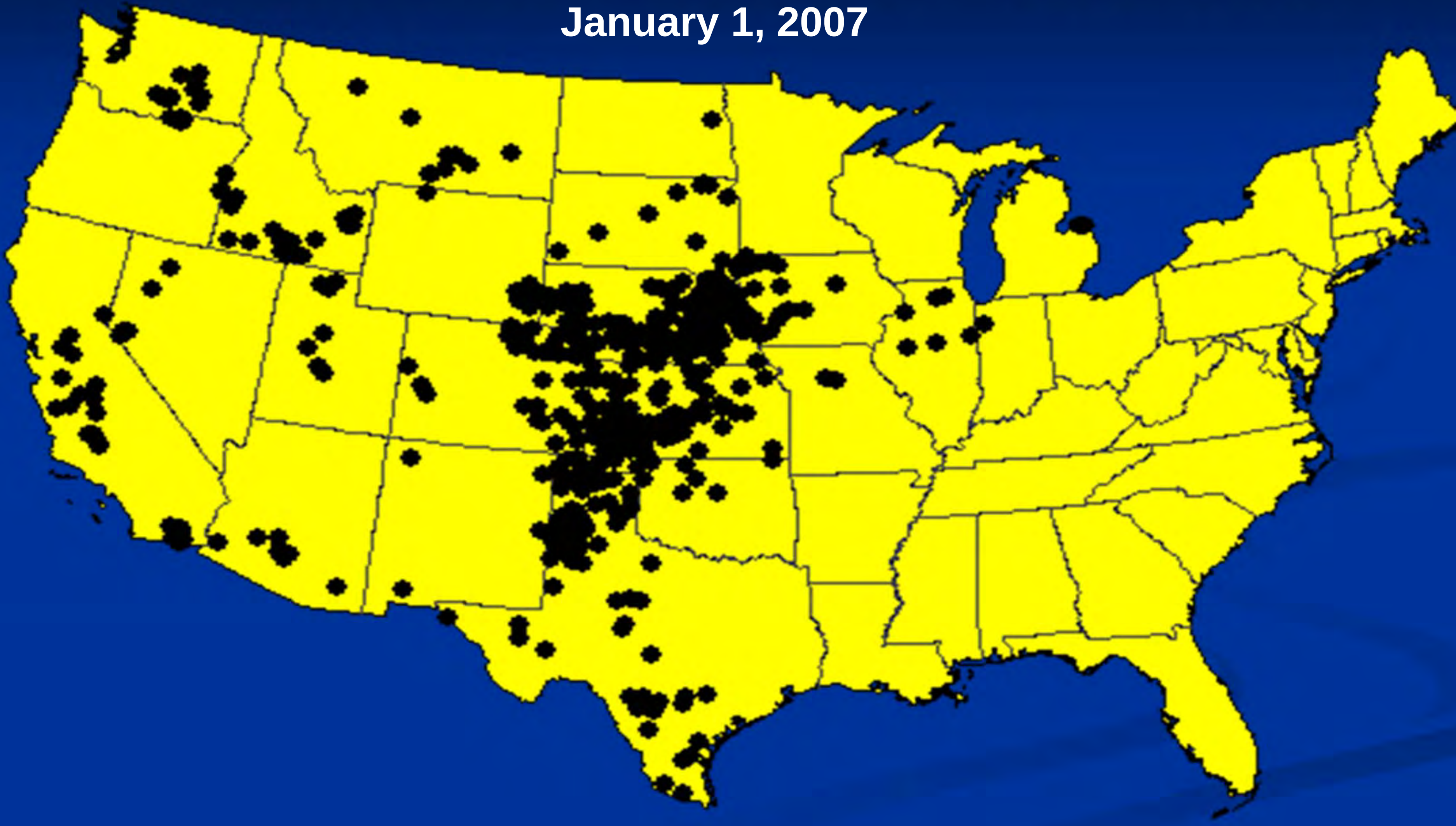
Four scenarios for us to ponder…

First Scenario: High Plains (Ogallala) Aquifer

- **174,000 sq. mi area of 8 states**
- **14 million irrigated acres**
- **165,000 irrigation wells**
- **~25% of U.S. irrigated lands**

United States Feedyards > 4,000 Head

January 1, 2007

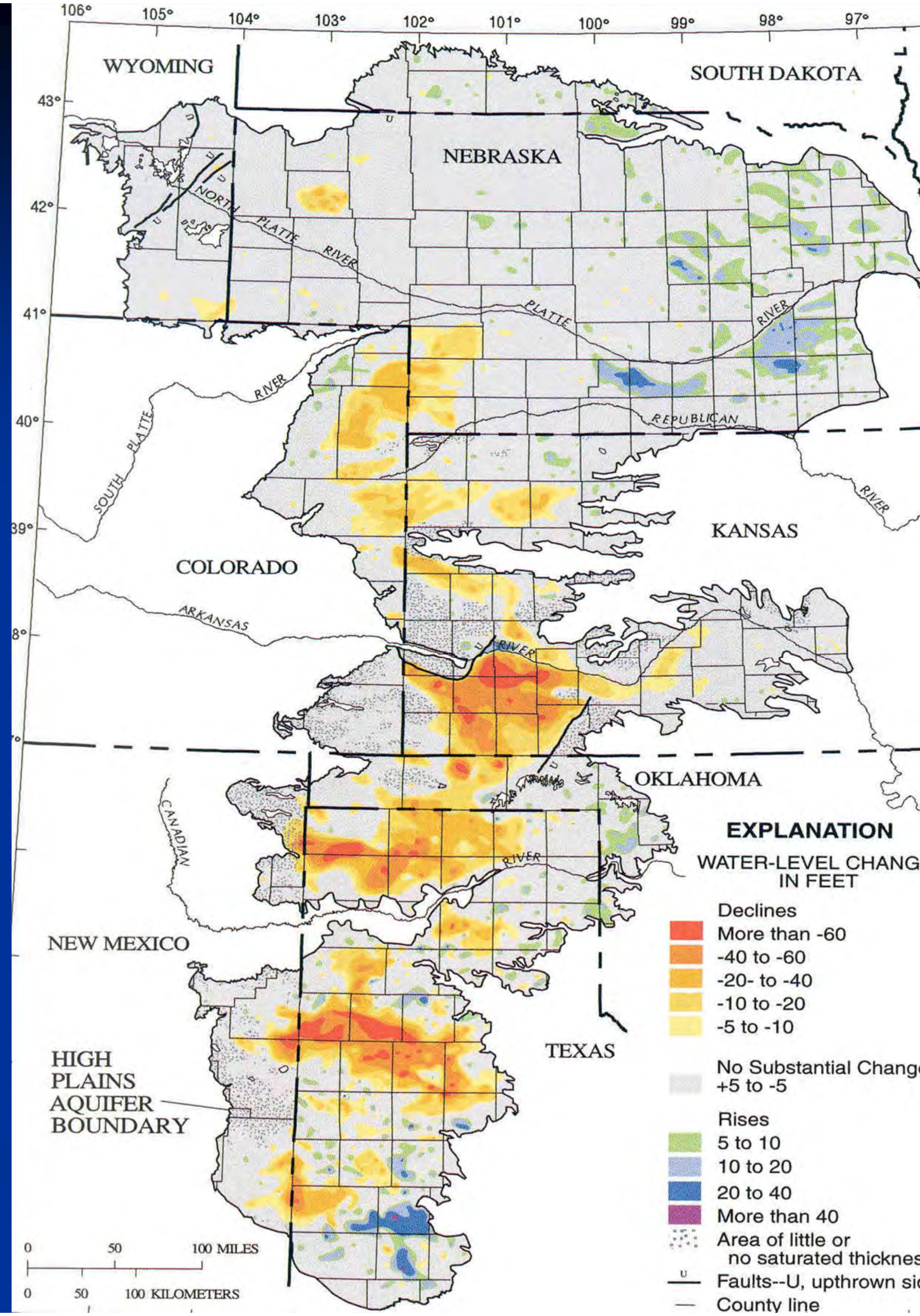


Water level changes in the HP Aquifer, 1980 – 2002

Aquifer contained ~3.27 Billion acre feet of water in 1990

Estimated depletion of 235 million acre feet

8% of total aquifer volume depleted

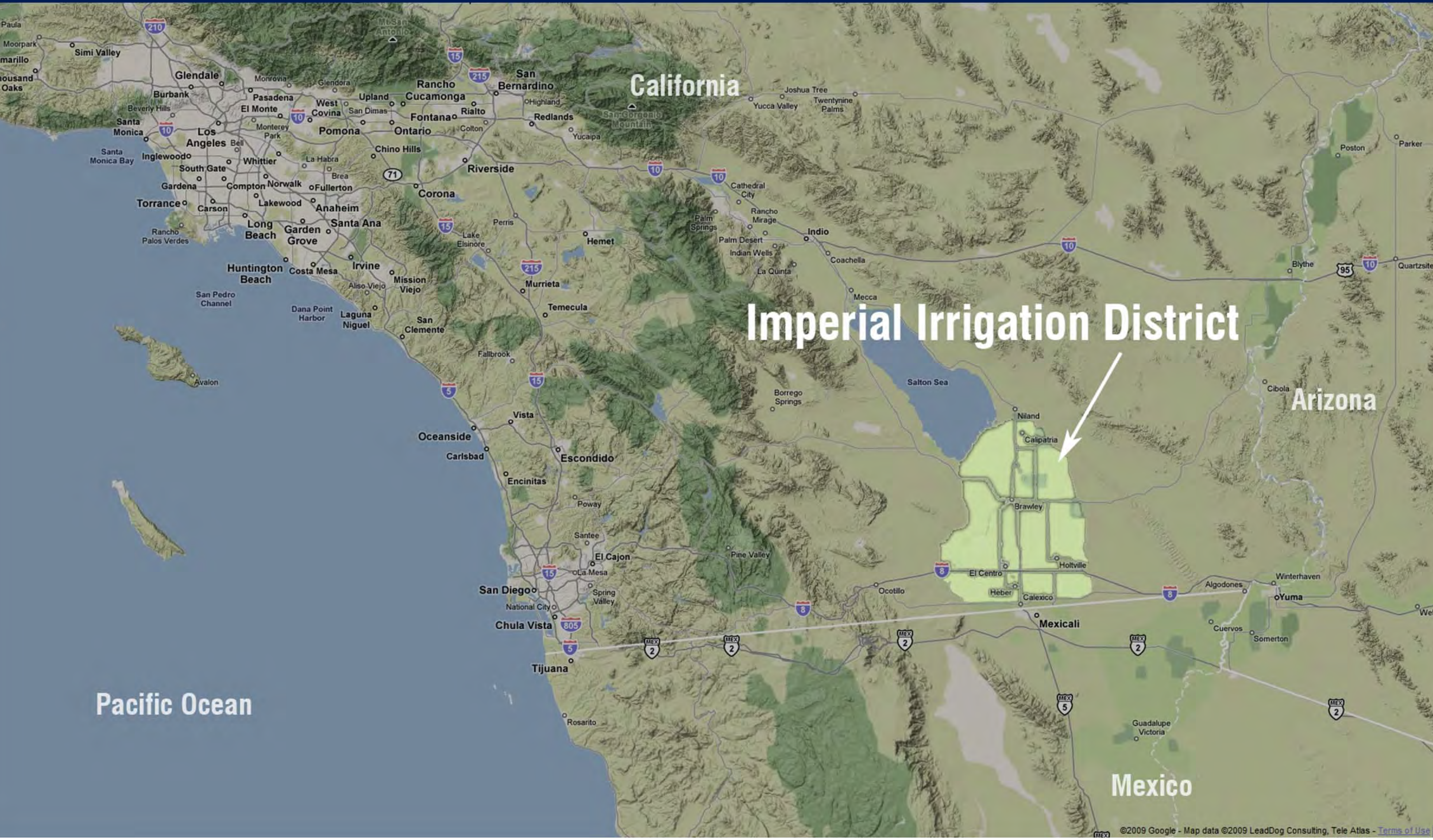



SD
Sioux Falls
Missouri River
NE
WY
North Platte River
IA
Omaha
Platte River
Lincoln
CO
South Platte River
Denver
Lakewood
Aurora
Republican River
Colorado Springs
Kansas City
Kansas River
Topeka
Overland Park
Independence
Arkansas River
KS
Wichita
Cimarron River
Tulsa
Albuquerque
Canadian River
Oklahoma City
Amarillo
OK
Red River
Pecos River
Lubbock
Plano
Irving
Garland
Fort Worth
Mesquite
Arlington
Dallas
NM
Abilene
El Paso
TX
Waco

Conflicts over use of groundwater are increasing

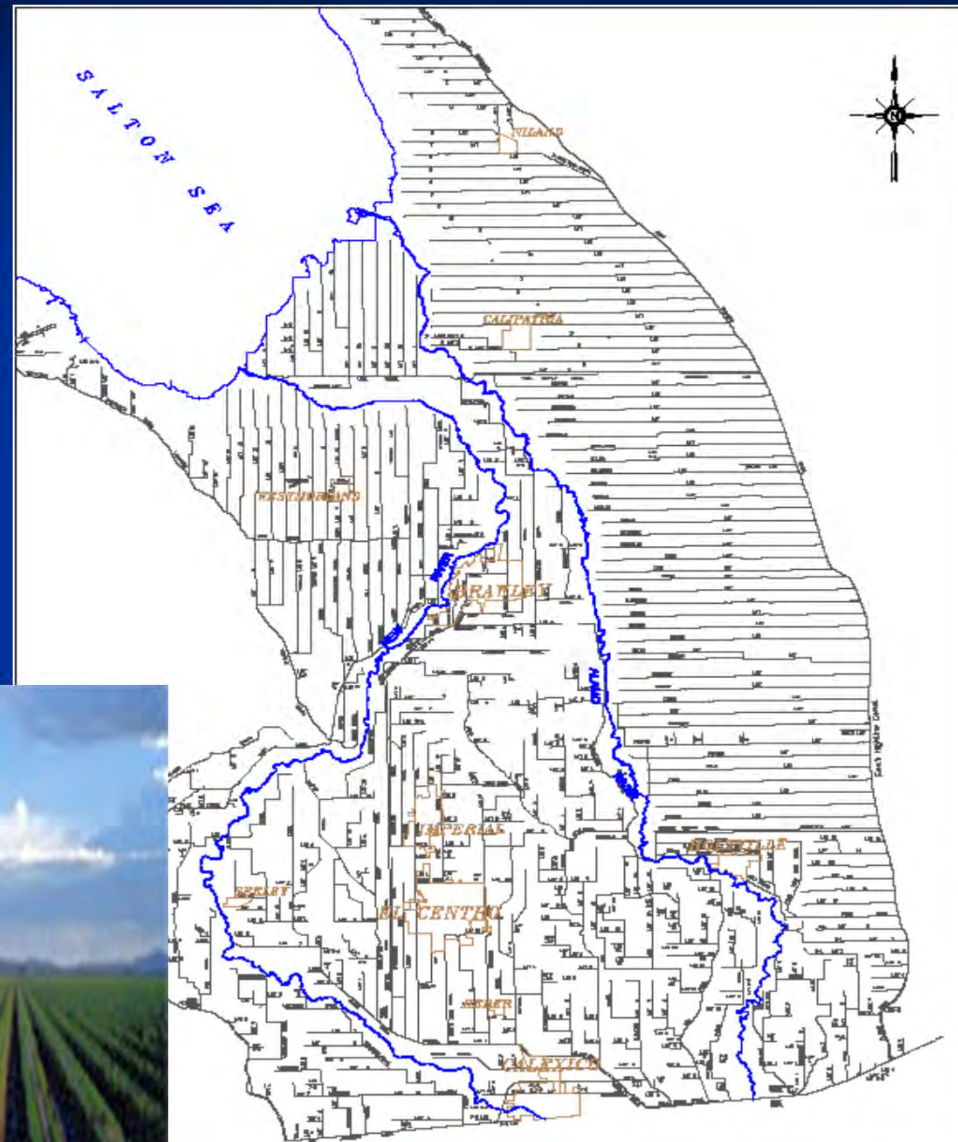
- Groundwater use is affected by both legal and physical constraints
- Reliance on nonrenewable groundwater raises serious reliability and sustainability concerns

Second Scenario: Imperial Valley, CA



Imperial Irrigation District

- 1,442 miles of lateral irrigation canals
- 148 miles of main delivery canals
- **Imperial Valley Commodity Total $1,684,522,000**



IID's Water Conservation and Transfer Programs

- Metropolitan Water District
  - 105,000 acre feet per year
  - 35 years
  - Cost Based – Facilities construction, operation and maintenance
- San Diego County Water Authority
  - 303,000 acre feet per year
  - Up to 75 years
  - Market Based – Value of water

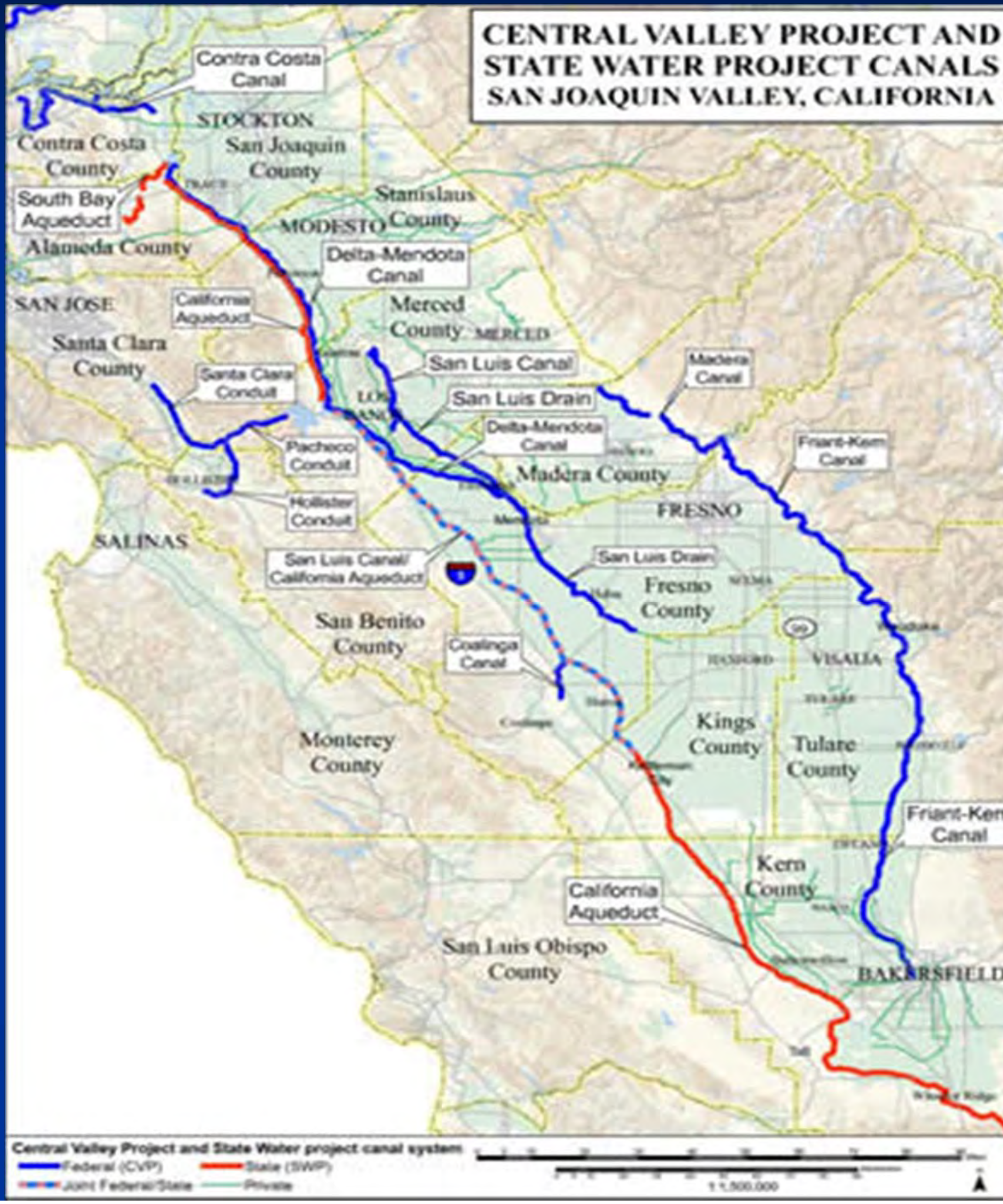
Third Scenario:

Bay Delta and the Central Valley

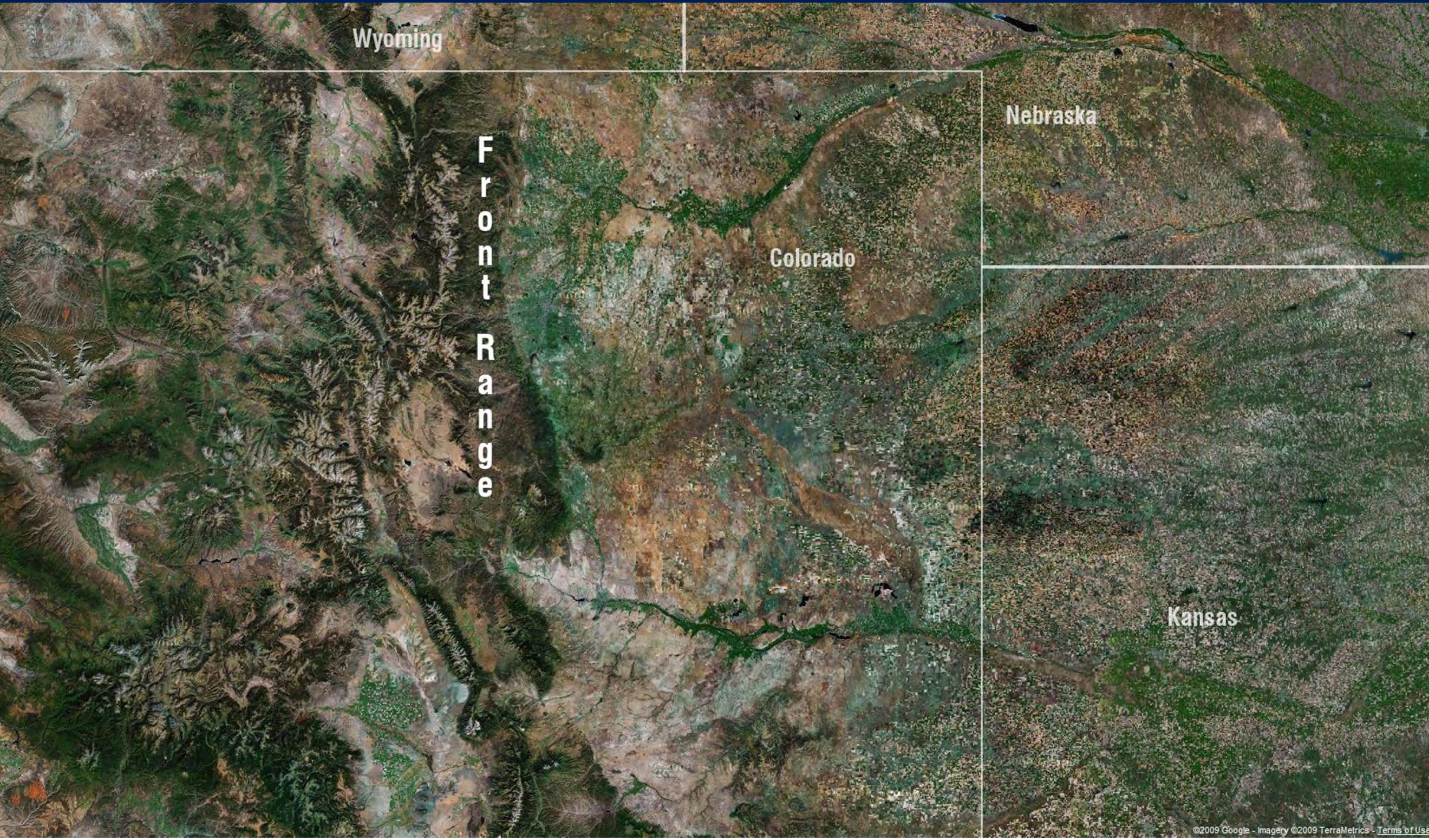
California's Central Valley Project

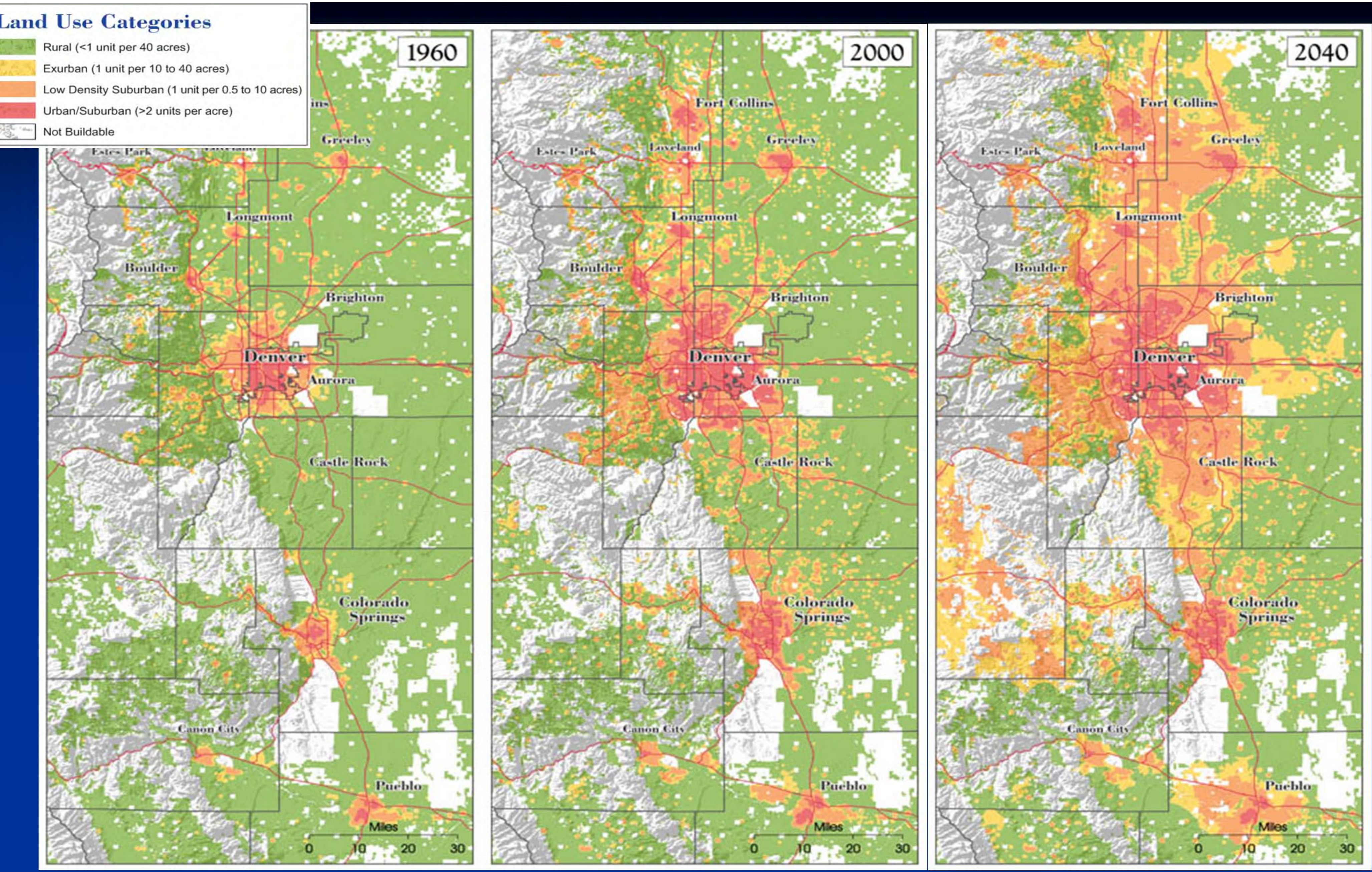
Provides about 5 MAF for farms -- enough to irrigate about 3 million acres Large fraction of domestic vegetables are grown here.

In 2009, the US Fish and Wildlife Service imposed restrictions on the US Bureau of Reclamation operations of the project pumps to protect the Delta Smelt, resulting in a 10% allocation to agriculture south of the Delta.



Fourth Scenario: Colorado’s Growing Front Range

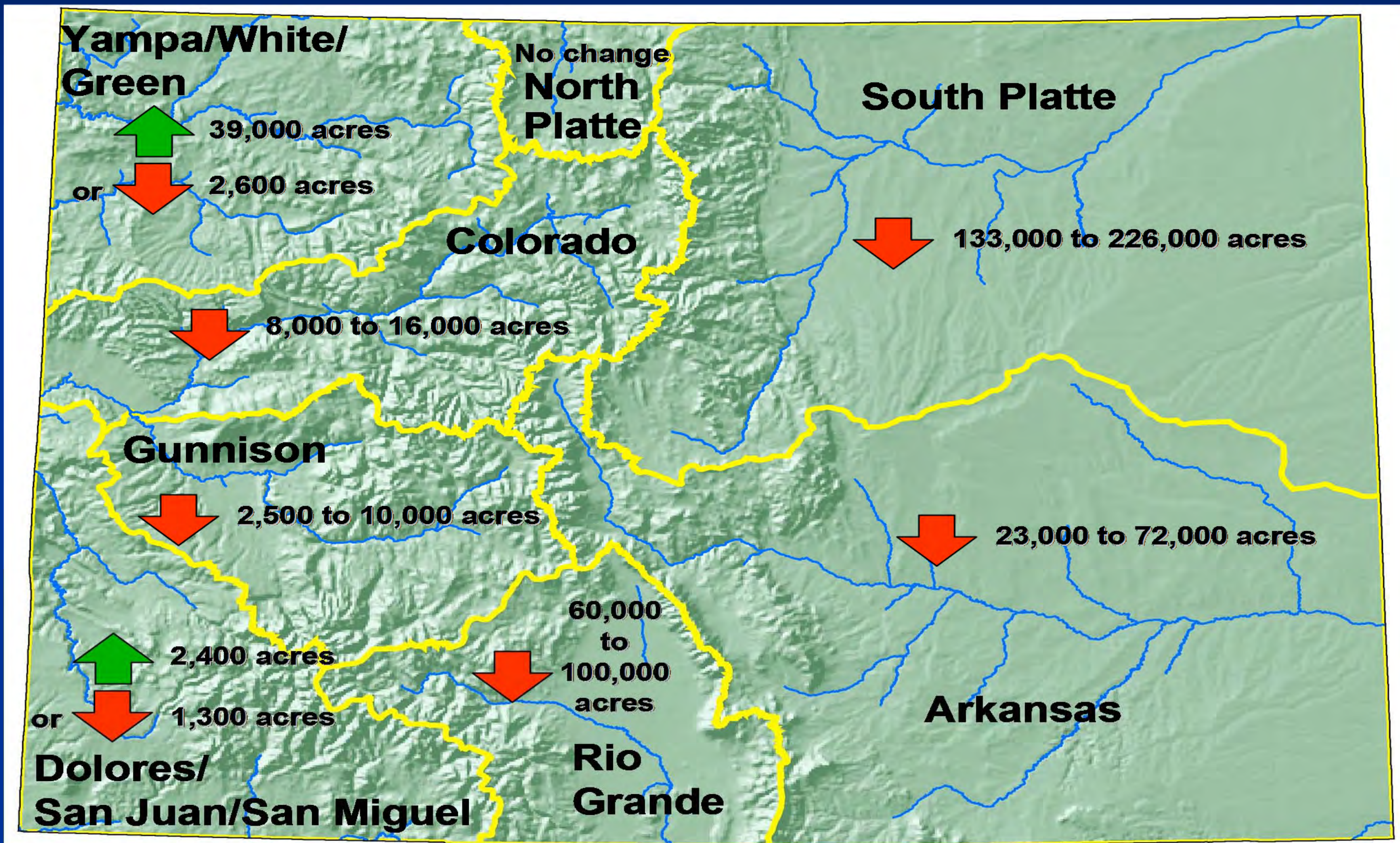




Colorado Front Range – Population expected to double by 2050

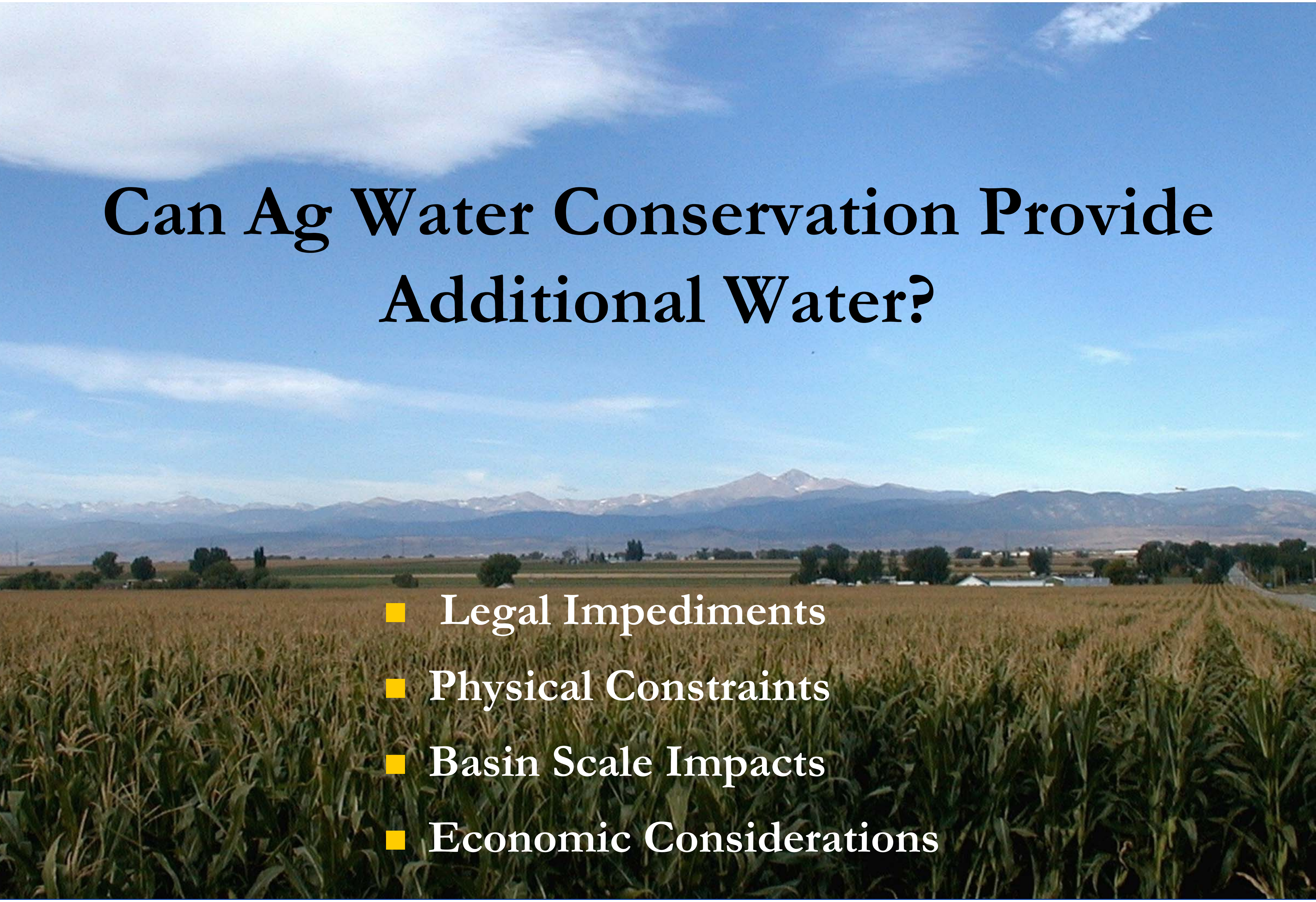
Market Driven Transfers of Agricultural Water to Municipal Use Are Rapidly Occurring

Potential Changes in Irrigated Acres in Colorado, 2005 to 2030



Meeting Colorado's Future Water Supply Needs

Are there viable alternatives to traditional agricultural water transfers?


Can Ag Water Conservation Provide Additional Water?
Legal Impediments
Physical Constraints
Basin Scale Impacts
Economic Considerations

Producer Responses to Reduced Water Availability

- ✓ Rotational and split cropping with dryland crops or fallow;
- ✓ Limited irrigation; Partial season irrigation
- ✓ Shift to sunflowers, sorghum, wheat, forage crops
- ✓ Higher level of scheduling and water management
- ✓ Reduced tillage; Re-nozzle and remove pivot end guns
- ✓ Use of EQIP and other federal farm programs

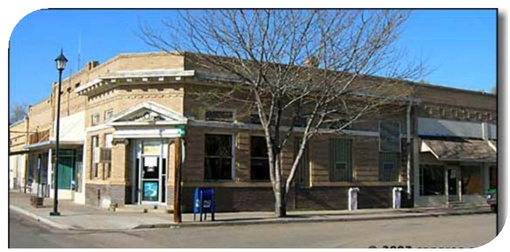
We must increase food productivity using less water and reduce Ag's footprint on water by:

- developing new crop varieties and cropping systems
- developing ag enterprises that are resilient to uncertain water supplies and drought
- transitioning to dryland and limited irrigation strategies
- minimizing transport and maximizing assimilation of wastes
- developing decision tools to increase flexibility, reduce risk, increase profitability (climate/water/energy)
- improving agricultural water management institutions, policies and organizations

Economic Impact of Agriculture







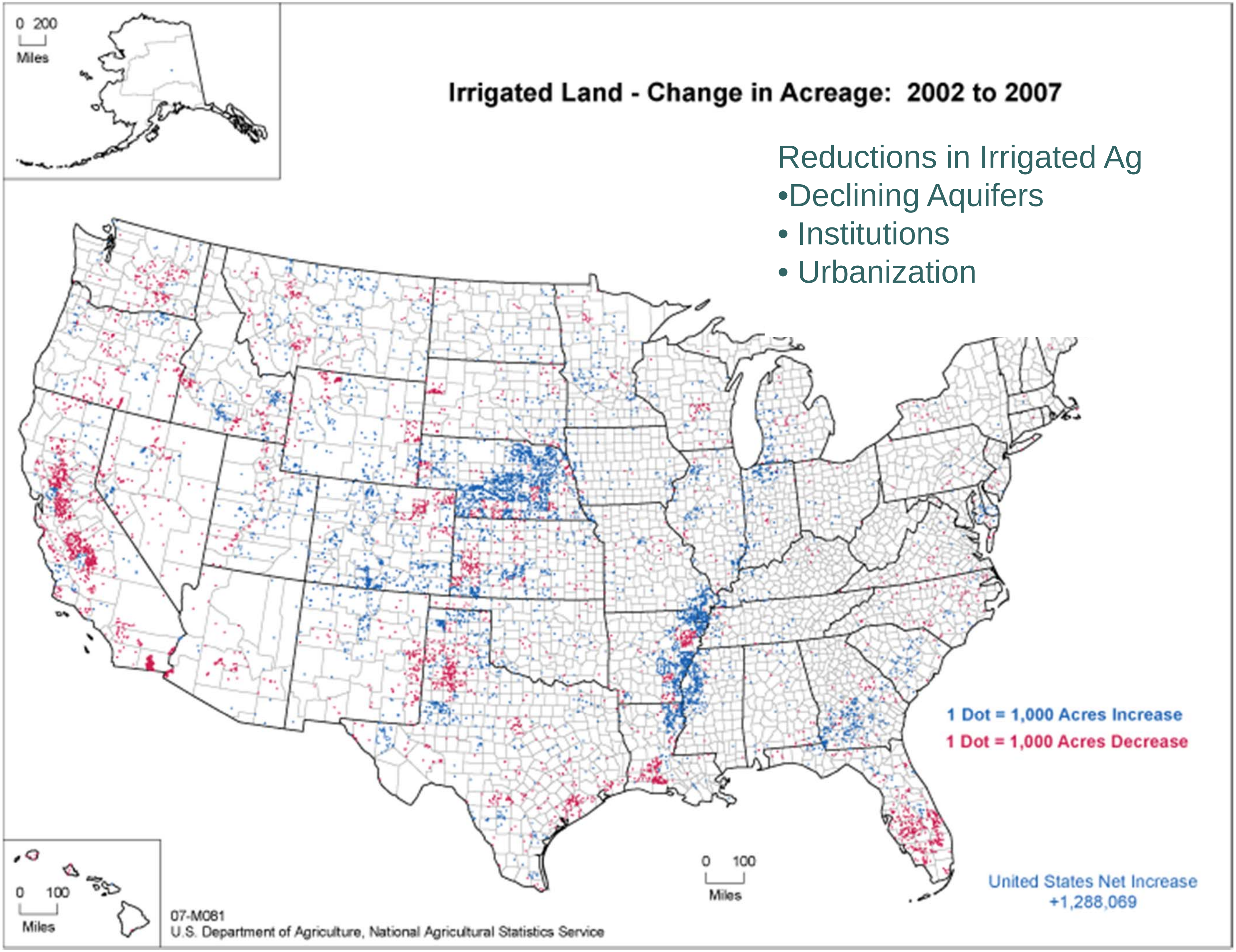

2011 ESS/SAES/ARD Meeting
Estes Park, CO
27 September 2011

James Pritchett
Agricultural and Resource Economics
Colorado State University
James.Pritchett@ColoState.edu

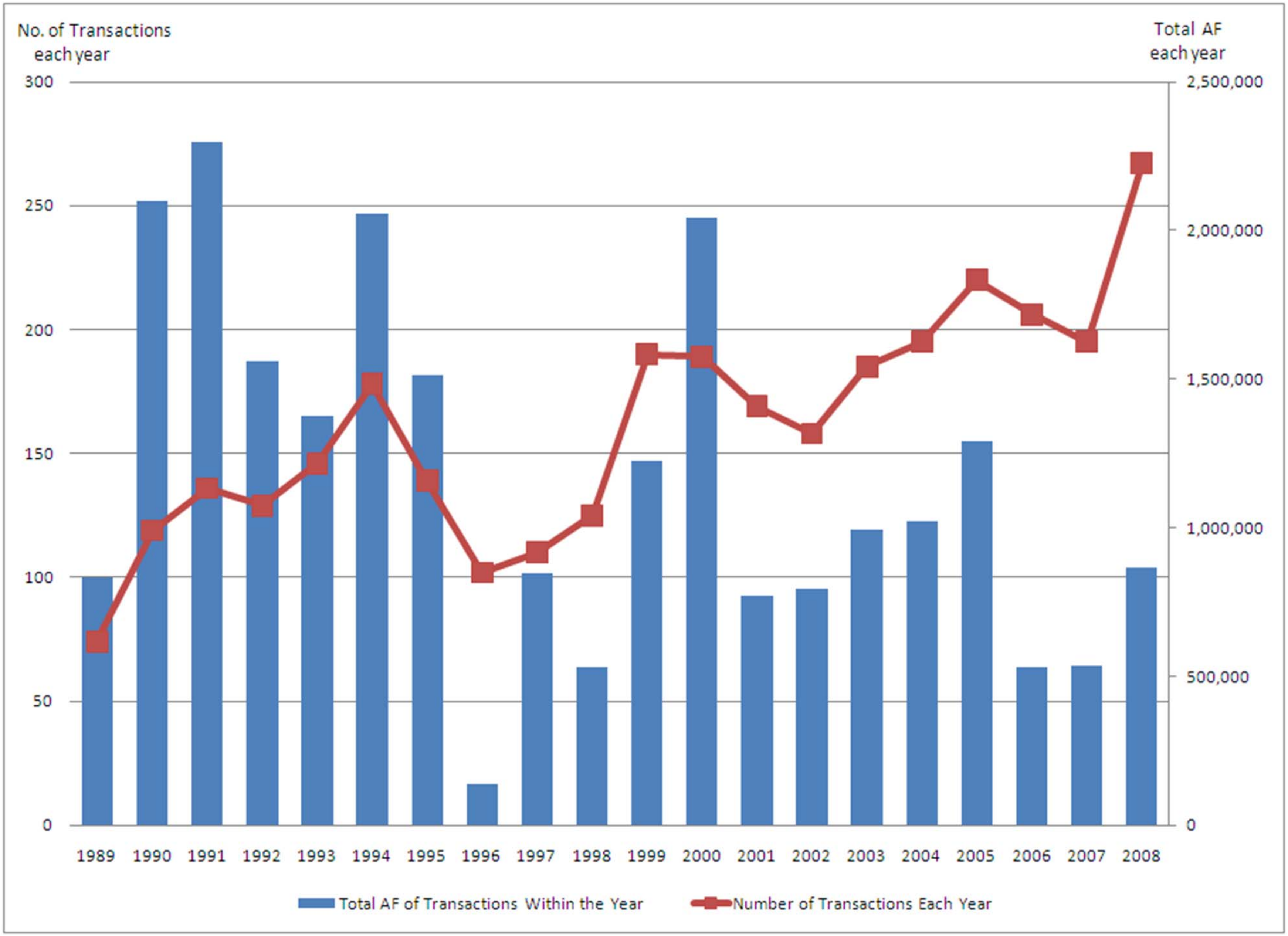
A Windshield Tour …

- Regional Economics:
  - What does irrigated agriculture mean to rural communities?
- Urban Households:
  - What do the rate payers want?
- Farm Level Economics
  - What are some innovative approaches?

Reductions in Irrigated Ag
•Declining Aquifers
• Institutions
• Urbanization



Agriculture to Urban Water Transfers are Increasing …



Economic Activity per Acre

Region	*Farm Gate Receipts Relative to Regional Sales*[a]	*Economic Activity Generated per Acre of Irrigated Cropland*	*Representative Cropping Pattern*
Arkansas	31 %	$428	Forages
Republican	37 %	$678	Continuous Corn - Alfalfa
Rio Grande	48 %	$1,127	Potatoes - Barley
South Platte	2 %	$690	Corn – Alfalfa – Sugar Beets

[a]Includes all production agriculture.

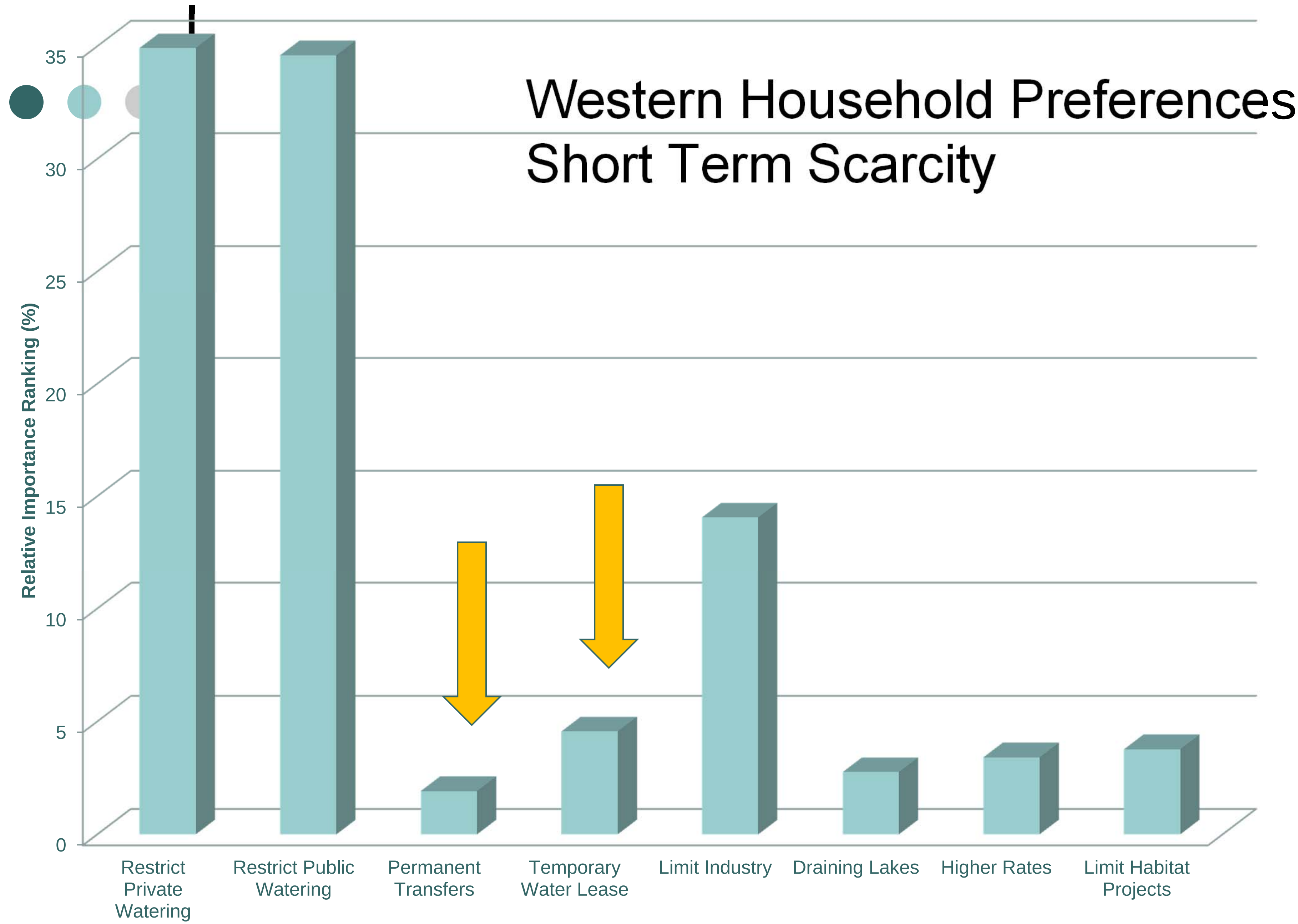
Economic Activity: Irrigated Agriculture

Region	Economic Activity ($/ac)
Arkansas	$428
Republican	$678
Rio Grande	$1,127
South Platte	$690

- Direct Activity
  - Crop Sales (Gross Revenues)
- Indirect Effects
  - Fertilizer, Seed, Chemical Sales (but margins only)
  - Transportation
  - Real Estate Services
  - Ag Consultants
- Induced Effects
  - Wages Spent with Local Businesses
- When is generated economic activity high?
  - High value crops sold outside the region.
  - Revenues spent on locally produced inputs.
  - Local support industries use local labor and inputs.

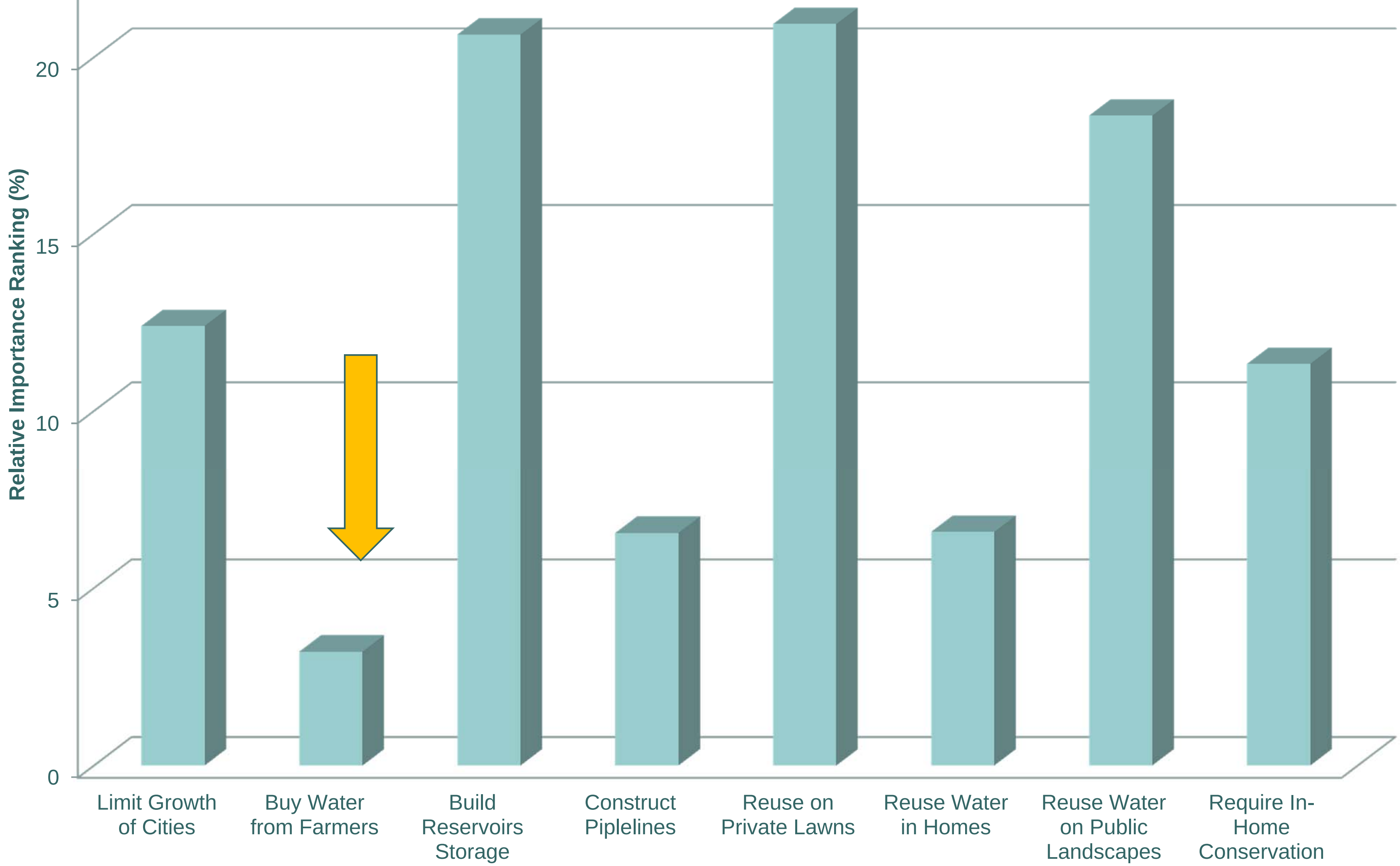
The Demand Side of the Equation: What Do Households Want?

- What are municipal households' perceptions of scarcity and water use in the West?
- What strategies do households rank as the "best" when setting priorities for meeting future needs?
- What are households willing to pay for?


Western Household Preferences
Short Term Scarcity
Relative Importance Ranking (%)
0
5
10
15
20
25
30
35
Restrict Private Watering
Restrict Public Watering
Permanent Transfers
Temporary Water Lease
Limit Industry
Draining Lakes
Higher Rates
Limit Habitat Projects

Western Household Preferences
Long Term Needs

WTP = $16/month
in summer



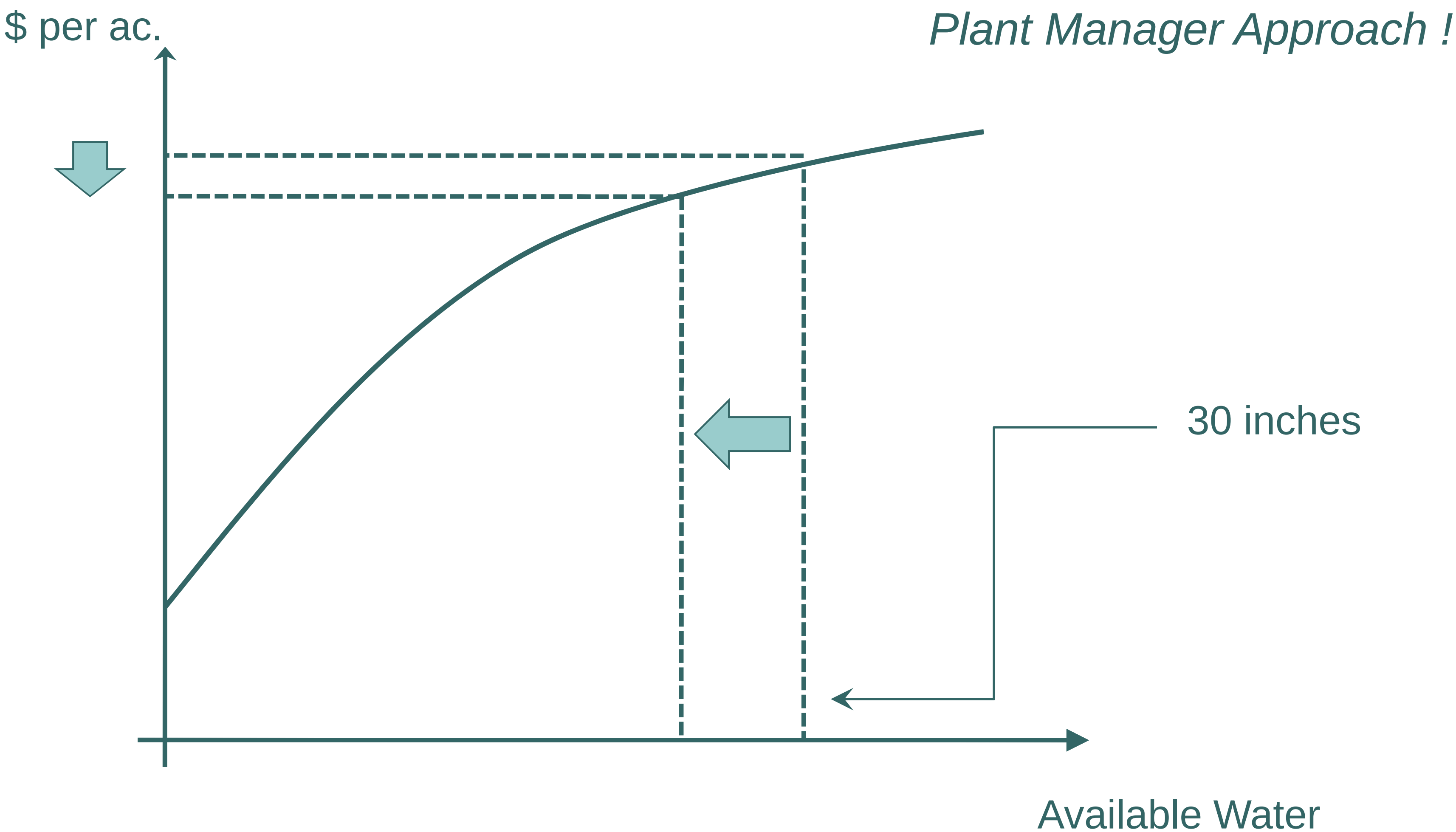
Farm Level Economics
General vs. Plant Managers

The difference between doing things Right

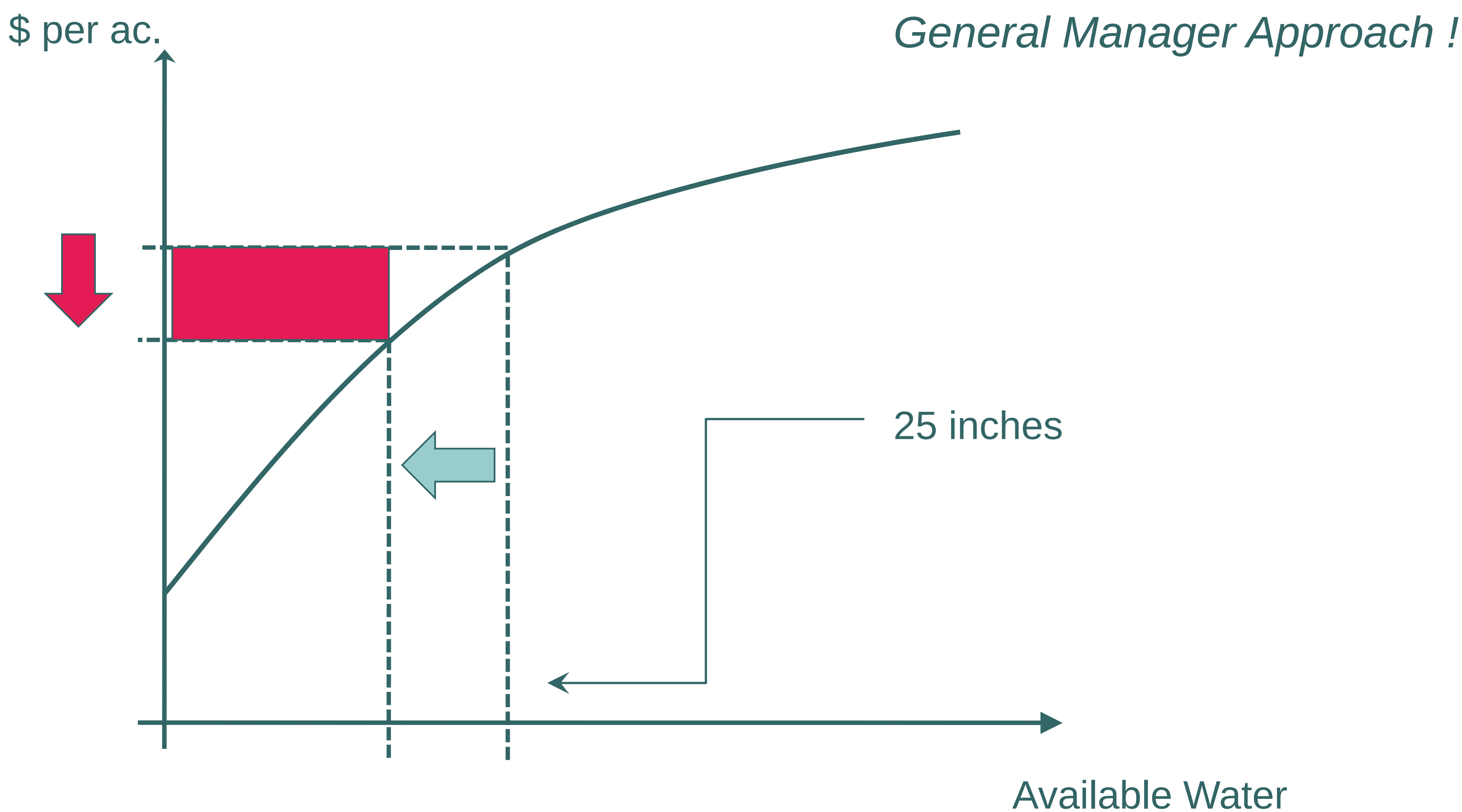
&

Doing the Right things ….

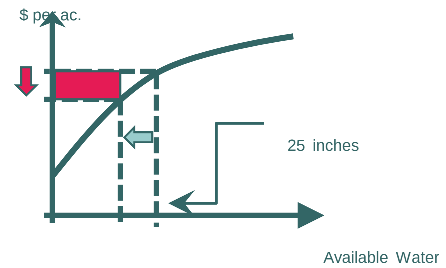
Profit & Water: Specific to the Operation



Profit & Water: Specific to the Operation



Profit and Water: General Manager Approach



Reduced Water <u>Challenges</u>

- Scale of Operation
  - Turns (asset efficiency)
  - Earns (cost efficiency)
- Financial Limitations
  - Cash Flow
  - Balance Sheet
- Operational Risk

Reduced Water <u>Opportunities</u>

- Opportunistic Farming
  - System Approaches
  - "Spreading" Water
  - Time Specific Management
  - Transition to Perennials
- Water as a Crop

Farmers and Future Water Supplies

Are farmers willing to do something other than buy and dry?

Innovative Approaches

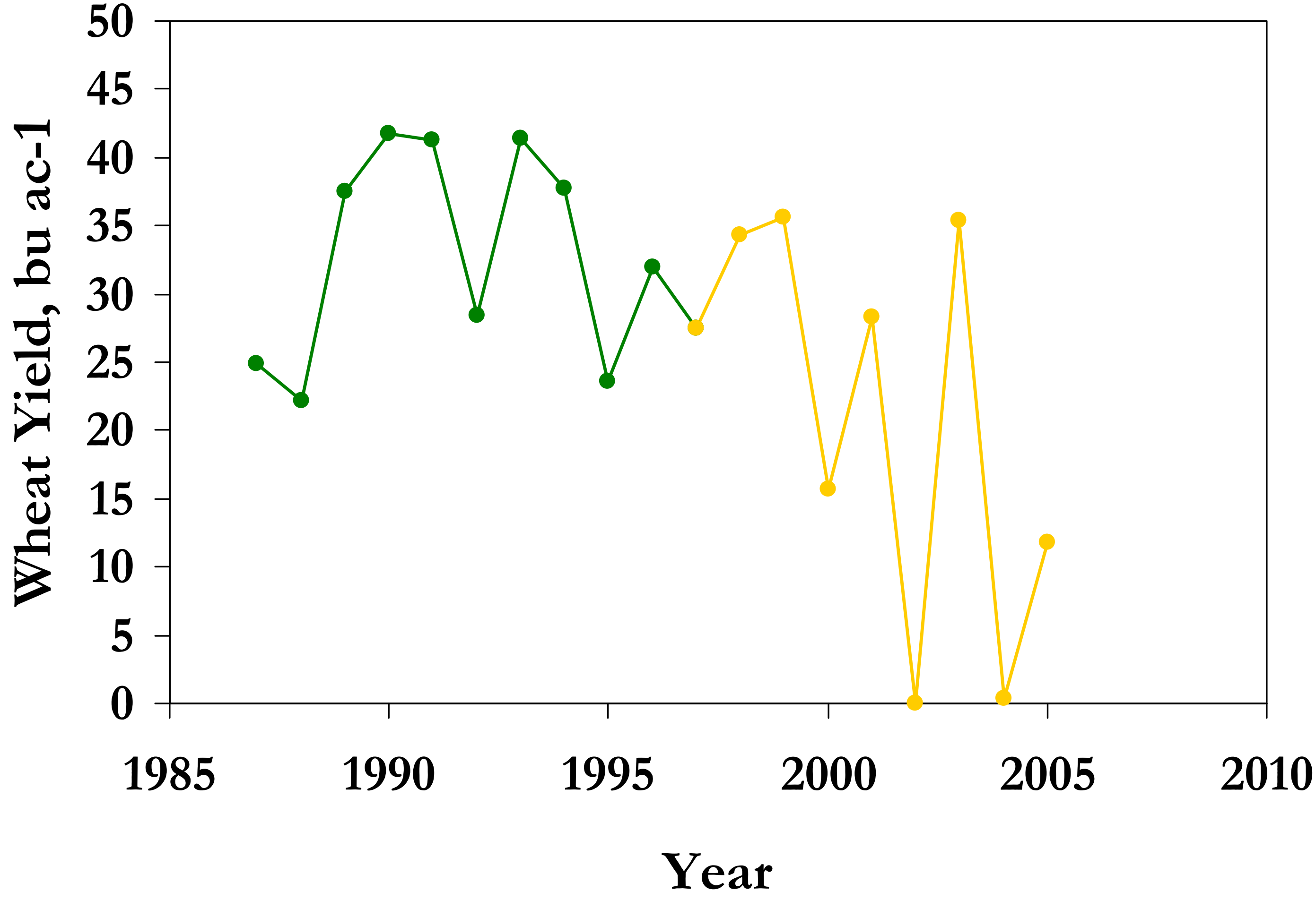
- Farm Conservation of CU
  - Deficit Irrigation and Dryland Rotation
- Innovative Institutions
  - LSP Water Cooperative
  - ‘Super Ditch’ in the Arkansas Valley
- Shared Infrastructure and Institutions
  - ‘One Stop Shopping’ for Projects
  - Economic Development Zones
  - Water Basin Approaches

Dryland Cropping in Colorado

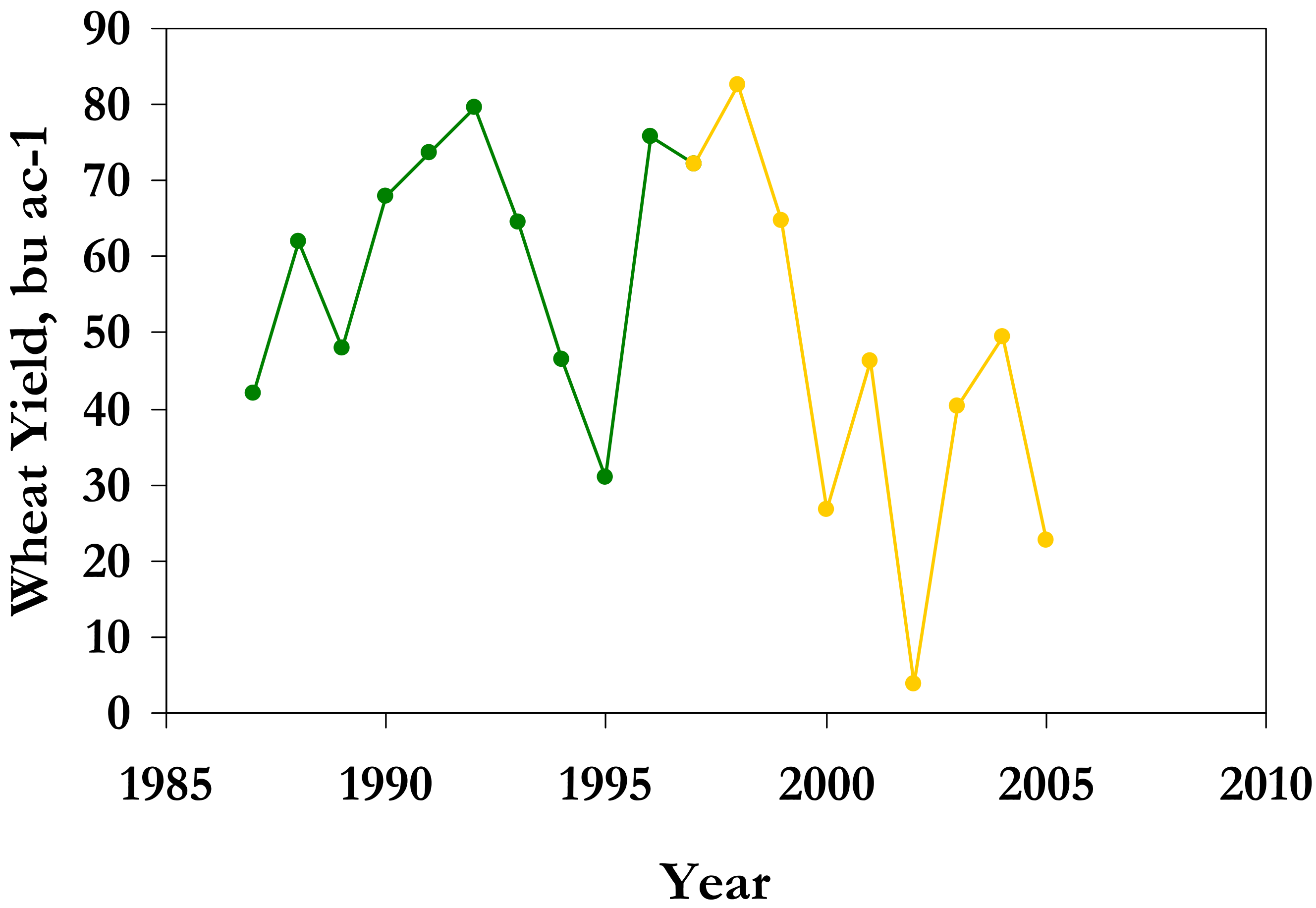
Dryland Farming in Colorado

Dryland Farming in Colorado

Variability of Dryland Wheat Yield



Variability of Dryland Corn Yield



Irrigated Cropping Systems

Irrigated Cropping Systems
Colorado Western Slope

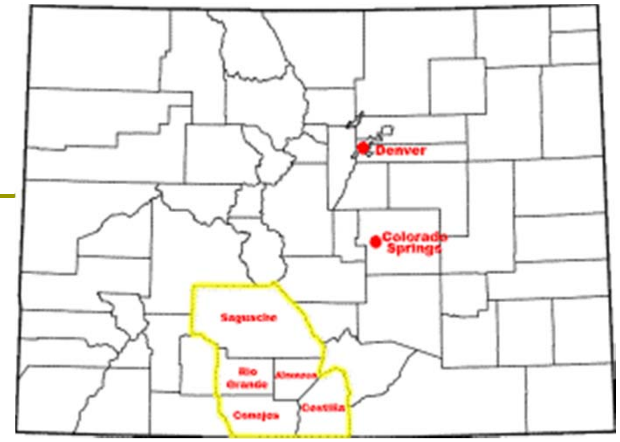
Wilson Farms – Olathe, CO

Onions

Sweet Corn

Dry Beans


Master



Heersink Farm and Ranch

San Luis Valley

Potatoes

Alfalfa

Barley


Columbia

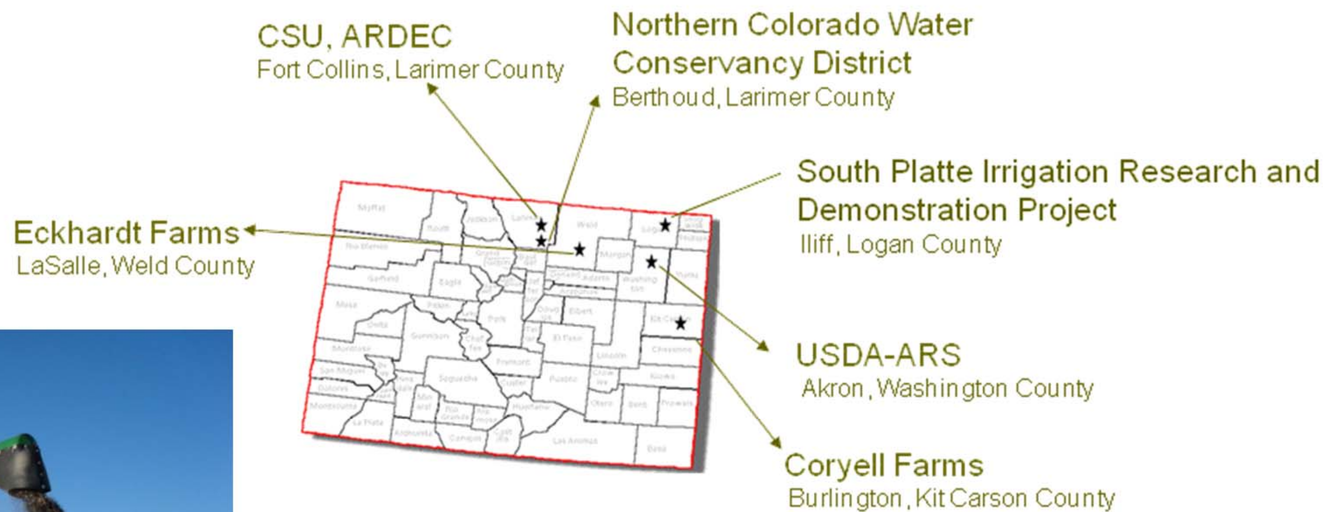
Alan and Randy Gerk
South Platte River Basin

Corn
Alfalfa
Sugarbeets


4x4

Maintaining Irrigated Agriculture

Field research and demonstrations of water conserving cropping systems.



Example Demonstration Project:
SOUTH PLATTE IRRIGATION RESEARCH AND DEMONSTRATION at Iliff, Colorado

Initiated in 2007 with agricultural and municipal sponsors

Water Conserving Cropping Systems

- Alternative crop rotations
- Limited irrigation
- Partial Season Irrigation

Alternative Crop Rotations

Traditional Irrigated Crops	Irrigation	ET
	----(in)----	
Corn	17	24
Alfalfa	22	31

Alternative Crop Rotation	Irrigation	ET
	----(in)----	
Corn	17	24
Soybean	9	19
Wheat	0	12


Alternative Crop Rotations

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	----(in)----	
Corn	17	24
Soybean	9	19
Wheat	0	12

Average Annual ET

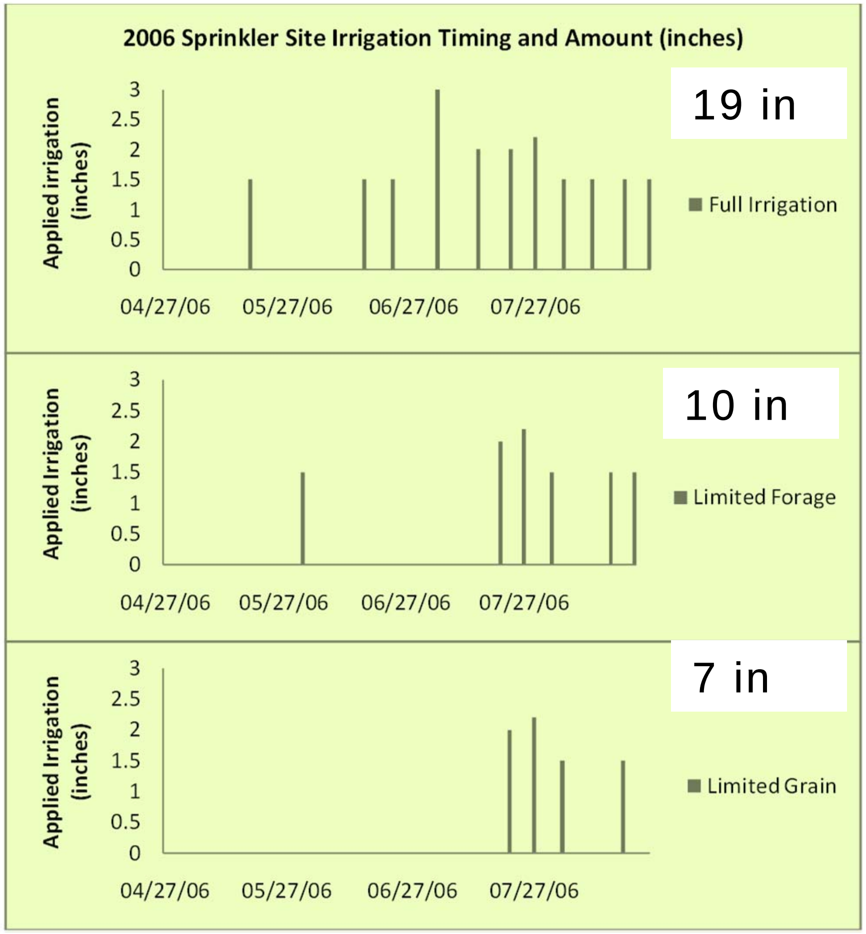
28 in 19 in

Potential for 240,000 gallons/ac of water for transfer to municipal use.

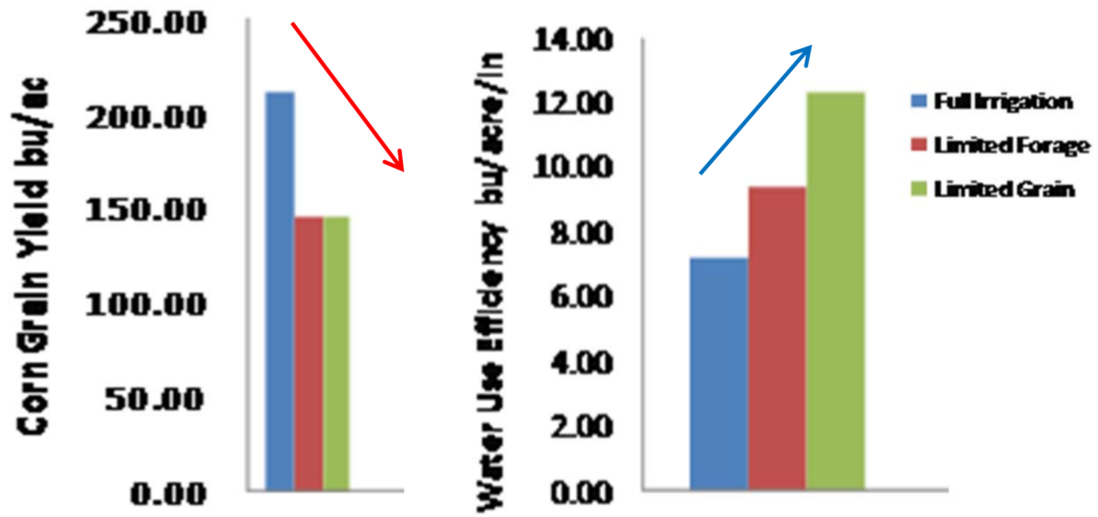
Municipalities to compensate farmers for saved water.

Limited Irrigation Corn

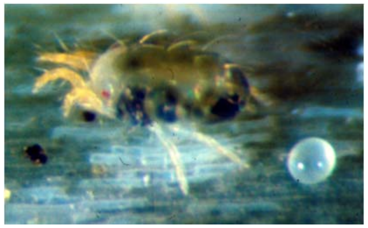
Irrigation amount does not meet full ET demand. Irrigation timed to critical growth stages.



Limited Irrigation for Grain Crops



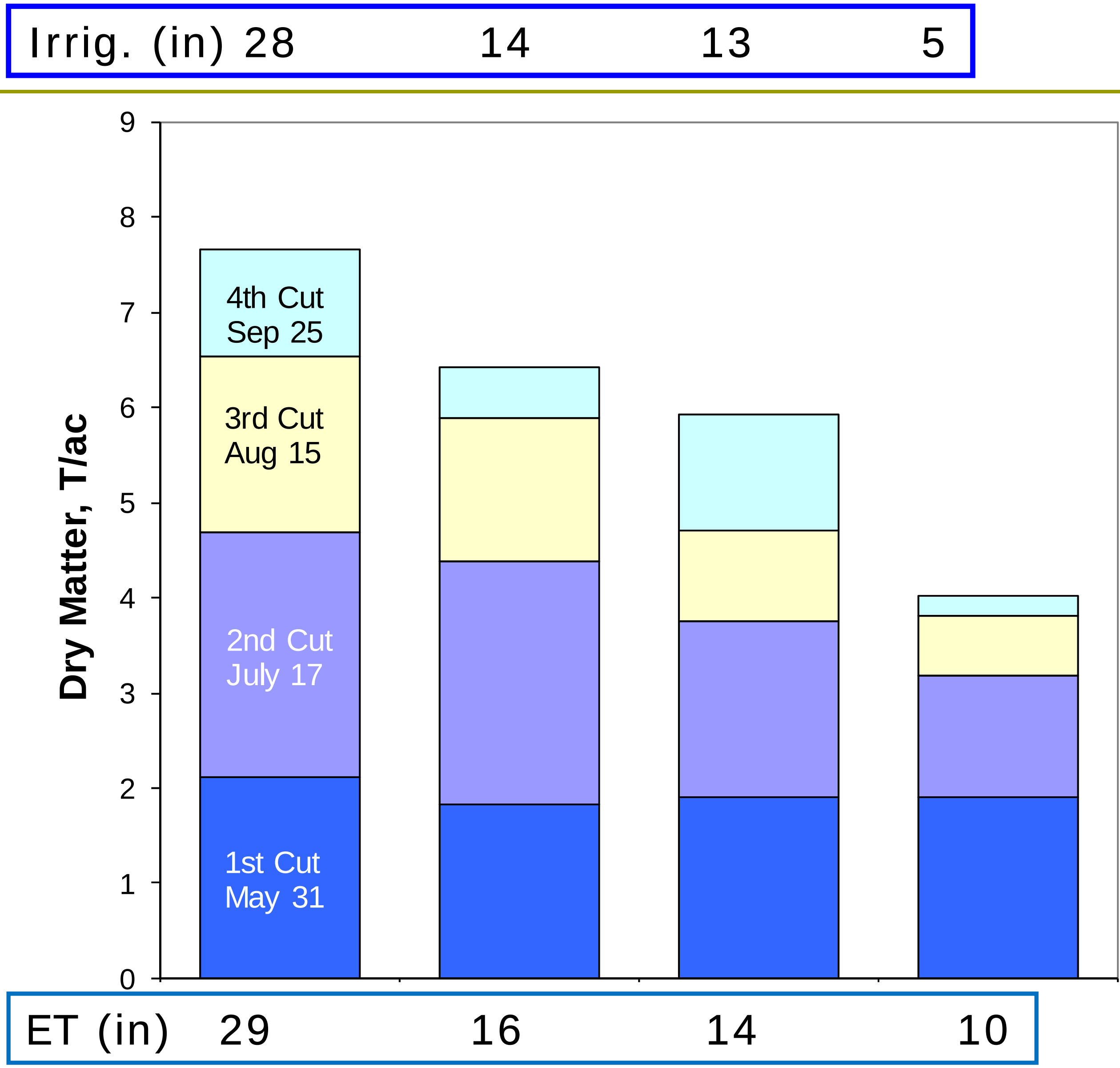
- Agronomic practices change under limited irrigation
  - Input cost management
  - Variety and Hybrid selection
  - Pest Management



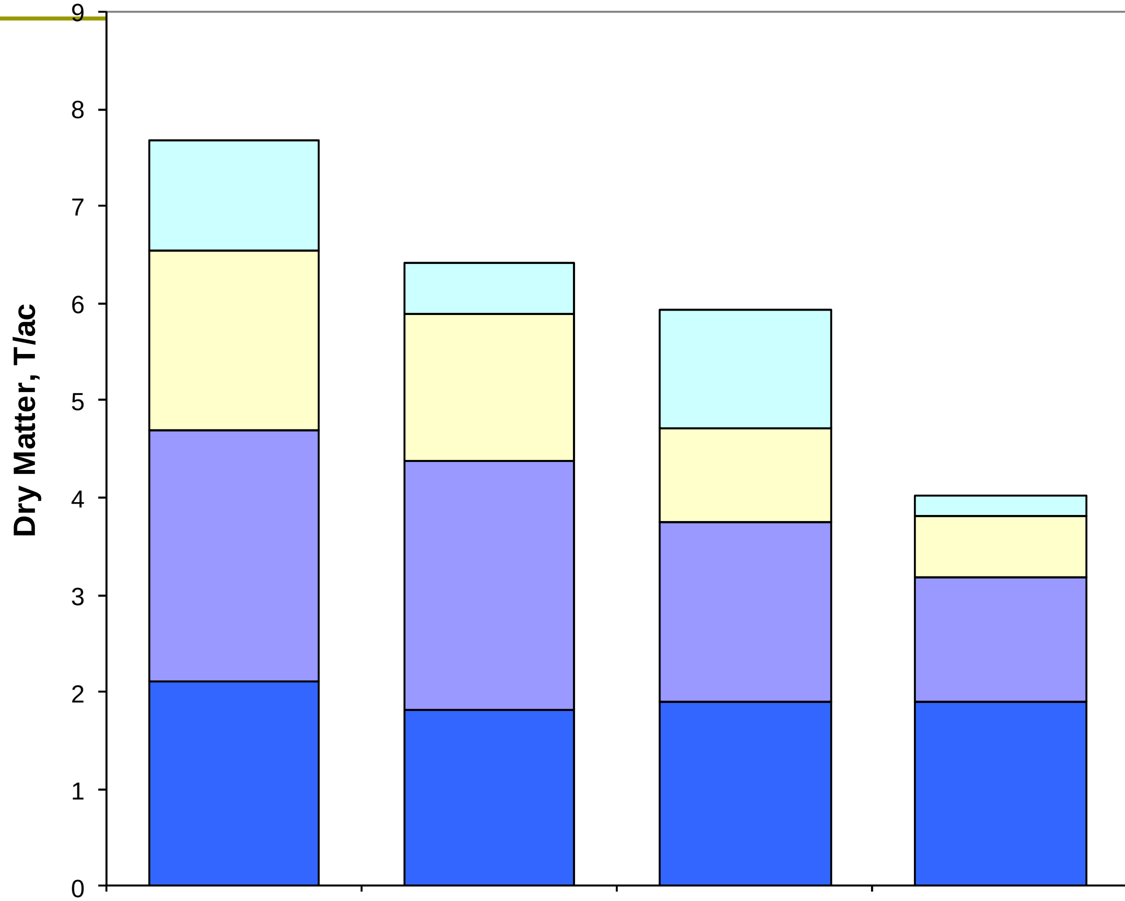
Partial Season Irrigation

- In-season irrigation termination of perennial crops (i.e. alfalfa).

Partial Season Irrigation - Alfalfa

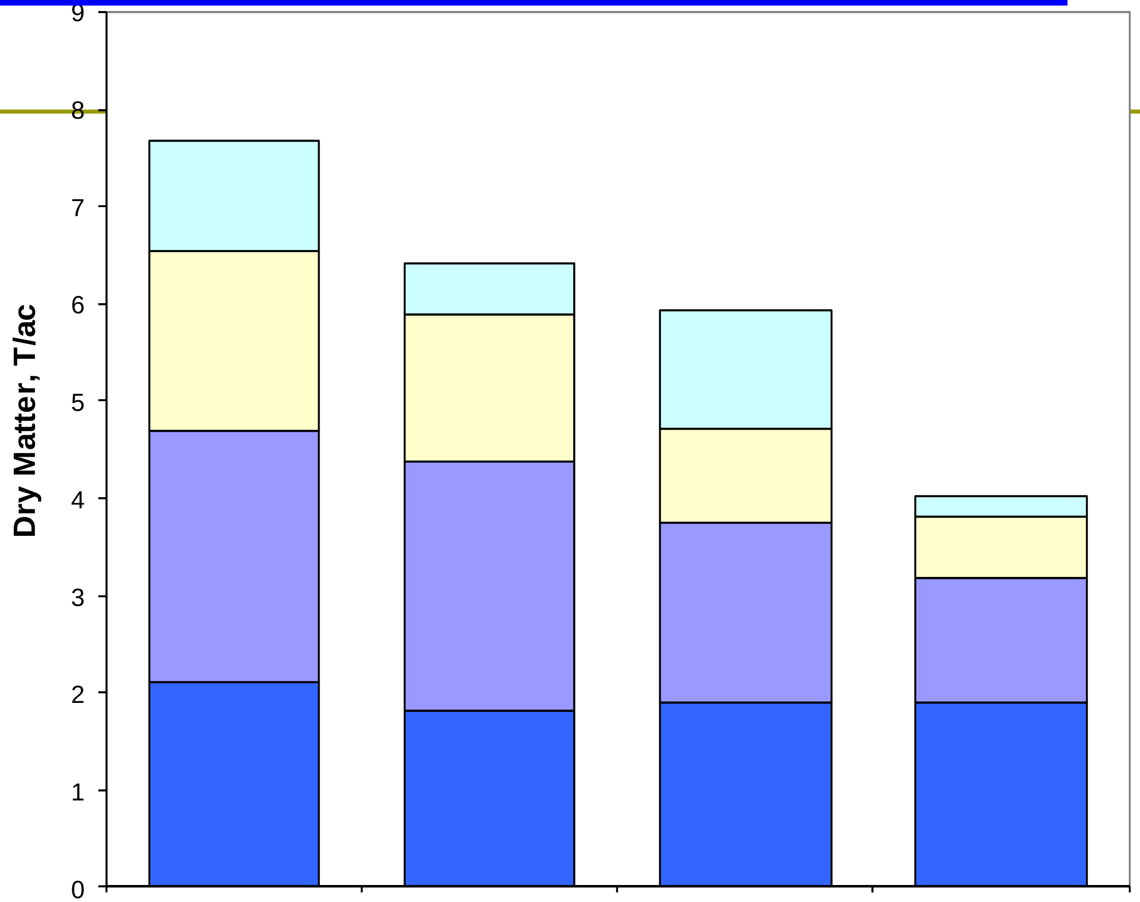


Example Economic Scenario



Income	$838	$722	$726	$490
Costs	593	545	536	474
Return	245	177	190	16

Example Economic Scenario



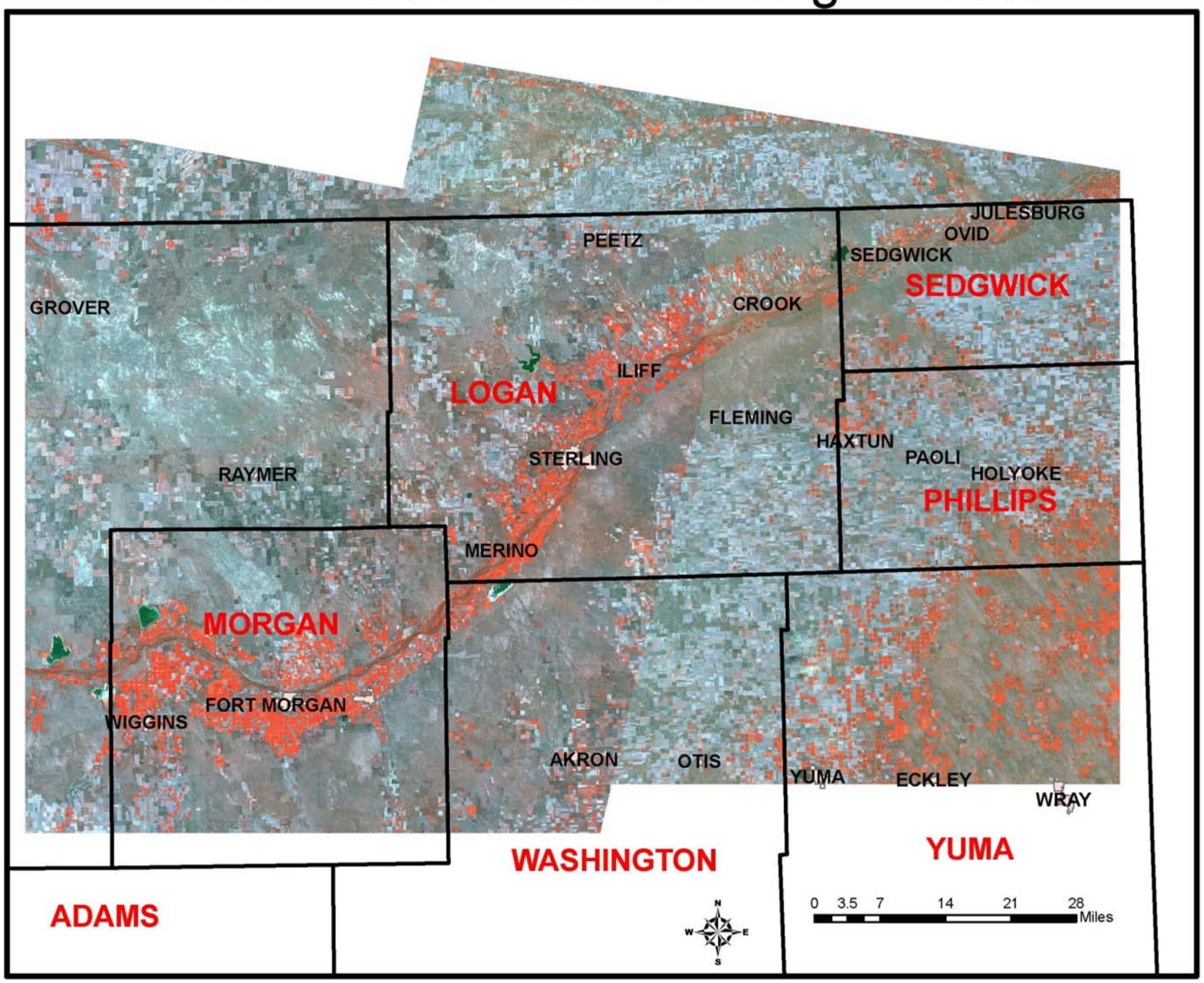
ET$_{saved}$ (in) -- 10 11 16

Potential value of leasing saved water ($250/ac-ft)

-- $220 $230 $345

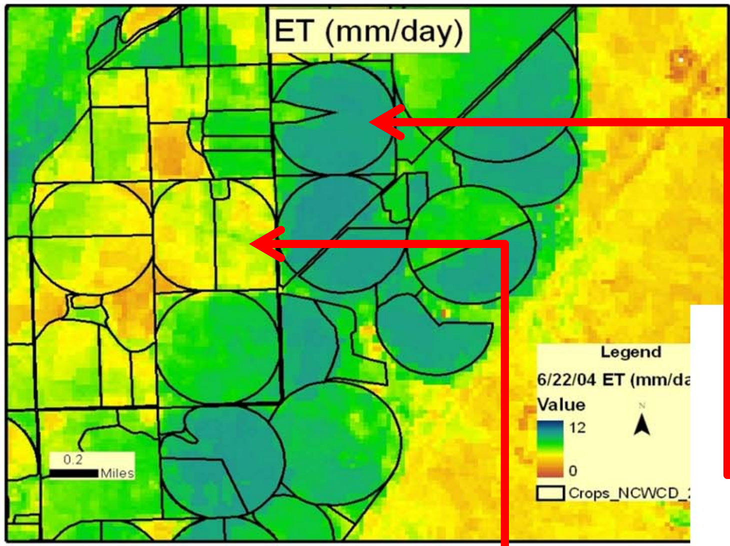
Verification of Saved ET

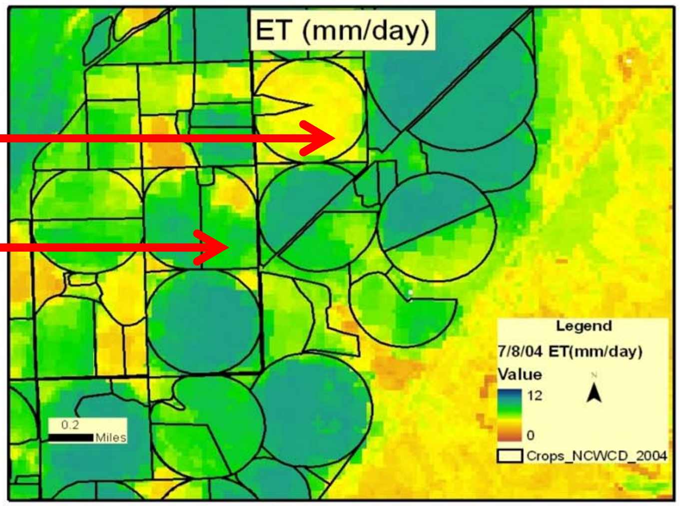
South Platte Remote Sensing ET Area



Estimating ET Using Remote Sensing

CSU Developed ReSET method (Remote Sensing of ET)





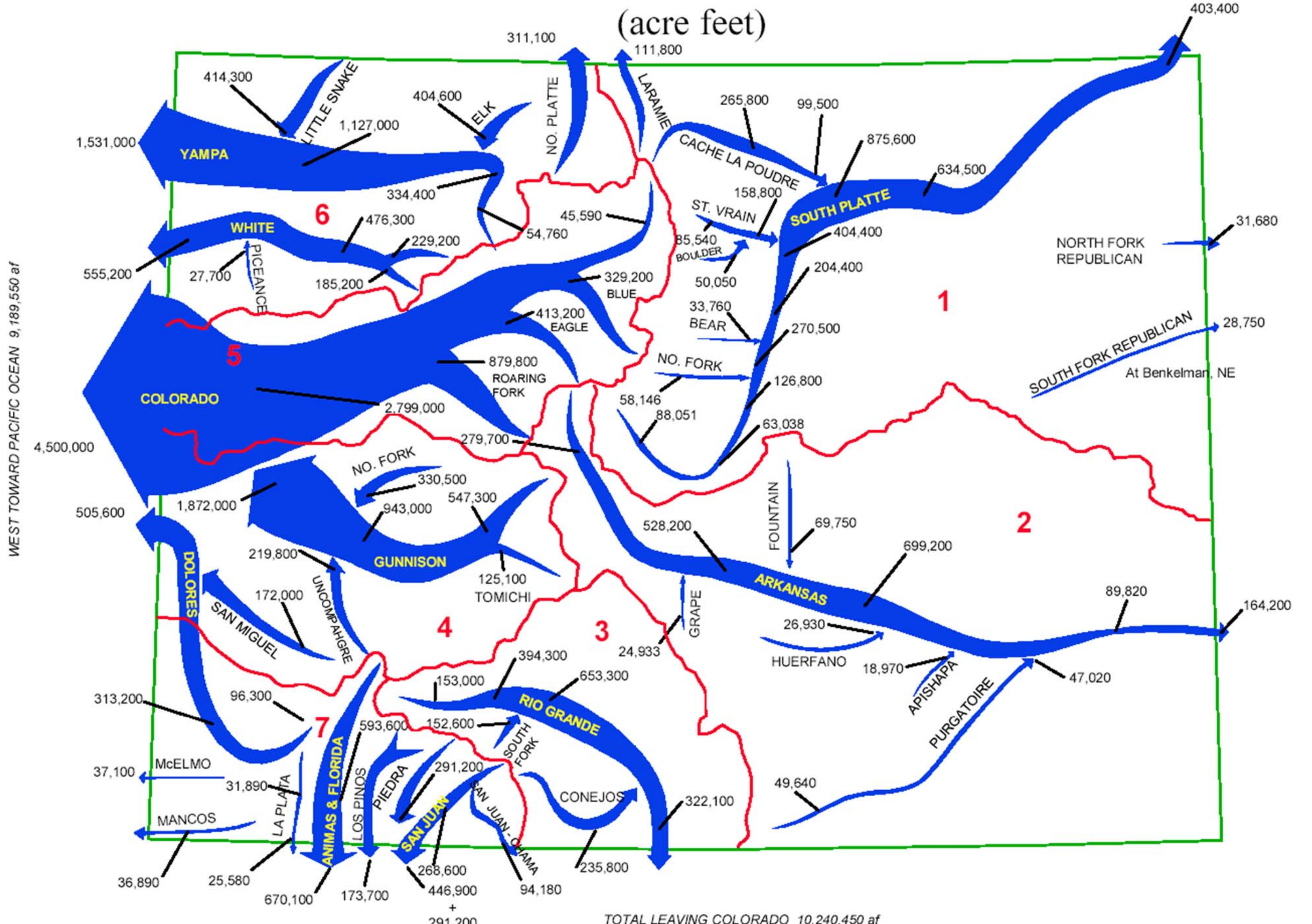
General Observations

- Potential water savings from alternative crop rotations and limited irrigation of grain crops
- Largest water savings – conversion to dryland or rotational cropping
- Least cost water savings from partial season irrigation of alfalfa
- Management and risk increase with reduced irrigation

For More Information

- limitedirrigation.agsci.colostate.edu
- neil.hansen@colostate.edu

COLORADO
HISTORICAL AVERAGE ANNUAL STREAM FLOWS
(acre feet)



Prepared by the Hydrographic Branch (2003 Revision)
Historic averages obtained from USGS Water-Data Report CO-02

OFFICE OF THE STATE ENGINEER
COLORADO DIVISION OF WATER RESOURCES

Expert Witnesses in Water Court

Colorado’s New Rules Governing Expert Witness in Water Court

Standards for Admissability of Expert Testimony - Colo. Rules of Evidence

- Rule 702: **Testimony by Experts** - If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify . . . in the form of an opinion . . . .

- Rule 703: **Bases of Opinion Testimony by Experts** . . . . If of a type reasonably relied upon by experts in the particular field in forming opinions or inferences upon the subject, the facts or data need not be admissible in evidence in order for the opinion or inference to be admitted. . . .

Court Acts as a Gate Keeper

Daubert v. Merrell Dow Pharmaceuticals Inc., 509 U.S. 579(1993):

The admission of scientific evidence under FRE 702 requires that the judge insure the evidence based on scientific knowledge, technical or other specialized knowledge be both relevant and <u>reliable</u> before it is admitted into evidence.

Considerations for Admissability

- Whether the technique can and has been tested;
- Whether the theory or technique has been subjected to <u>peer review and publication</u>;
- The existence of specialized literature dealing with the technique;
- The scientific technique's known or potential rate of error, and the existence and maintenance of standards controlling the technique's operation;
- The non-judicial uses to which the technique are put;
- Whether the technique has been generally accepted;
- The relationship of the proffered technique to more established modes of scientific analysis; and
- Whether such evidence has been offered in previous cases to support or dispute the merits of a particular scientific procedure.

Water Court Rule 11 – Role of Experts

- Expert reports, disclosures, and opinions are rendered to the water court under **professional standards of conduct** and **duty to the court**.

- The expert shall not include anything in his or her expert report, disclosure, or opinion suggested by any other person, without forming an **independent judgment** about the correctness, accuracy, and validity of the suggested matter.

Required Consultation Among Experts

- The expert witnesses for the parties shall meet, <u>without the attorneys or the parties</u>, to discuss the matters of fact and expert opinion that are the subject of the experts' disclosures and:
- Attempt to resolve disputed matters;
- Identify the matters of fact and expert opinion that remain in dispute.
- Advise the parties of the undisputed matters of fact and expert opinion and of the disputed matters that they believe remain for trial.

Declaration of the Experts

Every expert must sign a written declaration that affirms:

- The role of the expert, both in preparing this report or disclosure and in giving evidence, is to **assist the court** to understand the evidence or to determine facts in issue.
- The opinions expressed in my disclosures and in my report are my own professional opinions.

- Expert report and disclosures are <u>accurate and complete</u>;

- Addresses matters that are material to the opinions expressed, including the assumptions, the bases for the opinions, and the methods employed in reaching the opinions.

- The report and disclosures do not contain anything suggested by anyone, including the attorney for my client, on which the expert has not formed its own independent judgment.

- Disclose any qualifications (limitations) to Opinions.

- Has made the inquiries that expert believes are appropriate.

- No matters of significance that expert regards as relevant have been withheld from the court.

- Expert has disclosed any financial or pecuniary interest in the results of this lawsuit or in any property or rights that are the subject of the lawsuit for which the report and disclosures are being submitted.

- Immediately notify the attorney for the party for whom expert is giving evidence if, for any reason, I consider that my existing report or disclosures requires any correction or qualification.

Examples of Water Court Decisions Involving Complex Scientific Evidence

- In the Matter of the Confined Aquifer New Use Rules, Case No. 2004CW24, Findings of Fact, Conclusions of Law, Judgment and Decree, Nov. 9, 2006. < *http://www.courts. state.co.us/ Courts/Water/Division.cfm?Water_Division_ID=3*>

- Concerning the Office of the State Engineer's Approval of the Plan of Water Management for Special Improvement District No. 1 of the Rio Grande Water Conservation District, Findings of Fact, Conclusions of Law, Judgment and Decree, May 27, 2010 < *http://www.courts.state.co.us/userfiles/file/Subdistrict%20No %201% 202010%20Decree.pdf*>.

- Final Order – FRICO Barr Lake Division Change Application, <http://www.courts.state.co.us/Courts/Water/Rulings/Div1/02cw403.pdf>

Peak Oil, Peak Food, Peak Water . . . .just up ahead

National Meeting
Experimental Station Section

Estes Park, Colorado

John Oliver, President
Maple Leaf Bio-Concepts

September 27th, 2011

- Conventional supplies of oil, food and water – will be surpassed by demand – first 50 years of 21st century

- Peak oil is a commonplace discussion point – food and water – not yet

Great confidence in productive capability of agriculture

- Met the challenge of Club of Rome
- Met threats of droughts, floods, erratic weather
- Why not global warming?
- Why not climate change?

- Concern peak oil, peak food, peak water
- Not 40 or 50 years away
- Peak water may be 25 to 30 years away
- Peak oil and peak food are within next 20 years

Three Global Drivers of Peak Oil, Peak Food, Peak Water

1. Global population projected to be 9.0 billion – 2040. Reached 7.0 billion in August – my numbers say 9.0 billion – 2030/32. At least 1.0 billion not accounted for
2. 1.0 maybe 1.5 billion new Asian middle class consumers by 2020 – less than 10 years. Creating 3 new U.S. in demand
3. Climate change reduces global crop production capability by at least 20%

What does it mean . . .

1. We have only 15 years to do a meaningful turnaround
2. Agriculture and food must become the priority industry of every country on earth
3. Agriculture is the only industry which can impact each element of a gather perfect storm
4. Agriculture is the only industry that can push peak oil, peak food, peak water farther out into the future

The Gathering Perfect Storm

1. Climate change driven by global warming
2. The Health Care Crisis
3. Search for energy security
4. The Trump Element – access to ample secure, safe supplies of fresh water

Climate Change

- Climate change is happening
- People argue over the causes
- It doesn't matter
- Agriculture must adapt to extreme changes in weather variability

<u>WE MUST ADAPT</u> AND QUICKLY

Climate Change *continued . . .*

- Extreme weather events, heat, drought, floods on increasingly frequent basis
- Scientists at Princeton and North Carolina project 30-40% yield loss corn/soy bean when daily temps average 85º F
- Around world glaciers are melting. S.E. Asia is particularly vulnerable. 2.0 billion people at risk
- National Climate Data Center – 7200 sites worldwide, 2000-2009 – warmest decade on record
- Averaged 1º C over the average of 20^{th} century

The Health Care Crisis

- Crisis of life styles, nutrition, numbers, and cost
- Health care 11% GDP in Canada and 16% in U.S.
- 2 billion people overweight, overfed, under active – 1 billion obese
- 2 billion people underweight, undernourished, overactive – 1 billion at point of starvation

The Health Care Crisis *continued . . .*

- Because of overweightness and chronic disease, today's 2-19 year old generation likely to be first generation to die ahead of parents
- Without drastic life style change, 41% U.S. adults forecast to be obese by 2016
- July 1st, 1990
  - No state over 20% obesity among adults over 20
- July 1st, 2009
  - Only state not over 20% obesity – Colorado
  - Six states over 30% obesity
- July 12th, 2011
  - Only state not over 20% obesity – Colorado
  - 12 states over 30% obesity
- Double states in just 2 years

Search for Energy Security

Volatility in energy costs over past decade

$147.00/barrel of oil – July 2008

$37.00/barrel of oil – January 2009

- Peak oil is very close
- Conventional easy to reach capacity

100 – 105 million barrels/day

- 2007 – reach 86.4 billion barrels/day
- Oilfield capacity dropping 4 – 6 % a year

Search for Energy Security *continued . . .*

Peak Industrial Activity – July 2007

  - *300 million consumers (U.S.) consumed 22 million B/D*
  - *3.5 billion consumers (Asia) consumed 22 million B/D*
- **2007** – J.D. Power and Associates forecast – Chinese consumer would not buy more cars than American consumer until 2025
- **2009** – Chinese consumer passed American consumer
- **2010** – Chinese consumers purchased 1.0 more cars
- At current rate of purchase – by 2015 – forward motion (because of gridlock) in Beijing – will be 14km/hr.
- Same speed as bicycle

Search for Energy Security *continued . . .*

- Historic conventional capacity 105 million B/D
- New technology and new discovery – increases capacity to 111 million B/D
- Current aging wells dropping 4-6%/year
- International Energy Agency – 2010
  - Must find 3 new Saudi Arabia's by 2030
- New exotic energy sources are years away
- Peak oil is less than 5 years – maybe 2 years

Trump Element – Access to Ample Secure Supplies of Fresh Water

- Water is the foundation of life
- Canada and U.S. are luck – good farmland and good water supplies in much of the region
- Other parts of the world, such as South East Asia, have real problems
- We must not take water for granted
- Must focus on prudent, sustainable management of water supplies
- Agriculture can take a strong leadership position

The Future

1. **The future belongs to those who can access and manage renewable natural resources**
   – Effectively and sustainability
   – Good farmland and water are the two most critical resources
   – We must not let short-sightedness rule the day
2. **New technologies and wide application of existing technologies would seem to be the only way to fill the gap between food supply and demand**
   – This emphasizes the strength of the land grant system in becoming the "discovery" engine
3. **We in this room today has the best combination of science knowledge and will. We must tell the story to everyone – we must lead the implementation**
4. **We can kick up our low beam society to the high beam new**

Thank You

John Oliver, President
Maple Leaf Bio-Concepts
September 27th, 2011

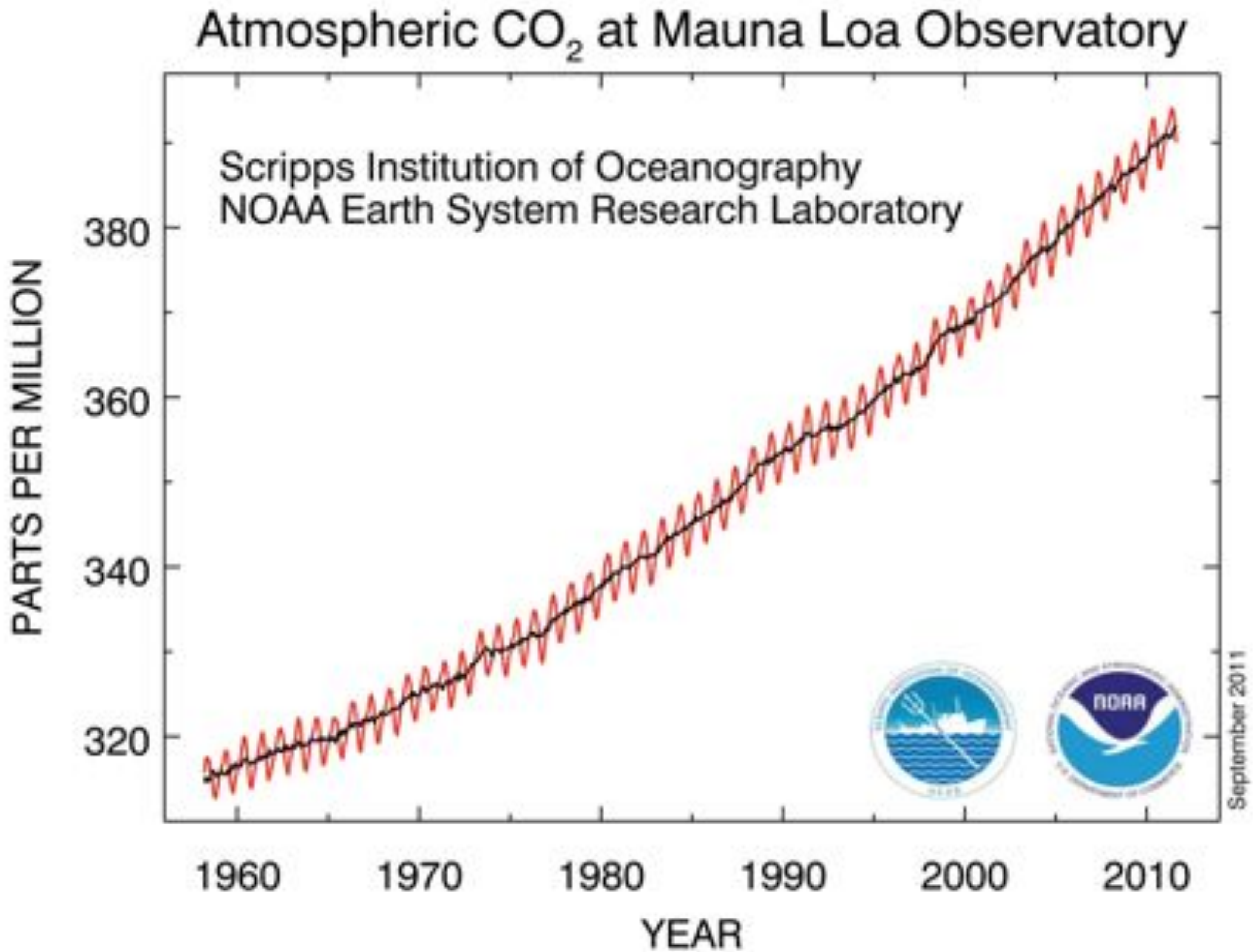
Climate Change
Impacts on the future of agriculture and natural resources

Mike Hoffmann
Director, Cornell University Agricultural Experiment Station
Associate Dean, College of Agriculture and Life Sciences
Cornell University, Ithaca
ESS/SAES/ARD Workshop 2011, Estes Park, CO

The basics:

- Climate vs. weather
- Greenhouse gases absorb infrared radiation (Tyndall 1863)
  - Sun emits mainly short wave radiation: most of sun's energy gets through the atmosphere, but earth's surface emits infrared radiation (heat). Hence greenhouse gases keep the heat in.
  - Without CO_2 - Earth would be very cold, with too much, very hot

- Fossil fuel signature
  - 3 isotopes of carbon: ^{14}C, ^{13}C and ^{12}C (preferred by plants)
  - Burning of fossil fuels (ancient plants) releases ^{12}C into the atmosphere
  - ^{12}C now highest in past 10,000 years, with biggest increase since 1850's
  - Evidence from ice cores, tree rings
  - Direct link to human activity


Atmospheric CO_2 at Mauna Loa Observatory
Scripps Institution of Oceanography
NOAA Earth System Research Laboratory
PARTS PER MILLION
380
360
340
320
1960
1970
1980
1990
2000
2010
YEAR
September 2011

Carbon Dioxide

1800 - 270 PPM

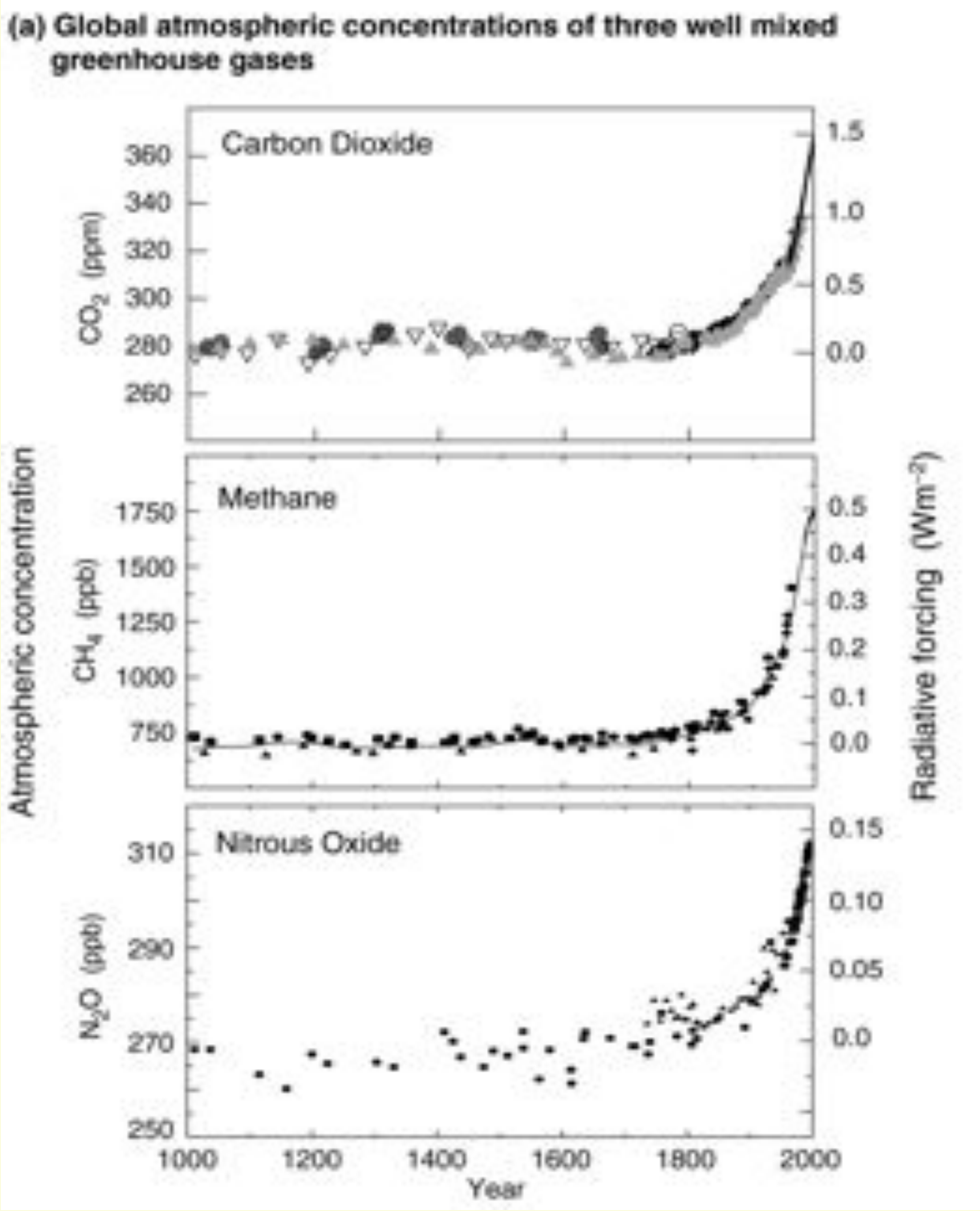
2010 - 390 PPM

2020 - 410 PPM

2030 - 430 PPM

2050 - 450 PPM

- 350 is important!
- Inertia
    - 100’s-1,000’s yrs



Thermometers work!

- 1.5^{0}F increase globally (warmer at poles)
  - Alaska, Antarctica
- Hottest decade ever: 2000-2009
- Longer summers, warmer winters
- Warming very fast (100X)
- $8\text{-}10^{0}$F by 2100 (usual business)
  - 5,000 land based stations,
    1000 buoys, ships
- Data from satellites

Evidence: It's Not Just Increasing Average Temperature

- Sea level rise
- Acidification of oceans
- Extreme weather events
- Glaciers melting
- Greenland
- Arctic sea ice retreating
- Plant hardiness zones moving north
- Pines in Rocky's

And then there are those tipping points …

- Methane
- Ocean acidification
- Droughts in the Amazon

Climate Change and Food Security

- Challenges and Opportunities -

ESCOP Science Roadmap

- **Grand Challenge: We must adapt to and mitigate the impacts of climate change on food, feed, fiber, and fuel systems in the United States**
- A grand challenge, a different challenge
  - Global in scope
  - Decision making under uncertainty
  - Timescale issues in ag decisions and policy
  - Complexity and interconnectedness of supply chains
  - Nonclimate factors – population growth, energy costs…
  - Need to mitigate AND adapt
- Local, regional, global – challenges and opportunities

Eastern Canada and Northeastern US - Regional Collaboration -

- Public and private sector "think tank" – climate change and agriculture – challenges, opportunities
  - Universities, government, private sector - leaders
  - To catalyze and facilitate multi-disciplinary and multi-institutional collaborations
  - Leverage our collective capacity to address the needs of the region
  - Between now and 2025
  - Set the stage for beyond 2025


AK
YT
NT
NU
BC
AB
SK
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QC
NL
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PE
NS
ME
VT
NH
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CT
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MI
OH
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NC
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LA
AR
MO
IL
WI
IA
MN
ND
SD
NE
KS
OK
TX
NM
CO
WY
MT
ID
UT
AZ
NV
CA
OR
WA
HI

Agriculture in the Region

- US: 374,000 farms, 64 million acres
- Canada: 100,000 farms, 25 million acres
- $58 billion total farm gate value
  - Dairy, vegetables, field crops, fruit, ornamentals…
- Employing 100,000's of people
- Add retail, wholesale… big business

The Region and Climate Change

- The Challenges
  - Extreme weather: floods, droughts, storms
  - New pests, high temp stress

- The Opportunities
  - Adequate precipitation
  - Warmer conditions (longer growing seasons, warmer winters)
  - Shifts in productivity elsewhere
    - Reduced glacial melt – Alberta
    - Changes in precip. patterns in Sierras
    - Ag-urban competition for water
    - High temps and grapes/wine - CA

The Opportunities

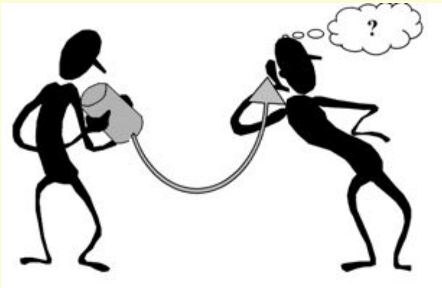
– Potential to increase intensity and diversification of agriculture in region
  - New crops, new varieties - winter canola, wine grapes…
  - Double cropping
  - Longer seasons - higher yields
– Markets
  - 116 million people (75% of Canadian, 30% of US population) – great cities to feed
  - Local grown, lower carbon footprint food supply
  - Job creation, economic development

Recommendations

- To Succeed – Partnerships critical
  - A model
- Farm level impact needed
  - Identify trends, research needs, priorities
  - What happened in 2011?
- Improved water management
  - Too much (drainage) or too little (irrigation)
- New crops and cropping systems – adapted to region
- Recoupling of plant and animal systems

Recommendations

- New and better decision tools based on economics
  - Cooling for dairies, new crops
- Communication strategies
  - To farmers, policy makers
- An increase in public sector investment in climate change research and education <u>is imperative</u>



Contributing Institutions/Organizations

- ACA Associates, Inc.
- Agriculture and Agri-Food
- Agriculture et Agroalimentaire Canada
- Canadian Agri Food Policy Institute
- Cornell University
- Croplife Canada
- Dow AgroSciences Canada, Inc.
- Lilly and Company
- Maple Leaf Bio-Concepts
- McGill University
- Michigan State University
- National Center for Food and Agricultural Policy
- New Brunswick Dept. of Agriculture
- North Central Regional Assoc. of State Agric. Experiment Station Directors (NCRA)
- Northeastern Regional Assoc. of State Agric. Experiment Directors (NERA)
- Nova Scotia Agricultural College
- NYS Dept. of Ag. and Markets
- Ohio State University
- PEI BioAlliance
- Penn State University
- Purdue University
- Queen's University
- Smithsonian Environmental Research Center
- South Dakota State University
- Twin River Technologies - Enterprise de Transformation de Graines Oleagineuses (TRT ETGO)
- Université Laval
- University of Connecticut
- University of Guelph
- University of Illinois at Urbana-Champaign
- University of Maine
- University of Maryland
- University of Nevada
- University of New Hampshire
- University of Rhode Island
- University of Vermont
- West Virginia University

Hoffmann and Smith. 2011. *Feeding our great cities: Climate change and opportunities for agriculture in Eastern Canada and the Northeastern US*

Conclusions
- Climate Change -

- One of the greatest challenges ever
- Global, affecting all people and their life support systems
- Agriculture has the opportunity to mitigate and must adapt
- Partnerships are critical
- A grand challenge for the Agricultural Experiment Stations, for the Land Grant System

We are on trial!

In 2050, what will my daughters say about their dad?

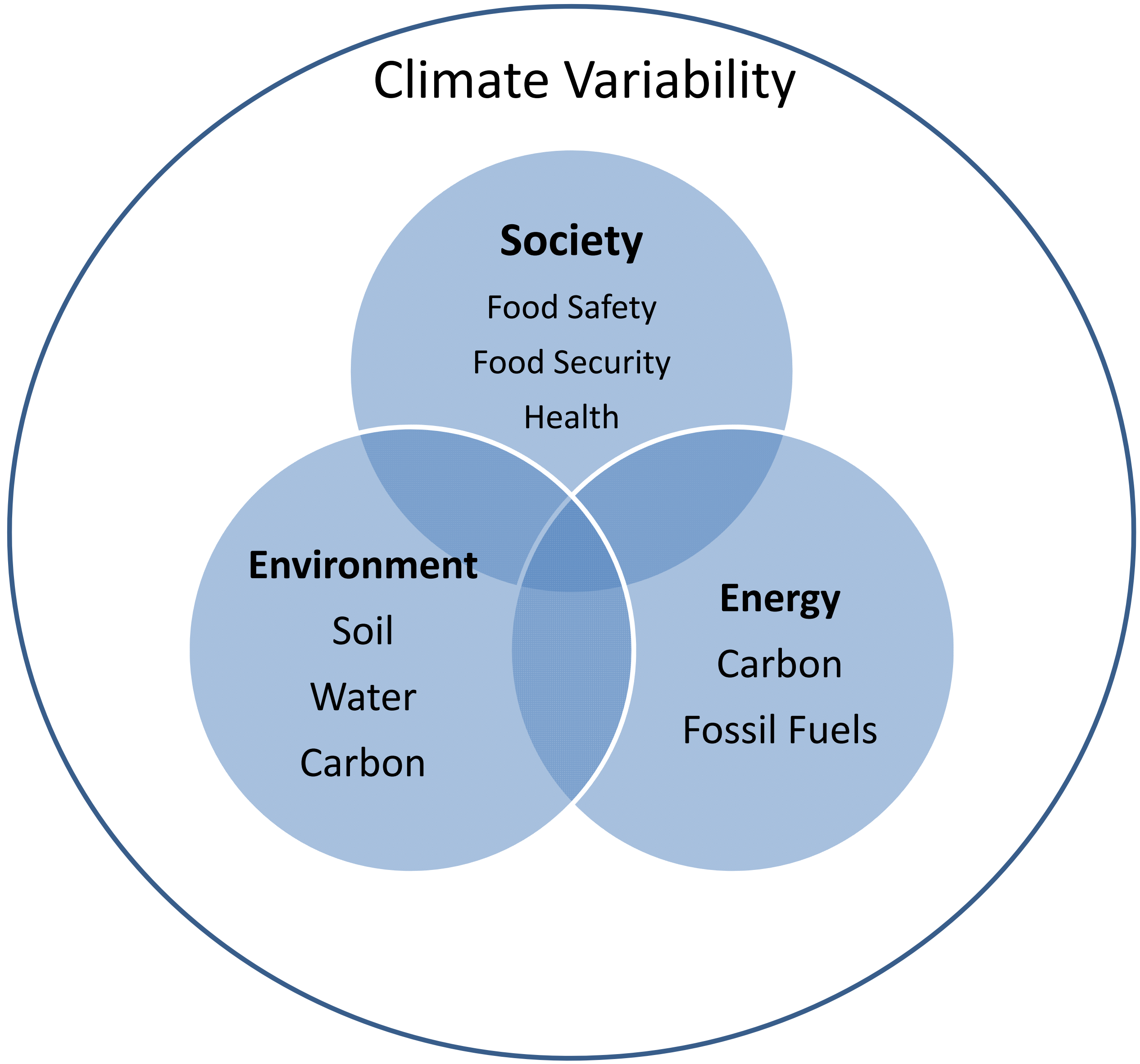
Did he try?

Climate Variability and Animal Agriculture

"Our goal is to figure out how to produce more with less land, less water and less pollution, so we won't be the only species left living on this planet.“

From Jason Clay, World Wildlife Fund

Vulnerabilities for the Future



Role of Livestock in Greenhouse Gas Emissions

- Food and Agriculture Organization (**FAO**, 2006) - *Livestock's Long Shadow*
  – first global estimate of the livestock sector's contribution to greenhouse gas (**GHG**) emissions.
  – Included the entire livestock food chain, the study estimated 18 % of total anthropogenic emissions

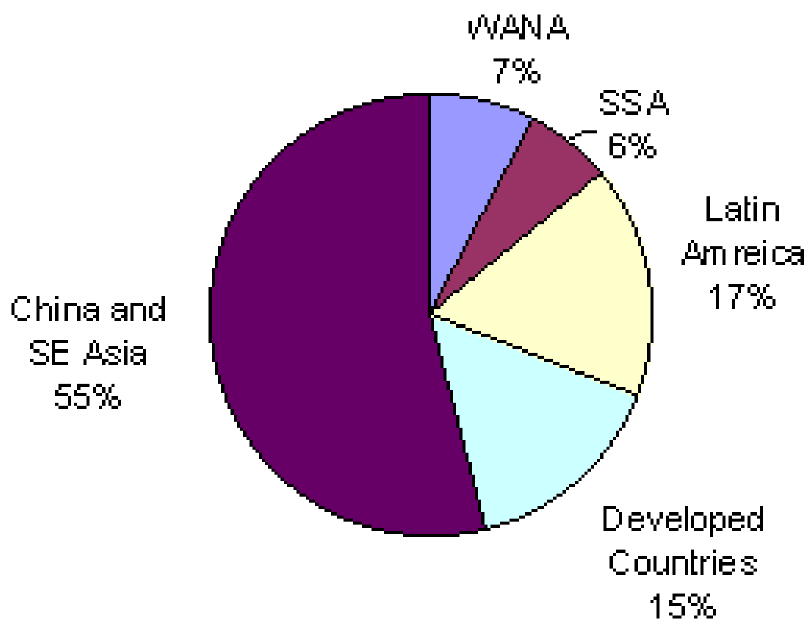
Sources and types of GHG from livestock

- Methane production from animals (25%)
- Carbon dioxide from land use and its changes (32%)
- Nitrous oxide from manure and slurry management (31%)
- These gases are usually converted to units of CO_2 equivalent (**CO_2 eq.**) as a common metric for gases that have varying global warming potential.
- Global warming potential
  - Methane -25
  - Nitrous Oxide - 300

State of Food and Agriculture FAO Report 2010

- Around one billion poor people depend on livestock production
- Livestock provides
  - income
  - high-quality food
  - fuel
  - power
  - building material and fertilizer
- Livestock is major contributor to food security and nutrition

Increase in global demand for meat 1993-2020



- S. Asia - South Asia
- WANA- Western Asia and North Africa
- SSA - sub-Saharan Africa
- LA - Latin America

From "Securing and Sustaining Adequate Food Production for the Third Millennium" by A. Pinstrup-Andersen and R. Pandy-Lorch, 1999, in World Food Security and Sustainability: The Impacts of Biotechnology and Industrial Consolidation (NABC Report 11), pp. 27-48. Ithaca, NY: National Agricultural Biotechnology Council.

What is the value of meat production?

- Current
  - Contributes 40 percent of the global value of agricultural production (keeps 1 billion people out of poverty)
  - Contributes 15 percent of total food energy and 25 percent of dietary protein.
  - Products from livestock provide essential micronutrients
- 2050
  - Annual meat production increase from 228 million tons to 463 million tons
  - Cattle population will grow from 1.5 billion to 2.6 billion
  - Goats and sheep will increase from 1.7 billion to 2.7 billion

From: towards a More sustainable livestock sector, FAO 2010
http://www.fao.org/news/story/en/item/40117/icode/

Use of water by livestock

Credit: University of Arizona AgNic

- Water uses
  - Drinking
  - Cooling of facilities for the animals and animal products
  - Sanitation and wash down of facilities
  - Animal waste-disposal systems
  - Incidental water losses.
- How much water?
  - 2,140 Mgal/d, or 2,390 thousand acre-feet per year (2005)
  - less than 1 percent of total freshwater withdrawals
  - 60 percent of total livestock is groundwater
  - Estimated total livestock withdrawals for 2005 were 8 percent less than in 2000.

http://ga.water.usgs.gov/edu/wulv.html

Global Impacts of Climate Change on Livestock

- Water – flooding and drought
  - Livestock drinking water sources
  - Feed production systems and pasture yield
- Feeds - land use and systems changes
  - Niches for different species
  - Primary productivity of crops, forage and rangeland
  - Ability of smallholders to manage feed deficits

http://www.ifad.org/lrkm/factsheet/cc.pdf

Global Impact of Climate Change on Livestock Production

- Biodiversity - genetics and breeding
  - loss of diversity
  - risk of extinction of various adapted species
- Livestock (and human) health:
  - expansion of vector populations
  - populations and large-scale outbreaks of disease (e.g. Rift Valley fever virus in East Africa).
  - effect on helminth infections

http://www.ifad.org/lrkm/factsheet/cc.pdf

Can livestock help with climate change?

- "Livestock can play an important role in both adapting to climate change and mitigating its effects on human welfare, FAO said."
  - Climate change mitigation
  - Adaptation
  - Enhanced capacities to monitor, report and verify emissions
  - Development of new technologies

From: towards a More sustainable livestock sector, FAO 2010
http://www.fao.org/news/story/en/item/40117/icode

What are some of the game changers that will transform agriculture for the future?

- **Plants**
  - Nitrogen fixation of grasses
  - Weatherproofing of Crops
  - Improving efficiency of light, **water** and nitrogen use in plants
  - Genetic Selection
  - Biodiversity Loss
  - Double Cropping

What are some of the game changers that will transform agriculture for the future?

- **Animals**
  - Improve Nutrient utilization in Animals (rumen manipulation)
    - Minimize nitrogen loss
    - Reduce carbon emissions from rumen
  - **Decrease water use** by animals
  - Build resistance to infectious diseases
  - Separate manure for efficient nutrient utilization
  - Genetic Selection

What are some of the game changers that will transform agriculture for the future?

- **Environment**
  - **Water** Desalination
  - Re-evaluate Ecosystem Services
  - Biodiversity Loss – Pollination
  - Build resilience to pests
  - Model Invasive Species movement

What are some of the game changers that will transform agriculture for the future?

- **Energy**
  - New methods for Urban Waste Management
  - Utilize Ag Production Waste efficiently
  - Efficient conversation of waste (Ag/Urban) to energy
  - Development of bio-based products

What are some of the game changers that will transform agriculture for the future?

- **Politics and Policy and Systems**
  – Precision Farming - Data Utilization
  – Developing predictive models for climate change
  – Full Systems Accounting – Looking at the whole picture
  – Close the gender gap – give women access to resources in developing economies

Role of Ag Experiment Stations

- Research engine to address climate change
- What can we do?
- What should we do?
- How do we address the issue?
- Who should we partner with?
- How do we fund the research?

Sustainability at the College of Agriculture and Life Sciences

The challenges facing our planet are daunting. The human population is predicted to reach nine billion in 40 years, the climate is changing, water availability and quality is an increasingly important issue worldwide It is also becoming very apparent that we are all interconnected and interdependent, economically and environmentally. Change is needed if we want to meet the needs of the present without compromising the ability of future generations to meet their own needs – the essence of "sustainability"

Climate change models predict "extreme" precipitation events (storms) will happen with increasing frequency, and some parts of the country will continue to have adequate water while other areas will experience, severe droughts. By 2070, New York could have a climate similar to Georgia's today. With these changes come enormous challenges but also opportunities. How is Cornell University responding?

University President David Skorton has committed Cornell to carbon neutrality and Cornell has invested extensively in improving campus wide sustainability, including adopting sustainable standards for new buildings, implementing lake source cooling that saves 25 million Kwh/yr, and constructing a new combined heating and power plant that is dramatically reducing the use of coal and shrinking the university's carbon footprint. On the academic side, the new Cornell Center for a Sustainable Future promotes new and synergistic collaborations and leverages Cornell's resources. There are a multitude of research, teaching and outreach programs focused on sustainability in the College of Agriculture and Life Sciences (CALS) and across the campus.

The Cornell University Agricultural Experiment Station (CUAES), which supports the research, teaching and outreach mission of the College of Agriculture and Life Sciences, is uniquely positioned to contribute to sustainability at Cornell on a large scale. To that end, we have adopted a "Culture of Sustainability."

The CUAES, with a staff of 55, operates CALS research farms, facilities and greenhouses in and around campus, including several thousand acres of diverse agricultural and forested land. We are committed to creating cultural change based on social, environmental and economic considerations as a model for other universities, communities and organizations regionally and nationally. We are:

- Implementing a series of management practices that reduce energy use and waste materials;
- Implementing forest management practices to intensify the rate at which carbon dioxide is captured, to reduce our carbon footprint;
- Linking together a diverse group to interact and cooperate with a wide array of researchers, educators and individuals leading sustainable initiatives at Cornell and elsewhere;
- Launching an energy conservation pilot project for the college to identify and measure the best methods for encouraging behavioral change;
- Developing the Cornell University Renewable Bioenergy Initiative to utilize 57 waste product streams and crop and forest biomass resources to produce energy in a model platform with regional applicability.

The Culture of Sustainability has three main pillars, all interconnected, to support the building blocks of change: The Human Element (The Sustainability Action Team); Technological Resources (Developing web-based tool kits for CALS energy conservation); and Renewable Energy (The Cornell University Renewable Bioenergy Initiative).

The Sustainability Action Team (S.A.T.) empowers staff at all levels through consistent and visible commitment to facilitate sustainable practices, large and small. The 12-member S.A.T:

- Sifts through, evaluates, and designs sustainability plans and projects with worker and supervisor input. Monitors and records results;
- Relies on the experience of office, field, greenhouse, and growth chamber workers to identify the real opportunities to improve efficiency and quality of the natural and work environment;
- Creates communication and marketing materials to engage staff and encourage behavioral change, along with change in practices and procedures.

The CALS Conservation Website will be a dynamic, interactive portal created in partnership with faculty researchers from CALS and Carnegie Mellon as part of a research project to encourage individual behavioral change. The website will contain accessible information related to sustainable practices and, uniquely, will include ways to document and measure individual involvement and resulting action. The toolkits will eventually be accessible to the CALS community and university at large. The website will:

- Organize the extensive range of opportunities and action steps individuals can take with immediate feedback on carbon footprint and cost savings, and promote competition among identified groupings;
- Provide a tool to measure the degree of behavioral change and the motivation, i.e. economic, environmental or social (peer-related.) The website will help researchers assess the popularity of particular actions, based on available research and best management practices;
- Maintain streaming data of building energy reduction, environmental benefits, economic benefits and general progress on an individual and group (building) basis.

The Cornell University Renewable Bioenergy Initiative (CURBI), currently in the feasibility study phase, envisions creating a model facility to generate renewable bioenergy from the 57 campus waste streams and other biomass resources to help fuel the campus. CURBI will:

- Maximize the use of available resources from farms, forests, food service and other operations in and around the Cornell campus to generate power and fuels. Materials range from animal bedding and switchgrass to vegetable oil from dining hall deep fryers;
- Utilize multiple cutting-edge technologies under 'one' Cornell roof -- providing a state-of-the-art research, education and outreach platform as well as renewable energy production;
- Offer a unique opportunity for comparison, demonstration, and improved efficiency of renewable energy technologies;
- Utilize "stackable" renewable energy technologies, so that waste product from one system can be utilized by the next, increasing overall efficiency of the system, and make the use of biomass that much more attractive;
- Address current operational, environmental, and economic issues through integrated and collaborative efforts with researchers and educators.

The response to these initiatives from both the public and private sectors has been enthusiastic. The opportunities for research, teaching, and outreach are unlimited, as are the opportunities to build new partnerships. It is the right thing to do, at the right time. Cornell, the Land Grant University to the world, is making a world of difference.

Cornell University
Agricultural Experiment Station

Sustainable Campus Operations
Adopting a Culture of Sustainability

Mike Hoffmann
Director, Cornell University Agricultural Experiment Station (Ithaca)
Associate Dean, College of Agriculture and Life Sciences
Cornell University

www.cuaes.cornell.edu

ESS 2011, Estes Park, CO

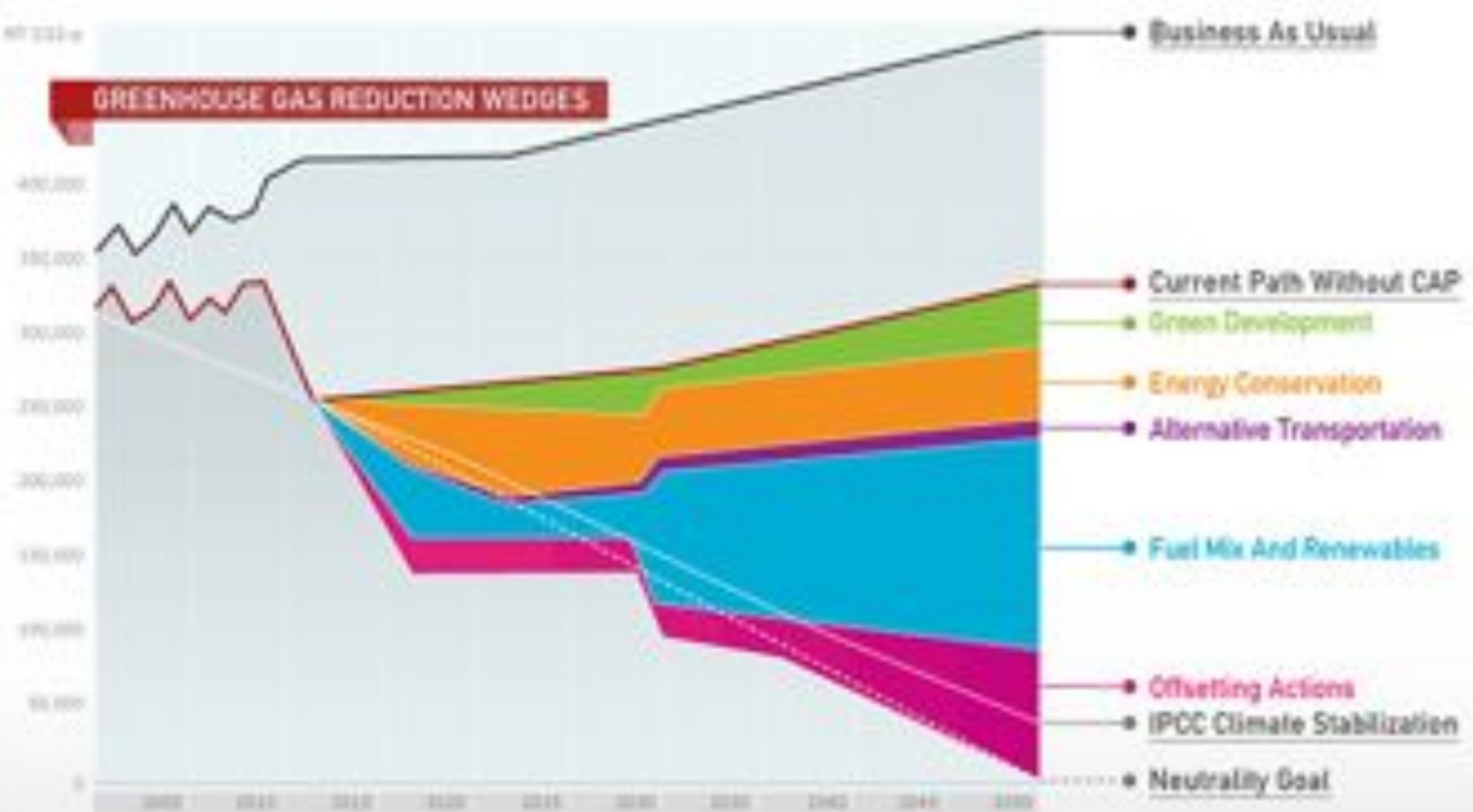
Sustainability

"Meeting the needs of the present without compromising the ability of future generations to meet their own needs"

UN Brundtland Report

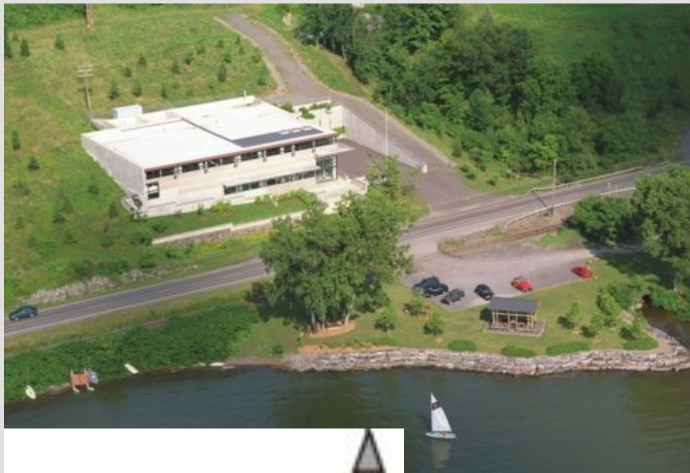
Cornell Climate Action Plan

CUAES figures prominently in the Cornell Climate Action Plan

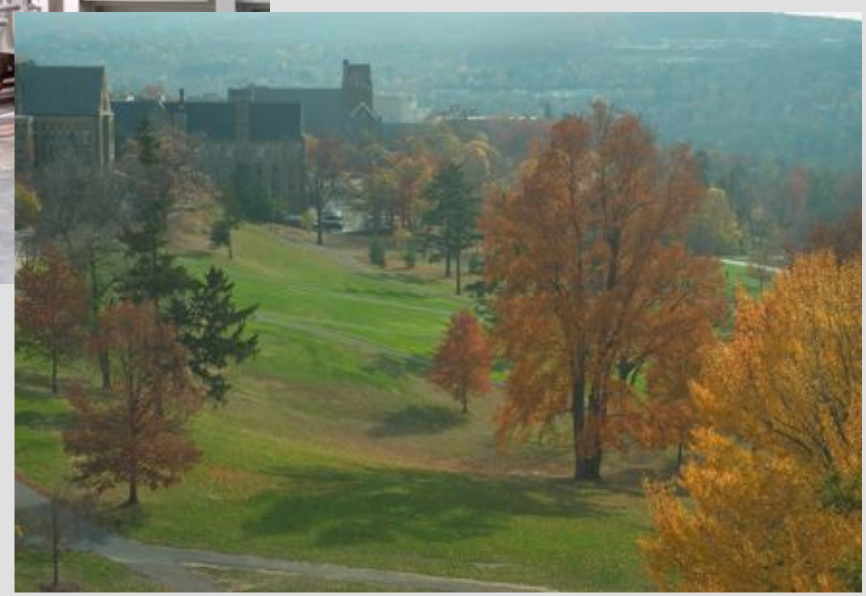


Cornell Operations

Lake Source Cooling



LEED buildings



Cornell's Ongoing Commitment to Sustainability

- President's Sustainable Campus Committee
  - Oversees all aspects of sustainability in campus operations and facilities (faculty, staff, students)
  - Focus areas: energy, climate, water, food, waste, buildings, people, land, purchasing and transportation

- Atkinson Center for a Sustainable Future (ACSF)
  - Advances multidisciplinary research in Energy, the Environment and Economic Development
  - $80 million gift makes ACSF permanent
  - Venture Fund grant program
  - Faculty cluster hires

Cornell University Agricultural Experiment Station, Ithaca (CUAES)

- Consolidation of multiple departmental operations - 2008
- Primarily supported with state funds, not Hatch
- Six farms – 2400 acres
  - Vegetables, field crops, ornamentals, organic…
  - Student run farm
- 55 staff
- Greenhouses – 4 acres
- Plant growth chambers – 130
- Forested properties
- 4 acre compost facility, 6,000 tons/yr
- Supports research, teaching, extension

CUAES Adopting a Culture of Sustainability

- Economic, environmental, social sustainability
- Emphasis on cost reductions, efficiencies, carbon footprint
- Staff empowered (generate ideas, implement)
  - Sustainable Action Team
  - Promote professional development/leadership
- Partnerships with faculty and Cornell operations
- A model

Plant Growth Chambers

130 units ranging from 9 to 108 feet^2

Up to \$28,000/unit/yr to operate

Growth Chambers

$3,400 Investment

Idea from Sustainable Action Team

Results:

- $567,000 grant – NYSERDA
- Retrofit 22, plus 35 coolers
- ROI < 4 years
- $157,000 savings/yr
- Drastic labor savings
- CO_2 reduction – 520 tons/yr
- Improved quality of service

Greenhouses

- $2.1 million – Cornell Utilities
- Retrofit 47 units – heating, lighting, controls
- ROI < 4-6 years
- $258,000 savings/yr
  - 40% reduction - electricity
  - 35% reduction – steam
- Improved plant care conditions
  - Only needed benches lit
  - Adjust light intensity
  - Optimal temperatures

To Mow or Not to Mow?

Grounds Department, Horticulture and CUAES

- CUAES mows 100 acres of lawns – Fuel, labor, carbon
- Why?
- Tested grass mixes (fescues)
- 2012 mowing schedules & heights
  - High use: 2-4”
  - Moderate use: 5-7”
    - 40% savings
    - Fescues
  - Little traffic: 1/yr
  - No traffic: reforest/repurpose

Farms to Dining – Locally Grown

- Local CUAES Farms – Cornell Dining
- Several tons of fresh produce delivered: Potatoes (guard rows), sweet corn, squash, mixed greens and more
- Without compromising support for research

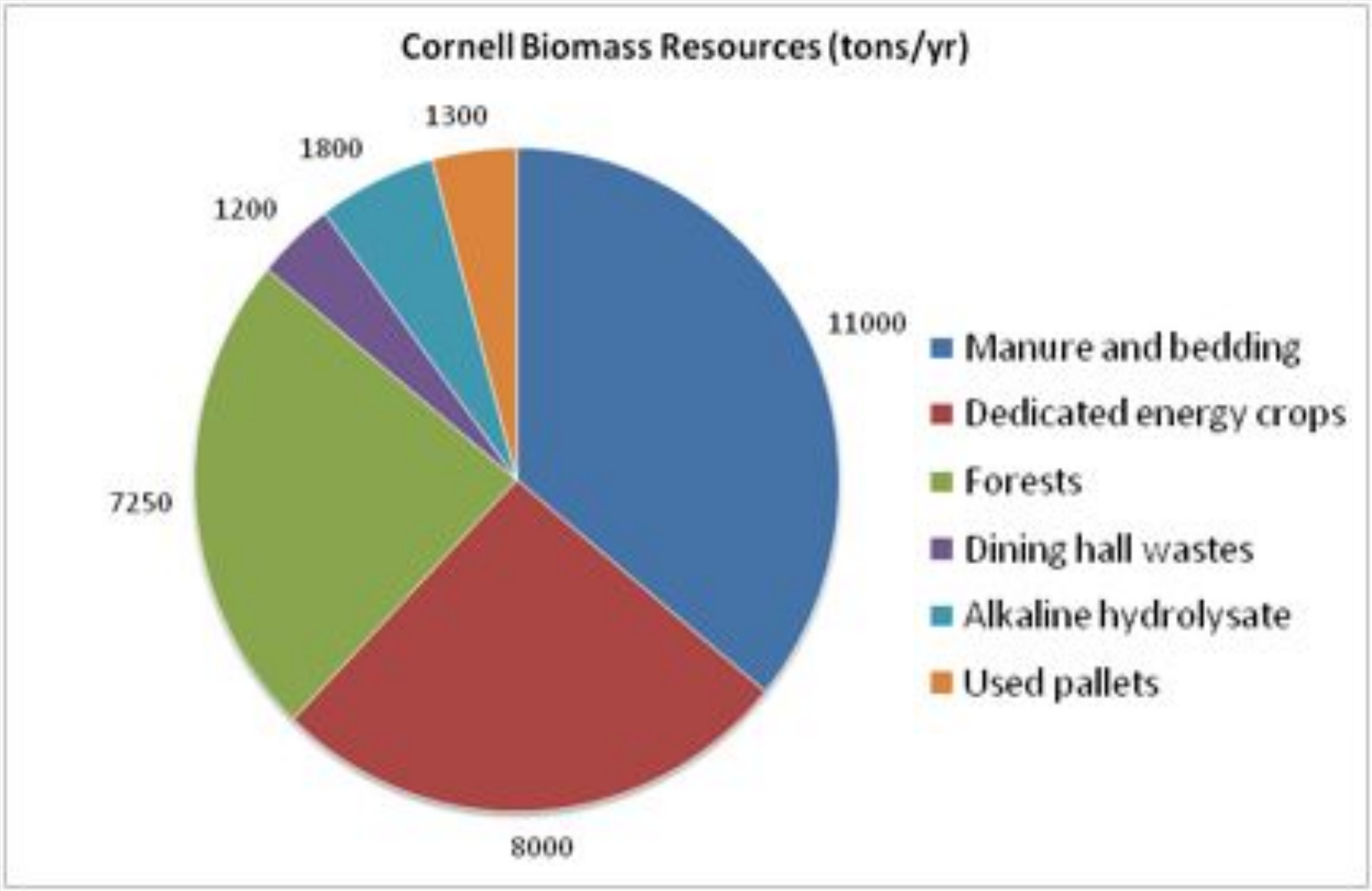
And More

- ✓ Winter building closure - $6,000/yr, no trash pickup, water coolers off, employees happier
- ✓ Seasonal drying oven shut down - $4-5,000/yr
- ✓ Windbreak installed – 25% reduced buildng heating costs
- ✓ Reforested 5 acres – 11.5 tons CO_2 sequestered/yr
  - Planning more
- ✓ Autoclave pots vs. recycling - $6,000
- Pellet furnace – saving $8,000/yr fuel, ROI 9 months
- 300 incubators @ $876/ea. – implement BMP's (future)
- Energy audits – all outlying facilities (2012)
  - Replace inefficient water heaters, furnaces…
- Unlimited Opportunities

Cornell University
Renewable Bioenergy Initiative

- Using local (CUAES) biomass
- A living, learning laboratory - teaching, research, extension, economic development –
  - Five complementary renewable energy technologies: anaerobic digestion, slow pyrolysis, direct combustion, dry fermentation, waste oil to biodiesel
  - Model with wide application
  - Multiple collaborations
  - Feasibility completed

Cornell University Renewable Bioenergy Initiative



Converting Cornell biomass to:
Multiple biofuels, heat, power, co-products

CURBI's Future

- Estimated cost - $9.2 million
- Converts 35K tons biomass
  - Heat to greenhouse - $1 million
  - Biochar – 2600 tons, $1.3 million
  - Carbon footprint reduction – 10K tons CO_2
  - Private-public partnerships
- But cheap natural gas, economic turndown
- 2005 vs. 2011

Energy Conservation in CALS Buildings
- CALS Green -

- Lead by CUAES
- Communications, Human Ecology, Utilities, AES's
    - Emphasis motivating behavioral change
        - Education
        - Motivation
        - Repetition
        - Permanent change
- Initial survey – 67% response (3400 academics, staff)
- 6 buildings, various uses/energy demands
- Model for rest of Cornell, SUNY System, beyond
- Change in culture

CALS GREEN

Understanding Audience
Pre-Pilot Construction Survey Highlights

- Consistent support for conservation and high levels of awareness
- Opportunity: *"It is not my responsibility to help Cornell reduce it's energy use."* 85% disagreed or strongly disagreed.
- Challenge: *"If I wanted to, I could reduce my energy use at work."* 12% disagreed, 30% neutral, 45% agreed.

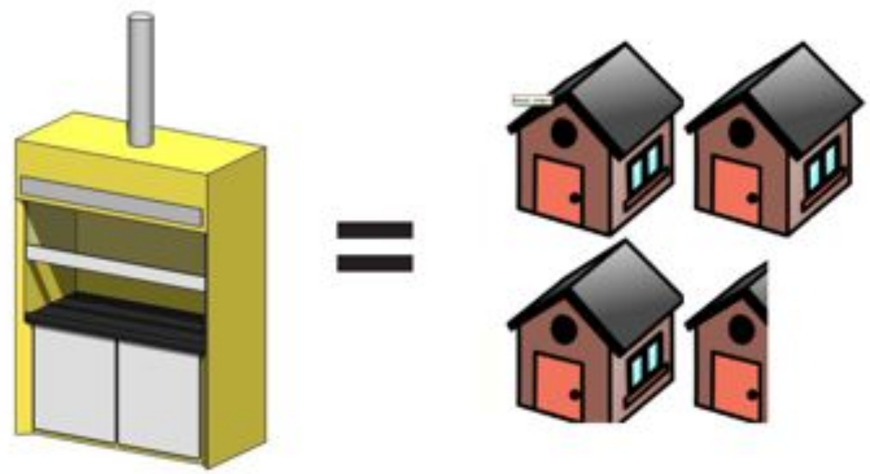
Total pledged savings (as of 9/16/11): 1,613,079.49 lbs CO2, $179,487.30

CALS Green – Laboratories

- Lab outreach program
  - Lab survey, first round: 80 labs, approx. 50% in participating buildings
  - Follow up survey to reach remaining labs
- Preliminary results
  - 75% of surveyed labs had fume hood sash heights below 10”, 6” optimum
  - 40% of labs containing more than 2 fume hoods had inactive third fume hood; fume hoods - $4,000/yr, $7.5 million at Cornell
  - 65% of freezers and refrigerators are more than 10 years old

Fume Hood Facts

Fume hoods use an average of $4,000 in energy per year, which is equivalent to 3.5 houses.



That’s equivalent to the CO_2 emissions from burning 4,475 gallons of gasoline or the carbon sequestered annually by 8.5 acres of pine forests.

Shut your fume hood sash to 6” when not in use.

If your fume hood will not be used for 3 or more months, call to temporarily decommission it. It’s free of charge and can be restored in 24 hours. Contact Mark Howe at mjh69@cornell.edu.

CALS GREEN

The Human (Social) Dimension Sustainable Action Team (SAT)

- Empowering people - Top down support for bottom up ideas
- Turn to staff for sustainability - ideas/opportunities
- Monitors and records results
- Many projects are the result of the work of the SAT
- Recent press emphasized role of staff – recognition!

Cornell University
Agricultural Experiment Station

Sustainability Action Team - SAT

Sustainability Action Team - SAT

Who we are:

A CUAES staff-led initiative, that relies on the experience of office, farm, greenhouse and growth chamber staff to improve sustainability

What we do:

- Identify opportunities to increase sustainability
- Initiate & facilitate sustainable practices & projects
- Model practices for others

Project Highlights:

- **Tightened buildings at all farms**
  Weather stipping doors, sealing windows, adding insulation, replacing windows and overhead doors, and more.
- **Autoclaving pots and trays at greenhouses**
  Collected data on energy use and cost for sterilizing and reusing greenhouse pots. Benefits include cost savings, reduced waste and landfill.
- **Greener Growth Chambers (GC)**
  Monitored electrical consumption of GC. Retired 25 units (saving $72,000 annually) renovated others. New signs alert user to energy use, resulting in much prompter shut off, when not in use.
- **Afforestation project at Freeville Farm**
  Planted 5050 trees on five acres of idle land, to reduce mowing and increase carbon sequestration.
- **Improved greenhouse lighting**
  Installed photosensors to greenhouses, to keep lights from being on all day. Added manual switches where needed.

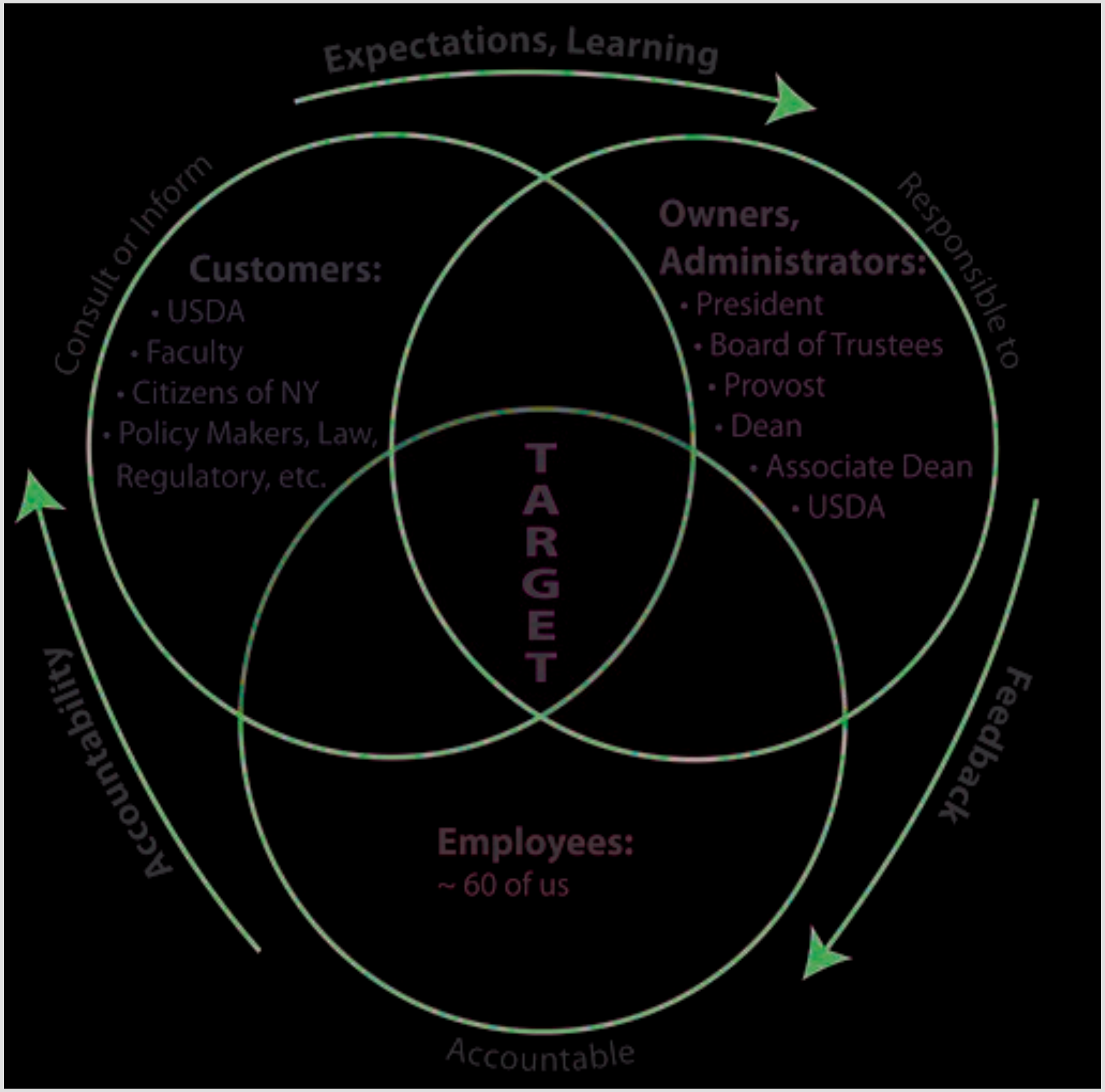
Your SAT representatives:

Paul Cooper, Nick Van Eck, Steve McKay, Tim Dodge, Paul Stachowski, Garry Tennant, Don Schaufler, Betsy Leonard, Glenn Evans, Anja Timm, Lauren Chambliss

Your ideas or suggestions:

The Human (Social) Dimension
Setting Priorities – Line of Sight

- The challenge - doing less with less
- "Being killed with opportunities"
- Driven by vision, mission and goals
- Tracks progress
- A model



Thank you!
Be sustainable!

Campus on a Carbon Diet:

Sustainability Efforts at Colorado State

There are no passengers on Spaceship Earth.
We are all crew.

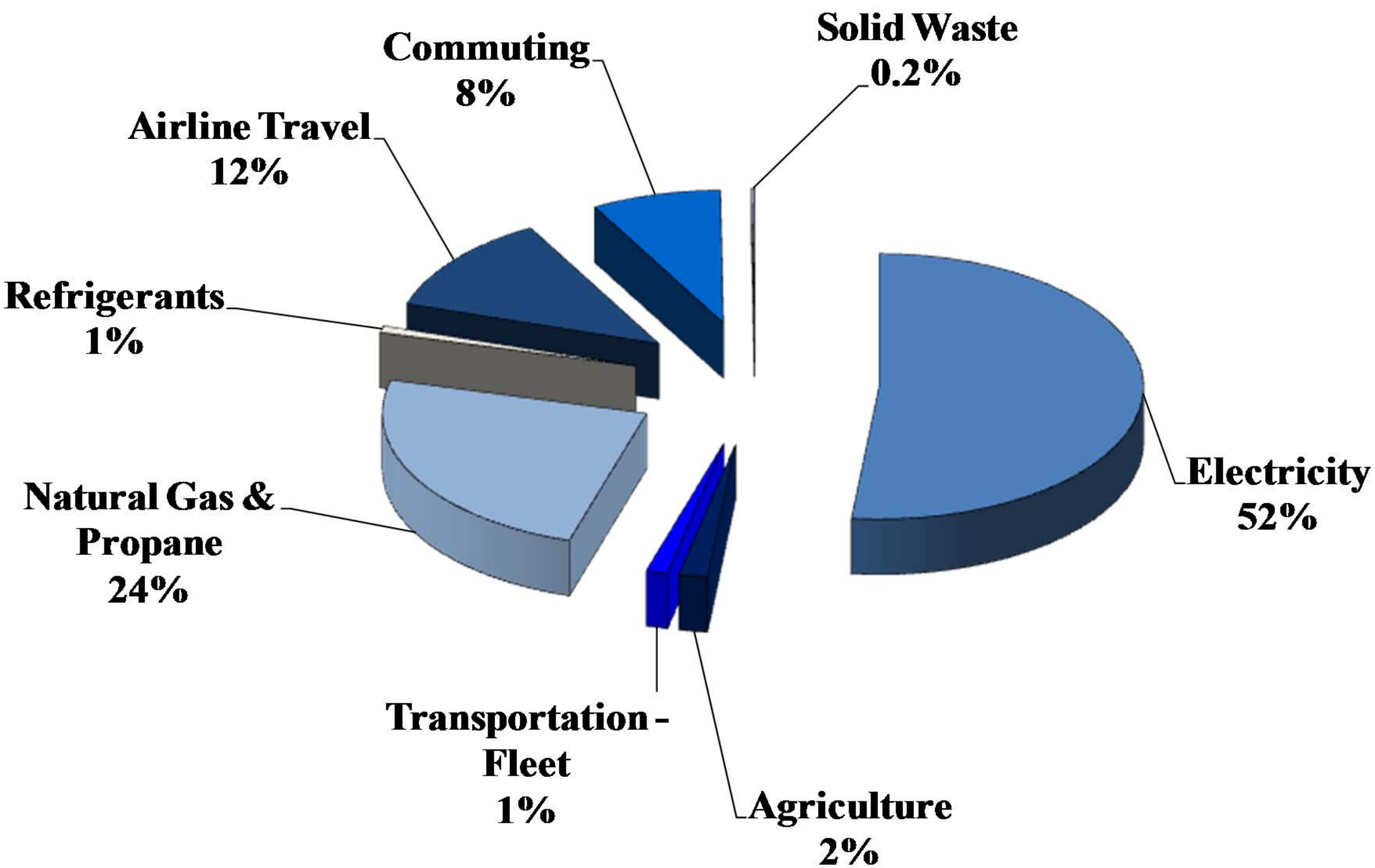
Marshall McLuhan - 1965

Commitments & Accomplishments

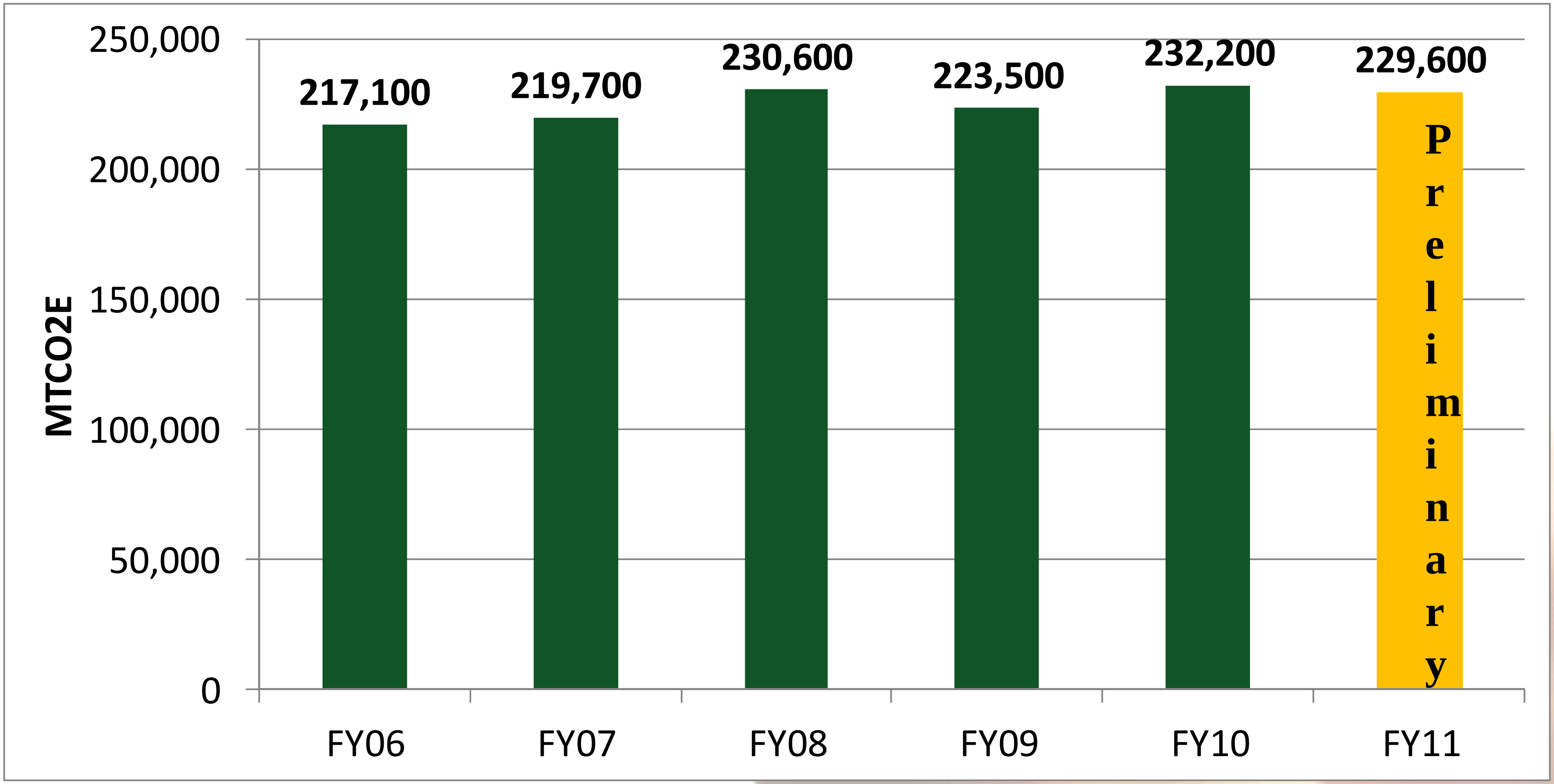
- Sustainability Tracking, Assessment & Rating System (STARS) - Gold
- American College and University Presidents Climate Commitment (ACUPCC)
  - Signed June 2008
  - Comprehensive GHG inventories each year
  - Climate Action Plan September 2010
- Mandatory GHG reporting to EPA began January 2010

American College & University Presidents Climate Commitment

GHG Footprint – FY11



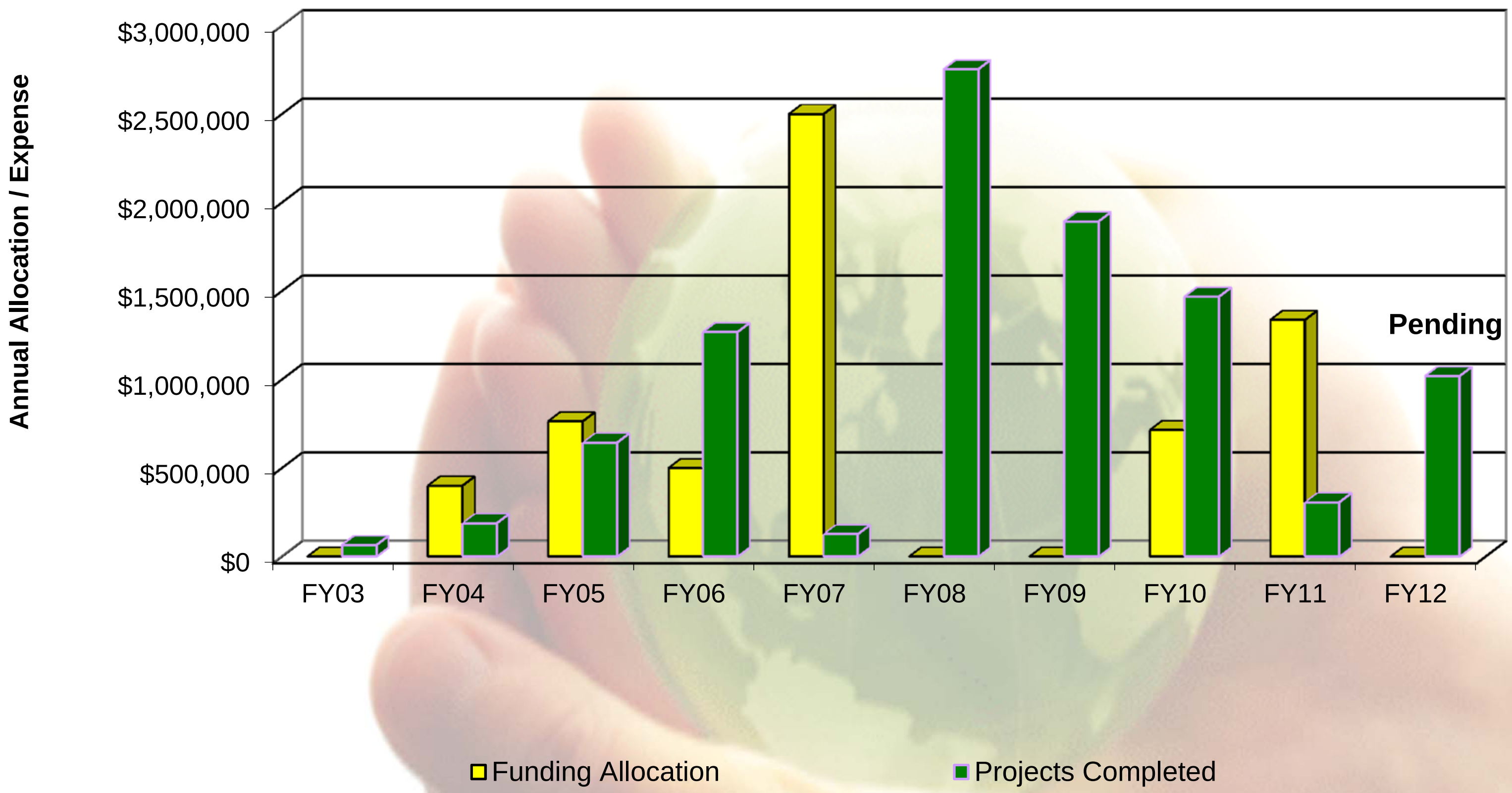
GHG Footprint Trends



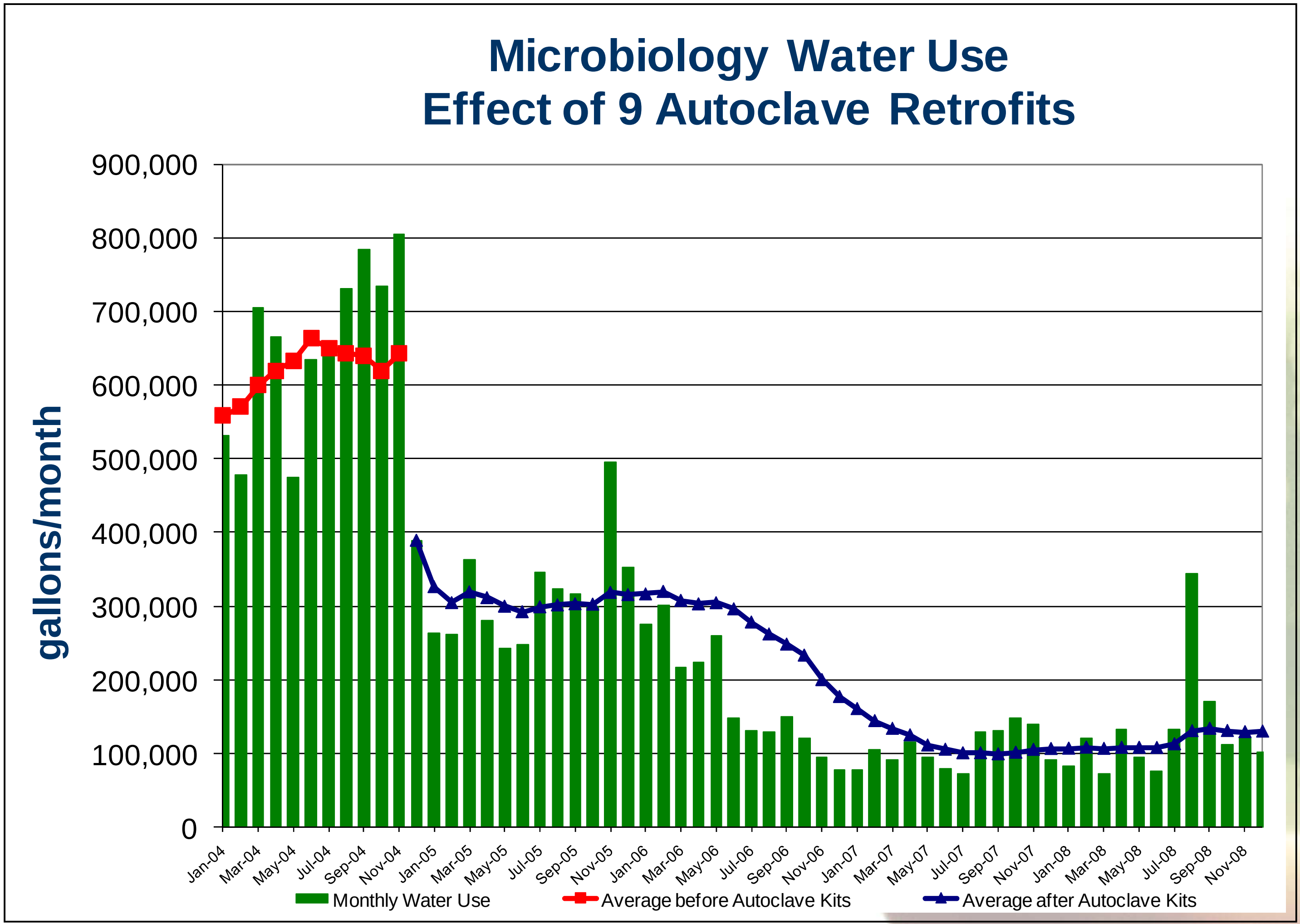
Efficiency & Conservation

Energy Fund Allocations & Spending

Long History of funding energy & water efficiency projects. Average allocation >$500,000/yr since FY04



Water Conservation



42 Autoclaves retrofit kits installed across campus are saving the university 15 million gallons of water/yr

Energy & Water Conservation: Behavioral Engagement Campaigns

Joint Efforts with Housing & Dining, Facilities

- Green Warrior Campaign
  - Student focused campaign launched in 2010
  - Self reporting of conservation strategies can earn incentives
  - 250 Participants in inaugural year
- Green is Gold
  - Focused on Faculty & Staff
  - 50 teams registered
- Pilot Program
  - Pilot underway for more focused effort in TILT Building

Green Buildings

LEED Buildings

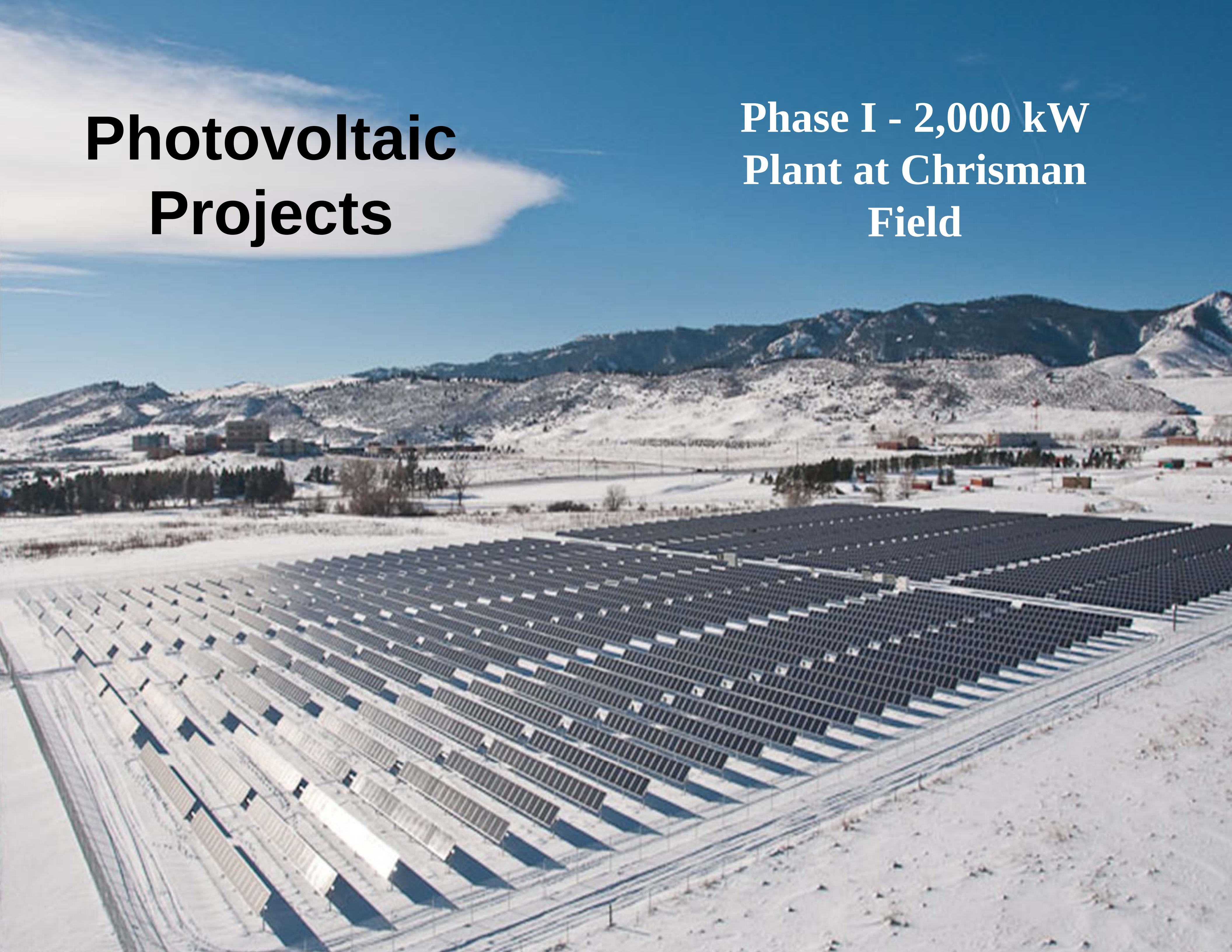
- ❖ Guggenheim Classrooms – CI Silver
- ❖ Transit Center – GOLD
- ❖ Aspen Hall – GOLD
- ❖ Academic Training Center – GOLD
- ❖ Rockwell West – GOLD
- ❖ Human Performance Clinical Research Lab – GOLD
- ❖ Indoor Practice Field - GOLD
- ❖ CSFS Office – Certified
- ❖ Research Innovation Center – GOLD
- ❖ Behavioral Science - GOLD

Certification Pending (anticipating GOLD)

- ❖ Student Recreation Center
- ❖ Lake Street Parking Garage

Student Recreation Center

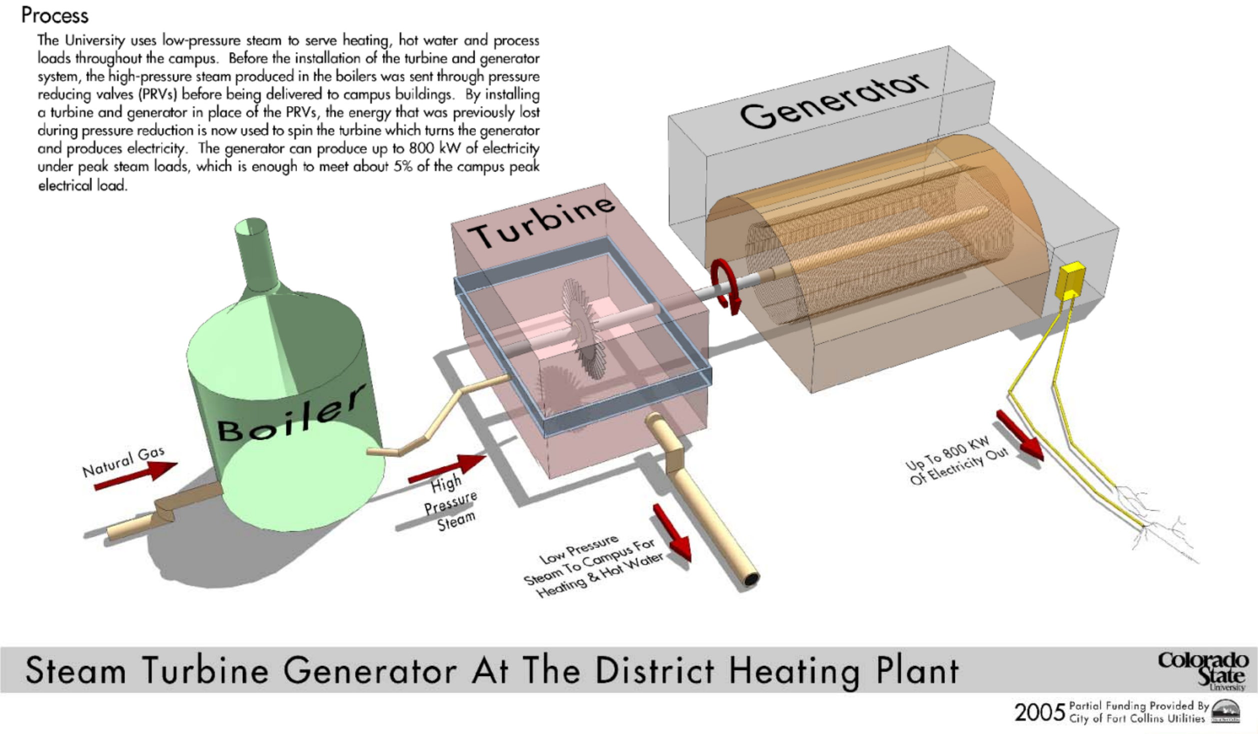
Renewable Applications


Photovoltaic Projects
Phase I - 2,000 kW Plant at Chrisman Field

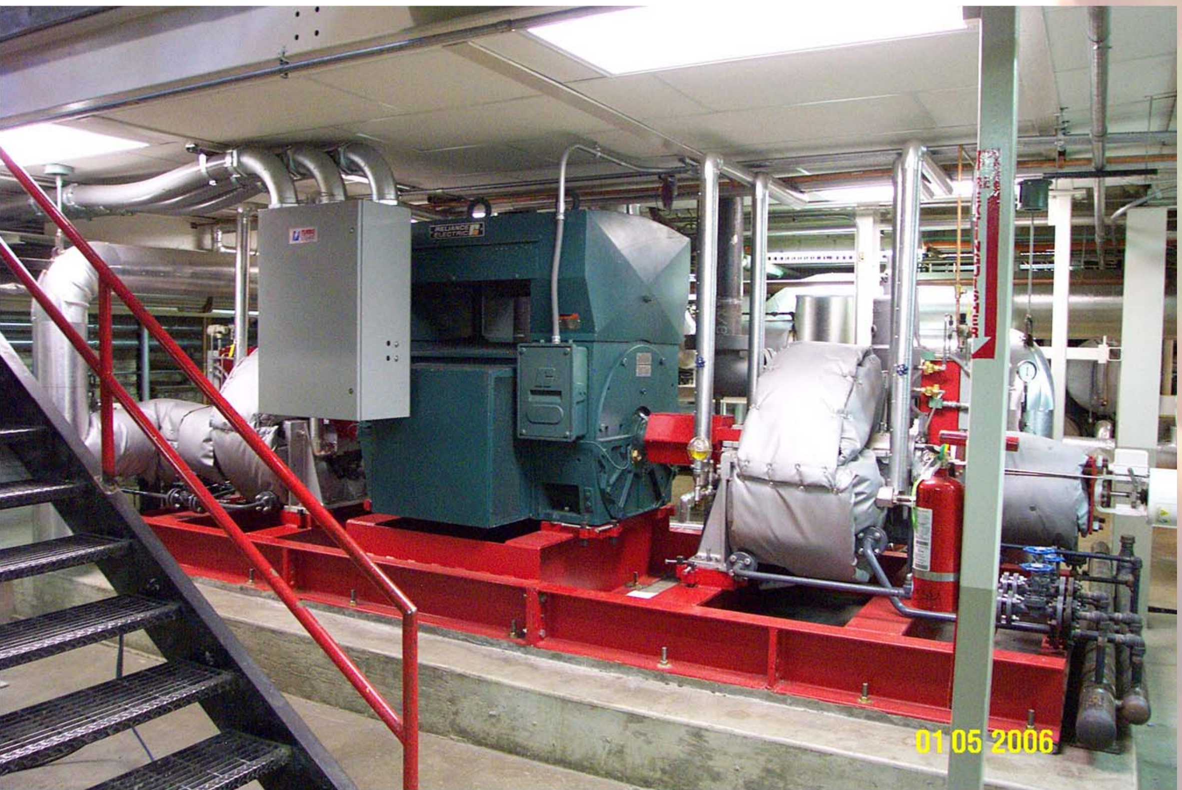

The addition of Phase Two increases the site 5,300 kW and makes it one of the largest solar plant on a US university campus

Biomass Boiler

- Partnership with the Colorado State Forest Service
- Produces hot water for building heat at Foothills Campus
- 96% fewer overall emissions than natural forest fires
- 97% fewer emissions than prescribed burning.
- Very low net carbon emissions
- Small – 46 bhp, but future phases envisioned



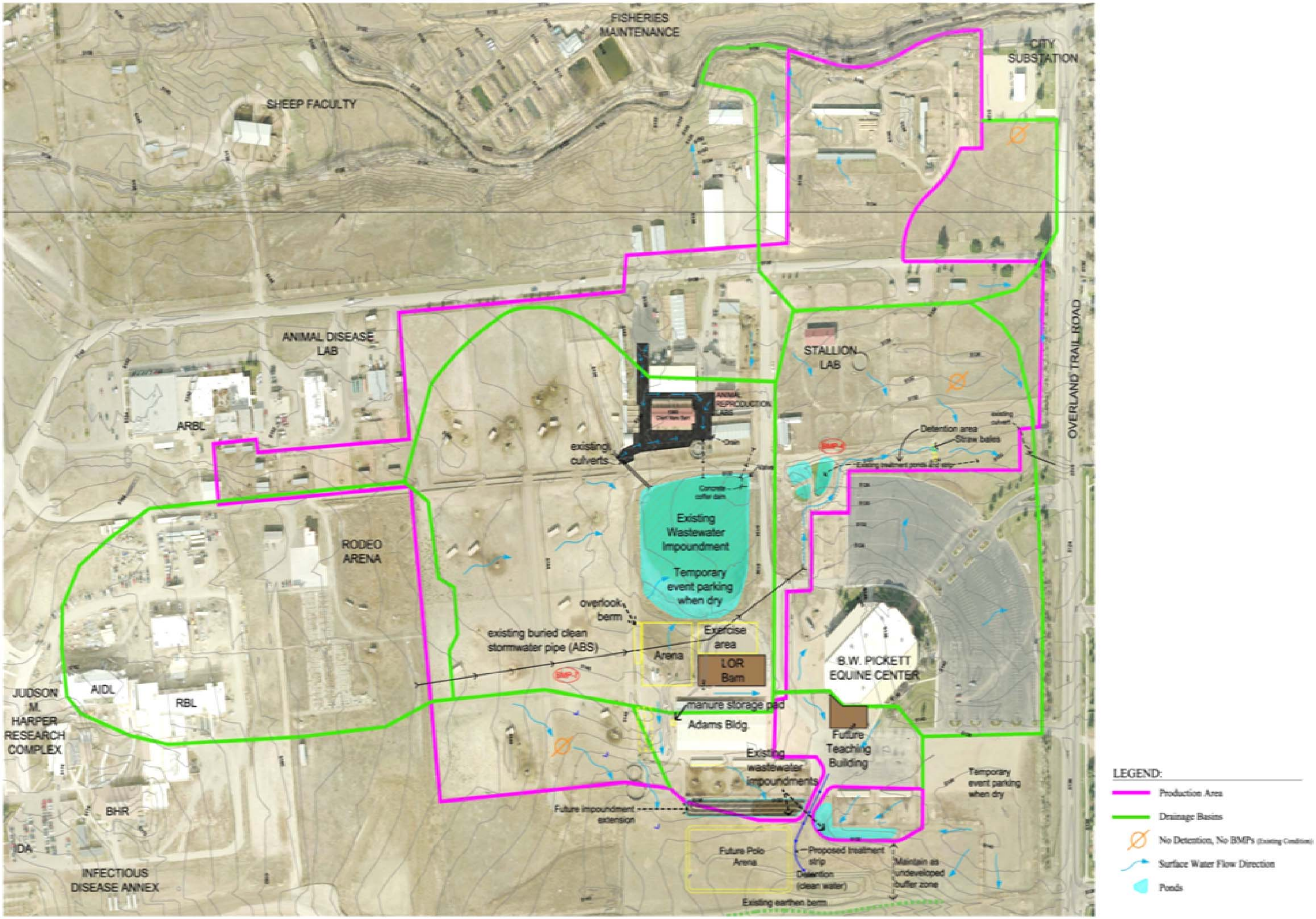
District Energy Plant Steam Turbine



- Peak Rating 800 kW
- Annual Output 3,200,000 kWh/yr
- Total cost savings since installation $850,000

Ag Efforts

- Storm Water Concepts
  - Separate Dirty from Clean
  - Clean Dirty Water – Friendly Manner
  - Equine Operations & Run Off - CAFO
- Mount Manure
  - Soil Amendment
- Composting
  - Community Effort



Colorado State University

AFO Stormwater Planning

Foothills Campus

Manure Management
Foothills Campus

- 900 CY/month animal manure and bedding
- Piled and turned at “Mt. Manure”
- Generates “soil amendment” (not compost)
- Managed and hauled by outside landscape firm
- Regulations: Colorado Solid Waste Regs.
- Agricultural exemption (CSU ag waste only; no infectious animal wastes and no other materials introduced).

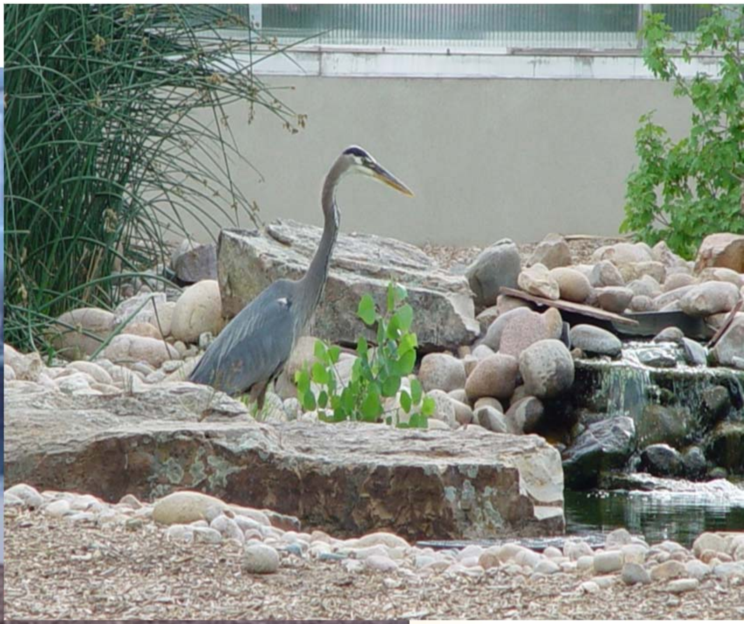
Composting Activities

- In-vessel composter – pulped food waste and small amount of Mt. Manure wastes
- Possible future operation in collaboration with City of Fort Collins
- Small composting operations (greenhouse, grounds)

Composting Regulations

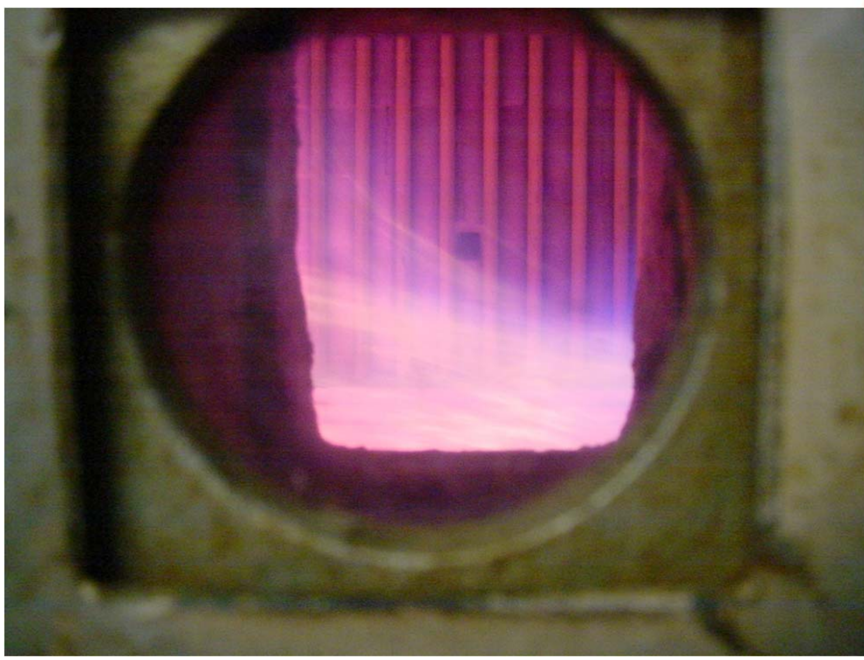
- Different classes of composting operations, depends on size and feedstocks
- Considerations: permit, size, security, vectors (e.g. rats), odor, water pollution, impermeable working pad, quality of end-product.

CSU Bioremediation Wetland
University Greenhouse




Other Projects Being Studied

- Landfill Methane
- Solar Thermal for Pools or Residence Halls
- Larger Biomass
- Waste to Energy
- Wind Power



To learn more about these projects and many more visit the Colorado State Sustainability Websites at

www.fm.colostate.edu/sustain

or

www.green.colostate.edu

Or contact
Carol.Dollard@colostate.edu

Operationalizing A Science Roadmap of Food and Agriculture

From Paper to Outcomes: Opportunities in the Farm Bill and Other Legislation

Overview of Roadmap Development

Goals

- Chart the major directions
- Define the needs & set the priorities
- Provide direction to decision makers
- Support advocates
- Support marketing
- Facilitate the building of partnerships

Overview of Roadmap Development

Conceptual Framework

- Ecology, Economics, Social Issues, Production Issues
- Global View & Systems Approach
- Frame “Issues & Needs”
- Identify “Grand Challenges”

Overview of Roadmap Development

The Roadmap Process

- Identifying Challenge Areas & Research Priorities
  - *Delphi survey*
  - *~ 250 Scientist &administrators*
  - *13 challenges & 64 research priorities*
  - *Crosswalk with other roadmaps*
  - *7 grand challenges*

Overview of Roadmap Development

The Roadmap Process

- Identifying How Science Can Contribute
  - *Fame issue, assess capacity, identify priorities*
  - *White papers prepared & reviewed*
  - *~ 80 scientists*
  - *Base document prepared & reviewed*

Roadmap Task Force

Rationale

- Excellent position from which to move toward creative & cohesive research agenda
- Timely & important resource for academic leadership, public & private partners & advocates
- Developed through broad consensus
- Does not provide direct solutions to problems; lays out paths to reach potential solutions
- Next step – operationalize recommendations; integrate into marketing, budgeting & advocacy plans

Roadmap Task Force

Charge

- Develop operational plans & corresponding strategies for implementing & marketing
- Develop strategies for use of recommendations in development of budget requests & advocacy efforts

Roadmap Task Force

Composition

- Chairs of ESCOP Budget & Legislative, Communications & Marketing, and Science & Technology Committees
- 5 regional research ED's
- Up to three additional appointees

Roadmap Task Force

Status

- ESCOP Chair appointed chairs of 3 committees & 5 ED's on May 11
- Bill Ravlin appointed as chair
- Met by conference call
- Designed session & survey to obtain initial input

Roadmap Task Force

Goals

- Communicate LGU national research agenda
- Provide input to research sponsor’s programs
- Facilitate interdisciplinary & inter-institutional team formation
- Stimulate on-going discussion across 7 challenge areas
- Serve as “raw data” for marketing tools

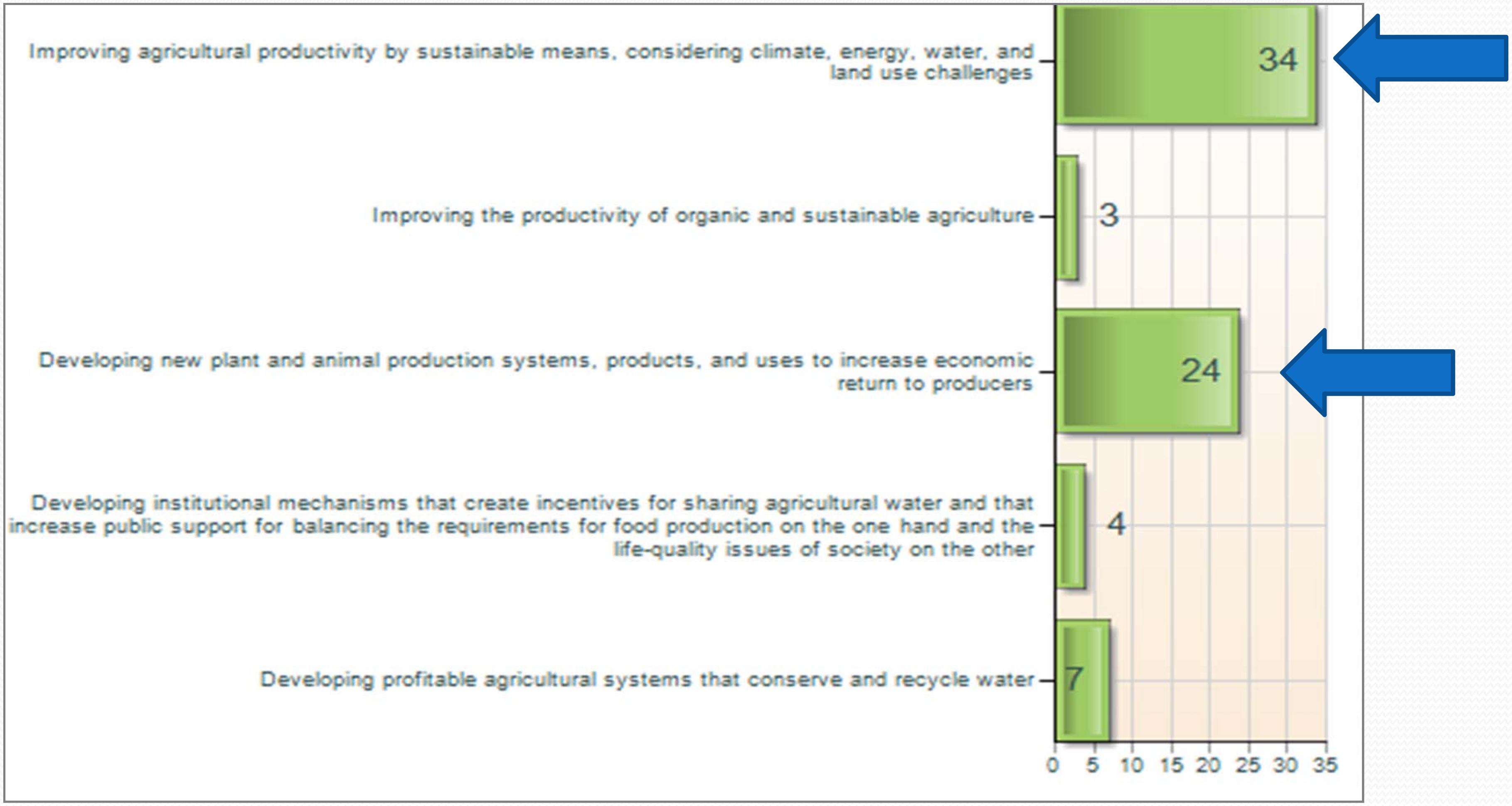
2011 ESCOP Survey Results on Science Roadmap Priorities

September 27, 2011

Simple Survey Process

- Each Challenge
  - Specific action items (4-5/Challenge)
- Each respondent was asked to select the top two action items within each Challenge.
- A total of 36 responses were received.

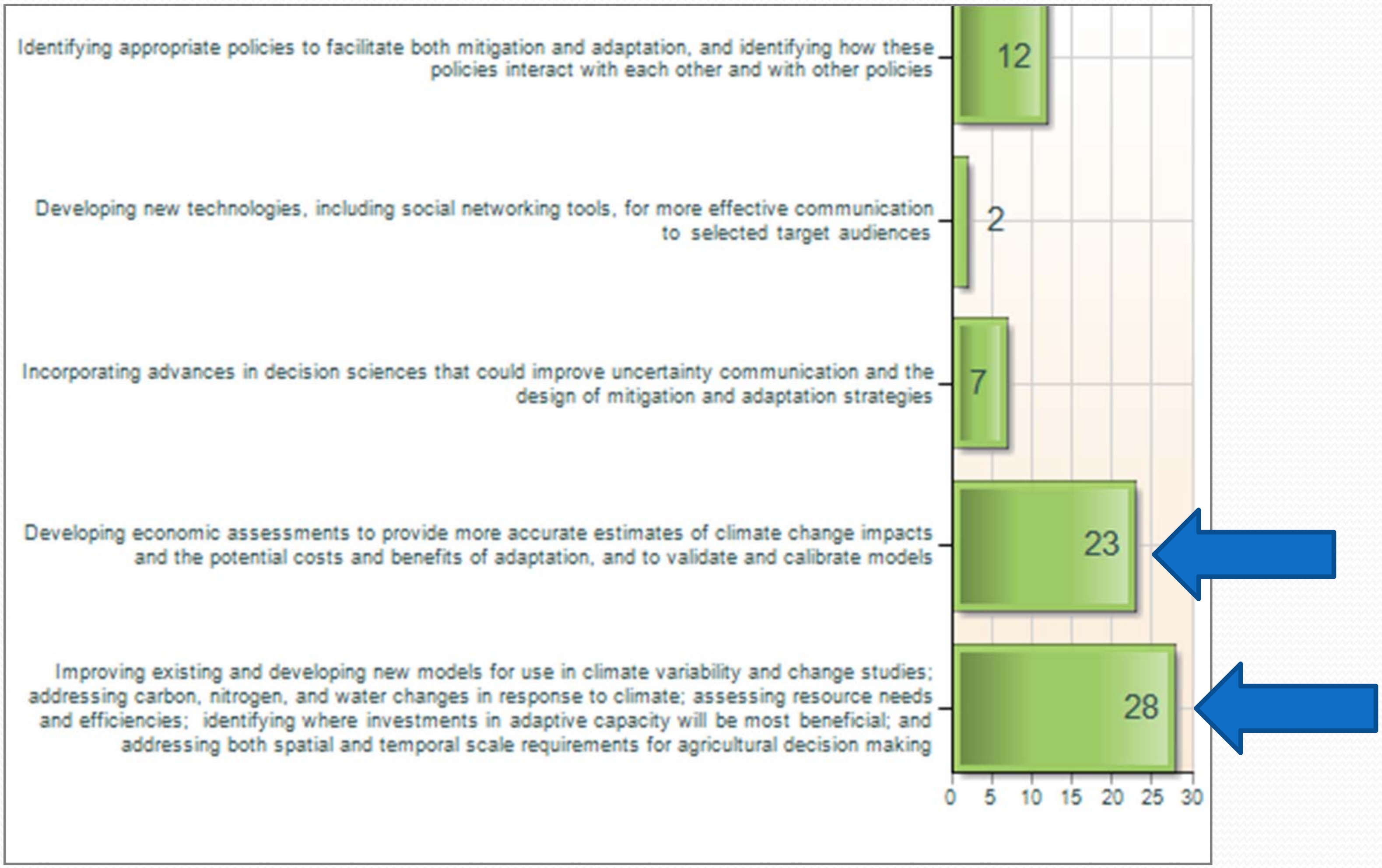
Challenge 1: We must enhance the sustainability, competitiveness, and profitability of U.S. food and agricultural systems.



Challenge 1

1. Improving agricultural productivity by sustainable means, considering climate, energy, water, and land use challenges (34)
2. Developing new plant and animal production systems, products, and uses to increase economic return to producers (24)

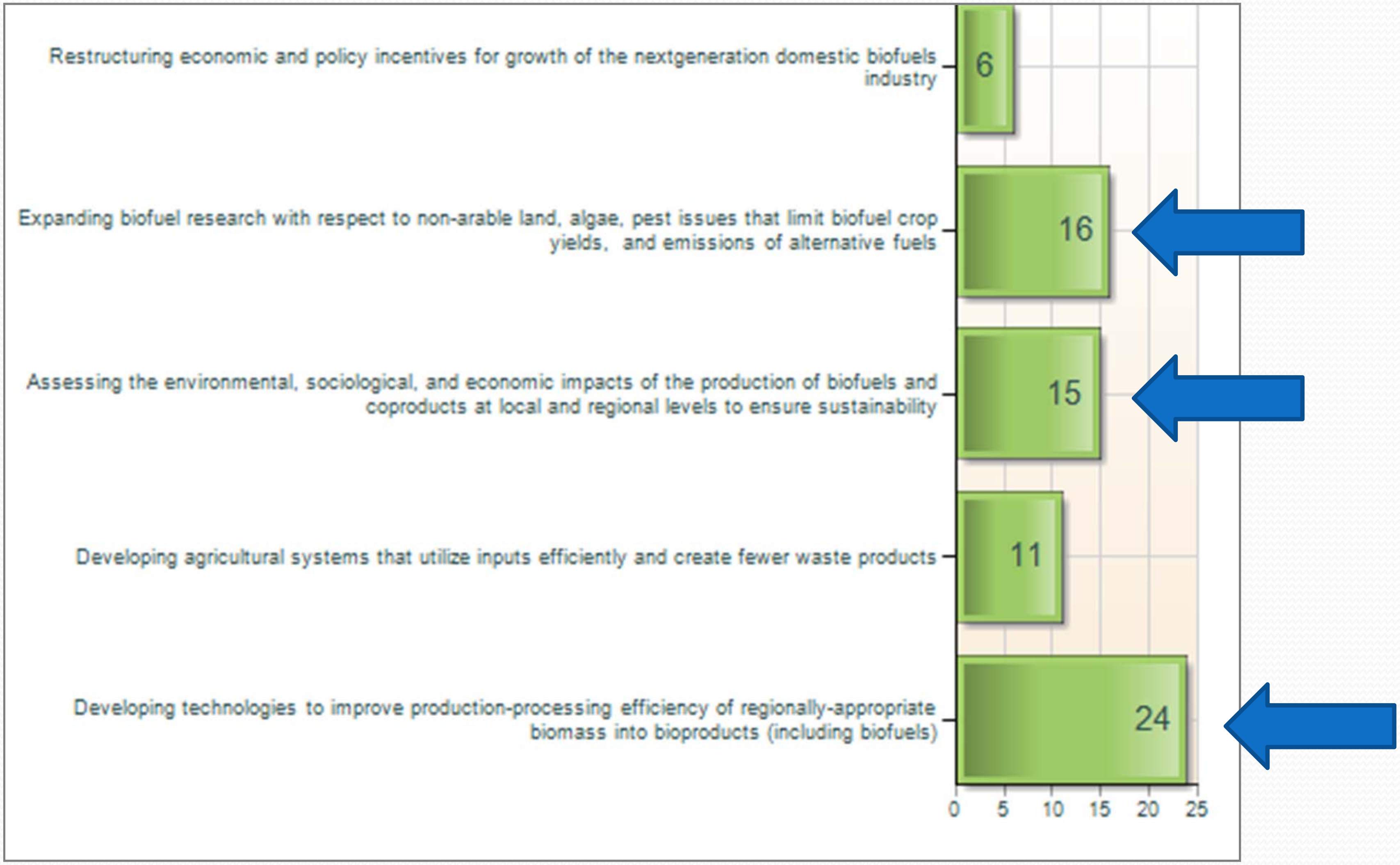
Challenge 2: We must adapt to and mitigate the impacts of climate change on food, feed, fiber, and fuel systems in the United States.



Challenge 2

1. Developing new plant and animal production systems, products, and uses to increase economic return to producers (28)
2. Developing economic assessments to provide more accurate estimates of climate change impacts and the potential costs and benefits of adaptation, and to validate and calibrate models (23)

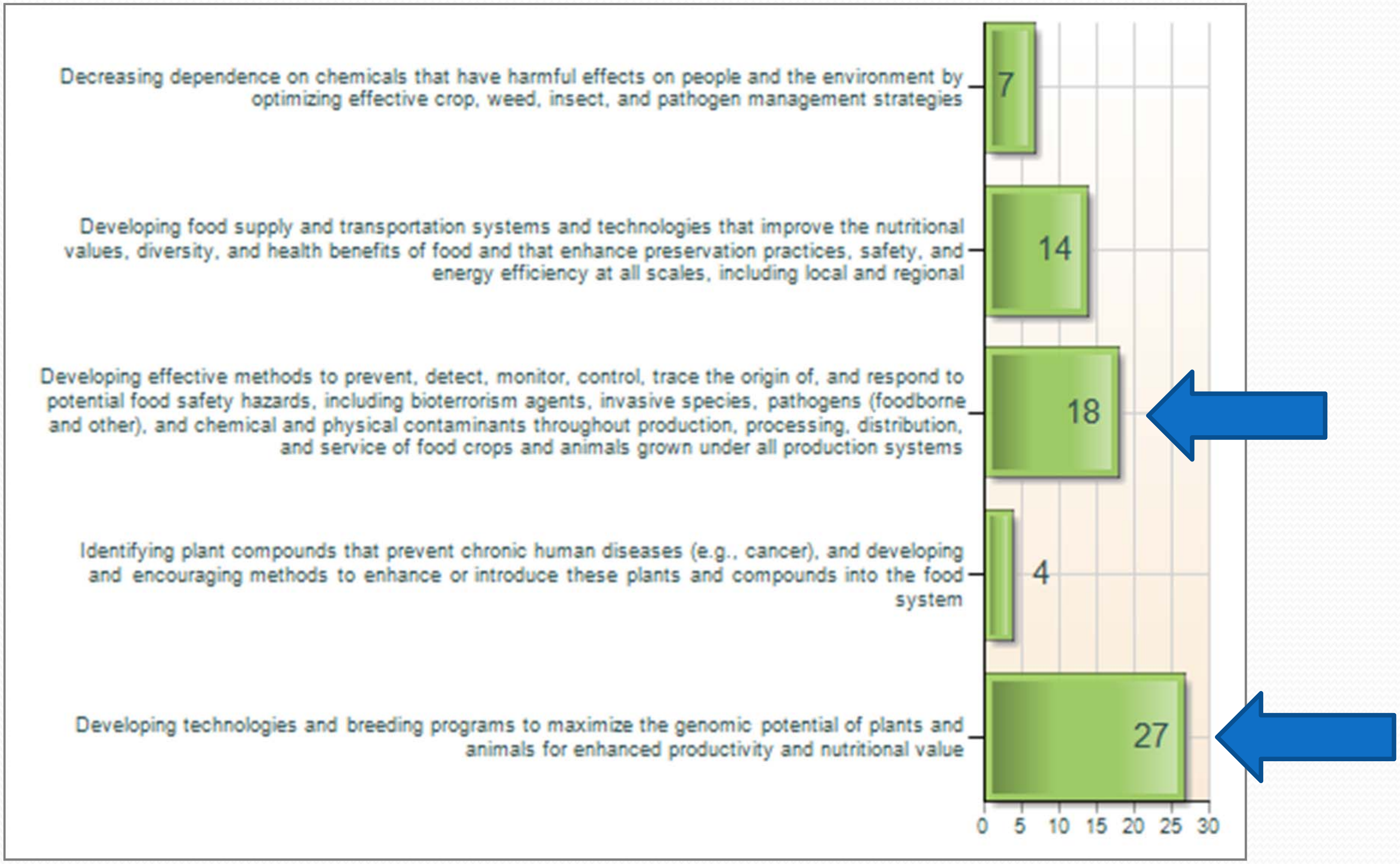
Challenge 3: We must support energy security and the development of the bioeconomy from renewable natural resources in the United States.



Challenge 3

1. Developing technologies to improve production-processing efficiency of regionally-appropriate biomass into bioproducts (including biofuels) (24)
2. Expanding biofuel research with respect to non-arable land, algae, pest issues that limit biofuel crop yields, and emissions of alternative fuels (16)
3. Assessing the environmental, sociological, and economic impacts of the production of biofuels and co-products at local and regional levels to ensure sustainability (15)

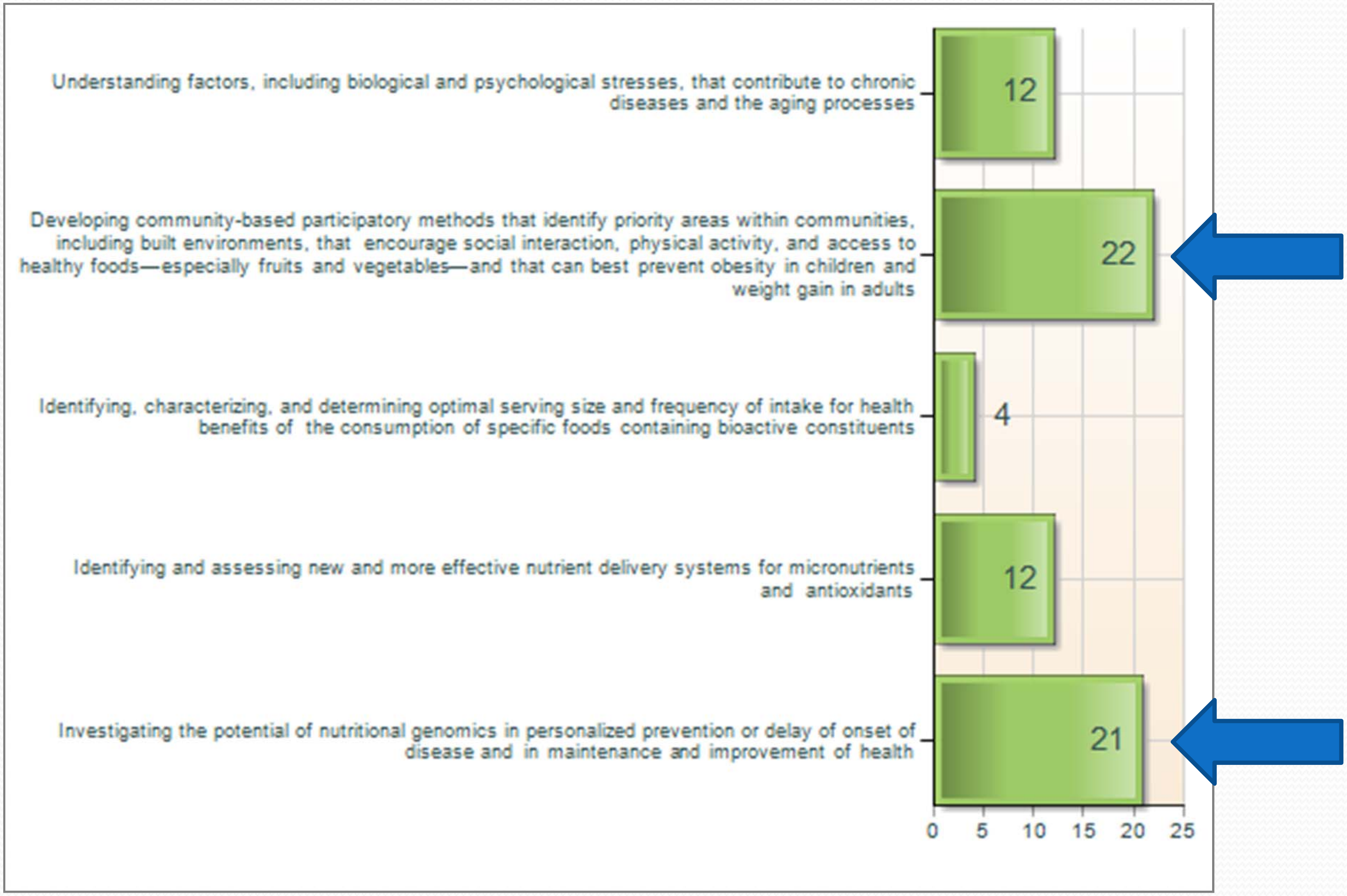
Challenge 4: We must play a global leadership role to ensure a safe, secure, and abundant food supply for the United States and the world.



Challenge 4

1. Developing technologies and breeding programs to maximize the genomic potential of plants and animals for enhanced productivity and nutritional value (27)
2. Developing effective methods to prevent, detect, monitor, control, trace the origin of, and respond to potential food safety hazards, including bioterrorism agents, invasive species, pathogens (foodborne and other), and chemical and physical contaminants throughout production, processing, distribution, and service of food crops and animals grown under all production systems (18)

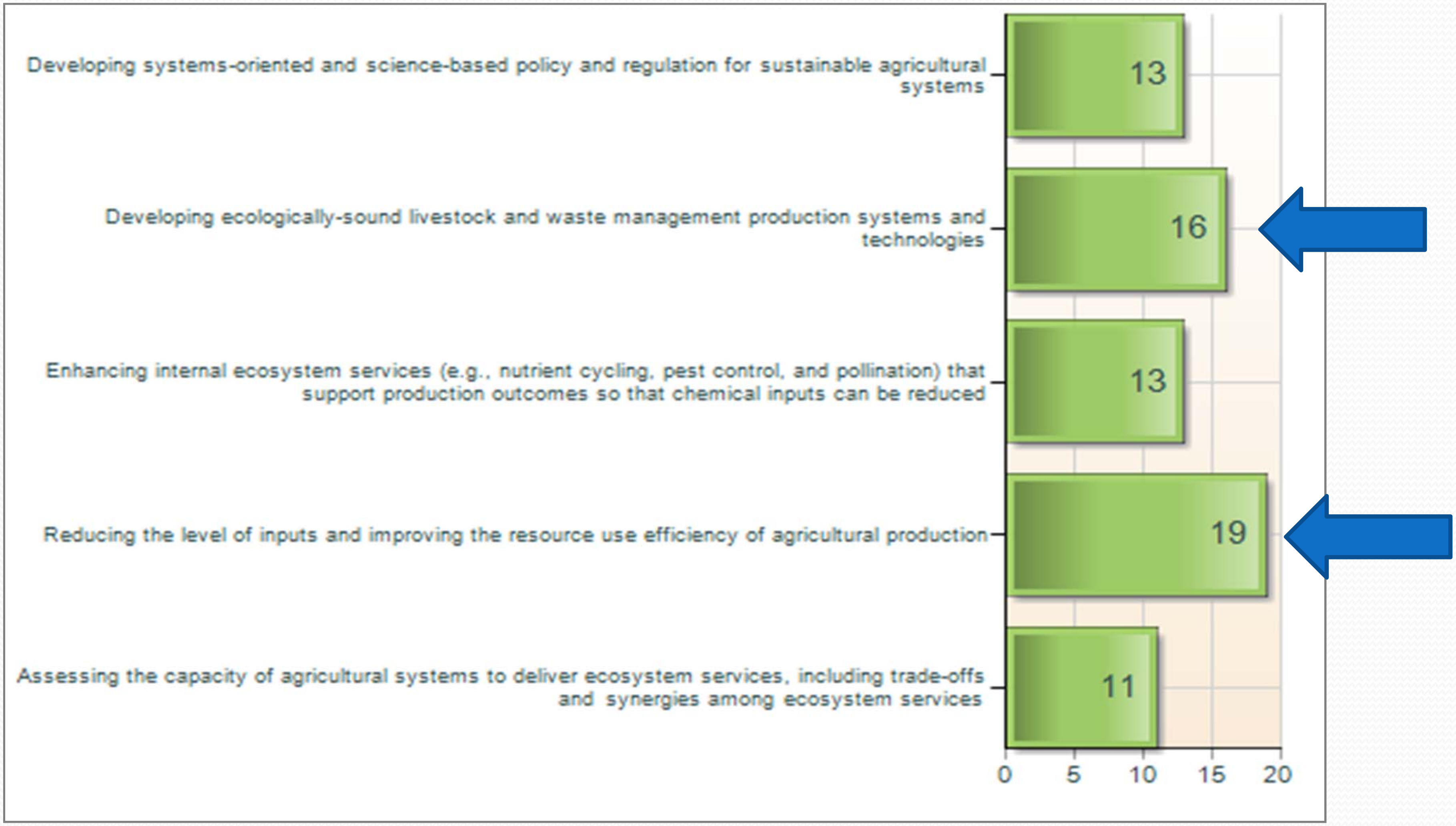
Challenge 5: We must improve human health, nutrition, and wellness of the U.S. population.



Challenge 5

1. Developing community-based participatory methods that identify priority areas within communities, including built environments, that encourage social interaction, physical activity, and access to healthy foods— especially fruits and vegetables—and that can best prevent obesity in children and weight gain in adults(22)
2. Investigating the potential of nutritional genomics in personalized prevention or delay of onset of disease and in maintenance and improvement of health (21)

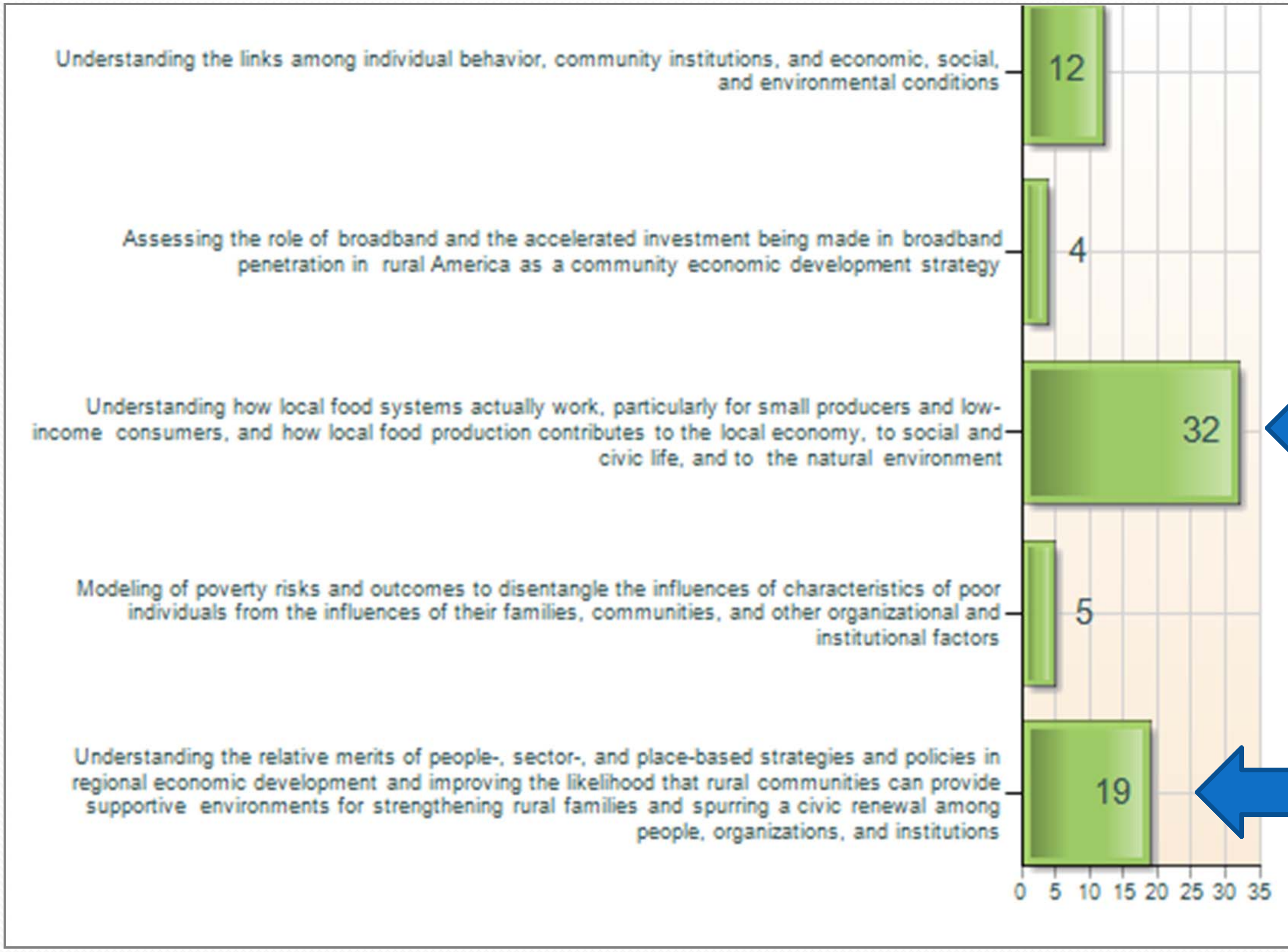
Challenge 6: We must heighten environmental stewardship through the development of sustainable management practices.



Challenge 6

1. Reducing the level of inputs and improving the resource use efficiency of agricultural production(19)
2. Developing ecologically-sound livestock and waste management production systems and technologies (16)

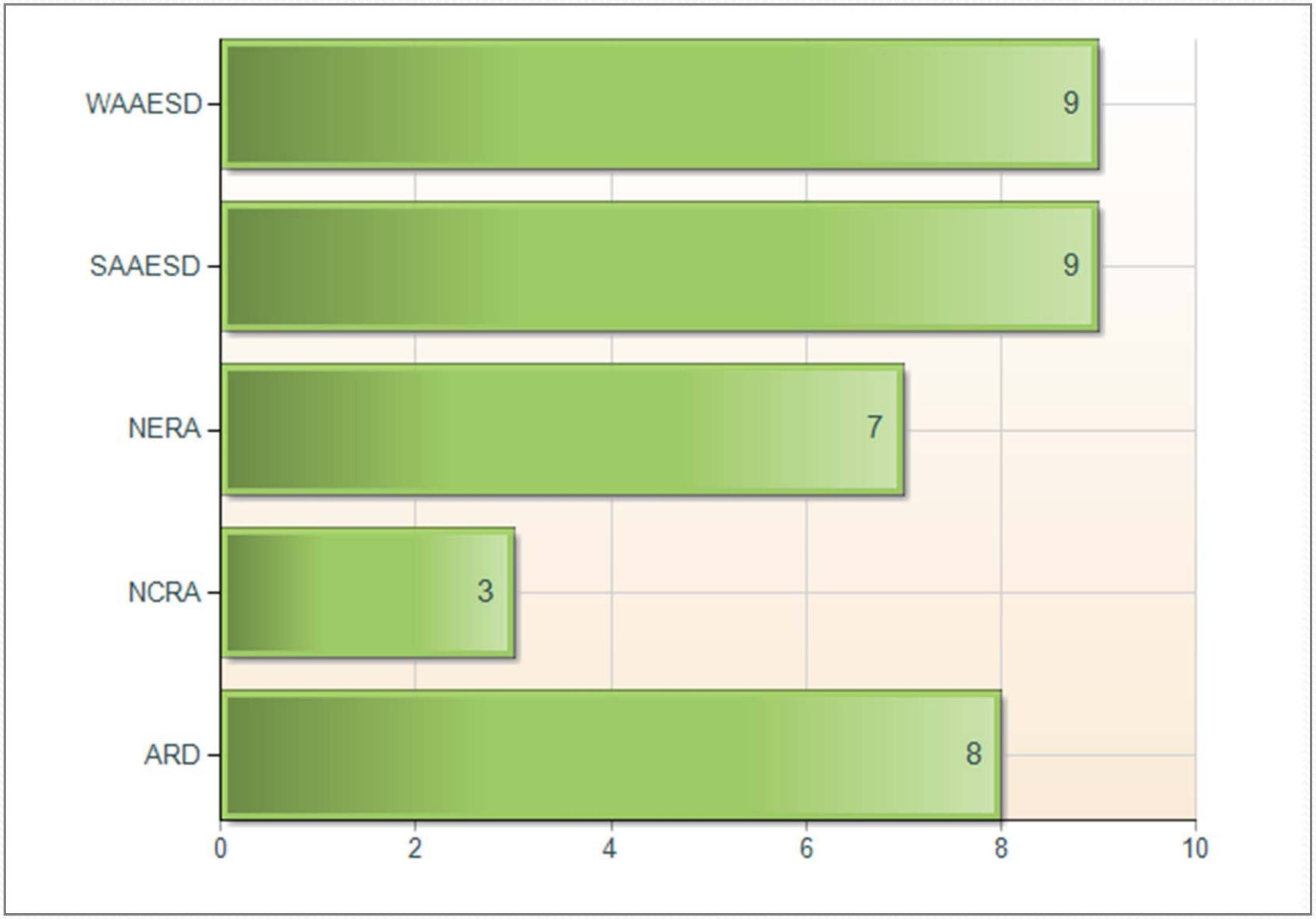
Challenge 7: We must strengthen individual, family, and community development and resilience.



Challenge 7

1. Understanding how local food systems actually work, particularly for small producers and low-income consumers, and how local food production contributes to the local economy, to social and civic life, and to the natural environment (32)
2. Understanding the relative merits of people-, sector-, and place-based strategies and policies in regional economic development and improving the likelihood that rural communities can provide supportive environments for strengthening rural families and spurring a civic renewal among people, organizations, and institutions (19)

Response Rate



Speculating About a Purposeful Future:

Challenges and Opportunities

Evan Vlachos
Civil & Environmental Engineering
Colorado State University

"The trouble with our times is that the future is not what it used to be."

P. Valery


Life just isn't that simple anymore.
TO
SOUTH
NORTH
95
95
JUNCTION
41
3
TO
EAST
41
TO
EAST
WEST
3
ALT
ALT
278
NO HITCH HIKING
NO TRUCKS OVER 33 FEET
STOP
7 SHERMAN

INTERLOCKING CRISES

- CLIMATIC SHIFTS
- MEGARUPTURES
- METABOLISM
- SOCIO-POLITICAL CONTEXT
- TRANSBOUNDARY DEPENDENCIES
- FAST PACE OF TECHNOLOGICAL DEVELOPMENT

The Grand Transformation

- Globalization
- Interdependence
- Vulnerability
- Complexity
- Uncertainty
- Turbulence

Complexification

Complexification

A. **Conceptual** = shifting paradigms/complexity/chaos/heterarchization

B. **Methodological** = multi-/GIS, ES, AI, DSS/systems/computational prowess

C. **Organizational** = participatory/anticipatory/contingency emphasis

D. **Substantive** = new focus/areas of concern

The 3 Revolutions

- **The Green Revolution**

  = tradition vs. modernization

  → complex organization

- **The "Geek" Revolution**

  = Guttenberg vs. Gates

  → data and information

- **The Gene Revolution**

  = Malthus vs. Mendel

  → bioengineering

APROACHING AGRICULTURAL CHANGES

- **As “*crises*”   *(. . . and discontinuities)***
- **As *challenges***
- **As *trends* and *developments***
- **As *strategies* and *tactics***


WELCOME TO
AGRI-PLEX
FARMS, INC.
A DIVISION OF
CULTIVATION MEGASYSTEMS INTERNATIONAL
A WHOLLY-OWNED SUBSIDIARY OF
ECO-DATA MULTI-NUTRITIONAL GERMINATION PROCESSORS
(FORMERLY OLD MACDONALD'S)

As “Crises”

- Crises 1: Farm and Ranch Survivability
- Crises 2: Modernization
- Crises 3: Feeding a Growing World
- Crises 4: Safe Food and Drinking Water
- Crises 5: Stewardship and the Environment
- Crises 6: Urbanization and Land Use
- Crises7: Country and Urban Conflicts

Source: D. Hoag, Agricultural Crisis in America (1999)

As “challenges”
Challenges for Public Agricultural Research

- Globalization of the food economy
- Emerging pathogens and other hazards in the food supply chain
- Enhancing human health through nutrition
- Improving environmental stewardship
- Improving quality of life in rural communities

Source: NRC, Frontiers in Agricultural Research (2003)

As "trends and developments"

= Structural transformations

rurality and urbanization

operation size

= Technological changes

automation, "closed system agriculture"

genetics

= trade and global competition

interdependence and global forces

= Social changes

economic base

"rurban" and botique farms

= Environmental impacts

monoculture and biodiversity

pollution, pesticides, erosion

As "strategies and tactics"

= An agricultural system highly competitive in the global economy

= A safe and secure food and fiber system

= A healthy, well nourished population

= A greater harmony between agriculture and the environment

= Enhanced economic opportunity and quality of life for all Americans

USDA Stakeholder Symposium (1997)

Underlying Transformations

VOLATILITY

- Turbulence and Uncertainty

VULNERABILITY

- Interdependencies and Risk

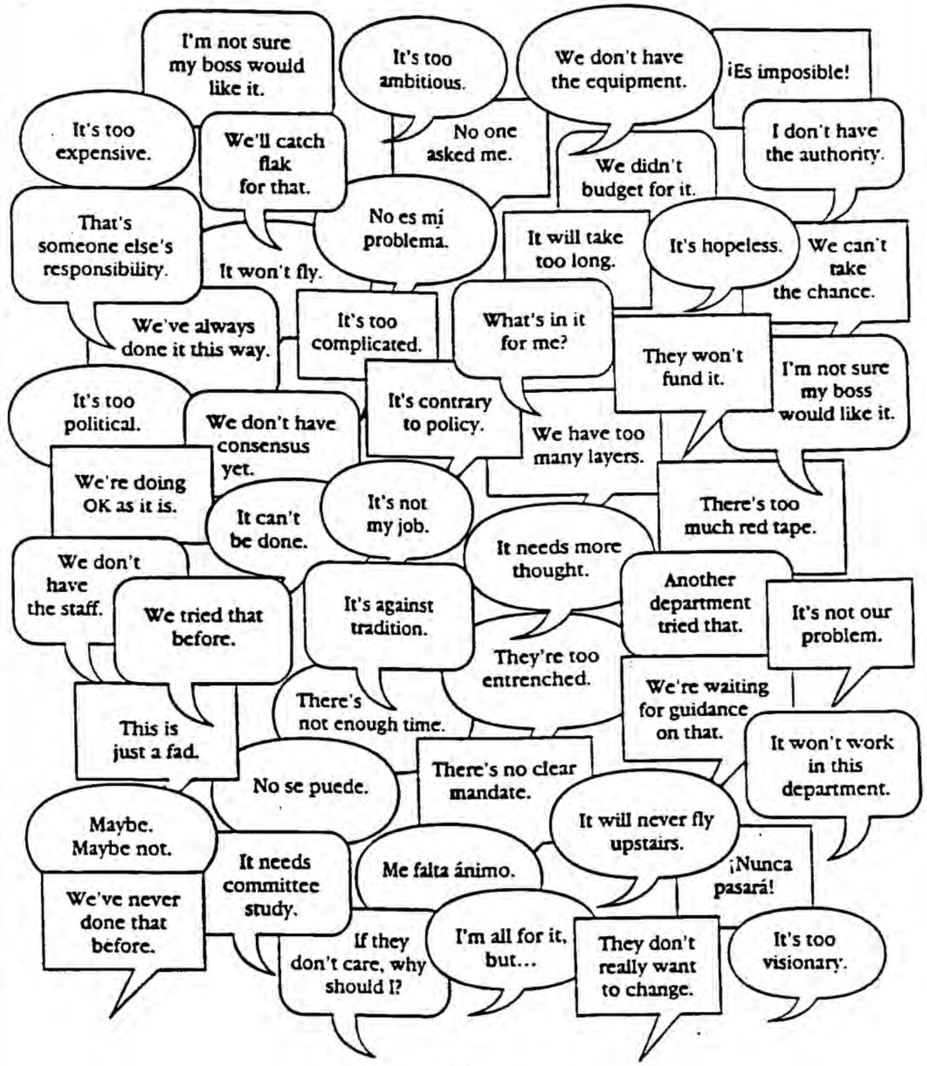
VIGILANCE

- Environmental Scanning and Preparedness

The Politics of Transformation

- Building Data / DSS
- Expanding Knowledge / Judgement
- Creating Institutions / Capacity Building
- Mobilize Resources
- Articulate Values

50 Reasons Not To Change



Stop.
Look inward.
Listen.
To yourself.
To others.

ALTERNATIVE WORLD FOOD SITUATION ENVIRONMNENTS

[supply - demand emphasis]

I. TECHNOLOGY INDUCED ABUNDANCE

= technology driven plentiful, low cost food

II. SUPPLY - DEMAND REASONABLE BALANCE

= problem of both abundance and scarcity,

periodic crises, some reasonable management

III. SUSTAINABLE DEVELOPMENT

= conservation, ZPG, demand-managed future

IV. MALTHUSIAN NIGHTMARES

= starvation, famines, ecocatastrophes, geopolitical,

upheavals, disequilibrium

Emerging Operational Principles

- **Envisioning**

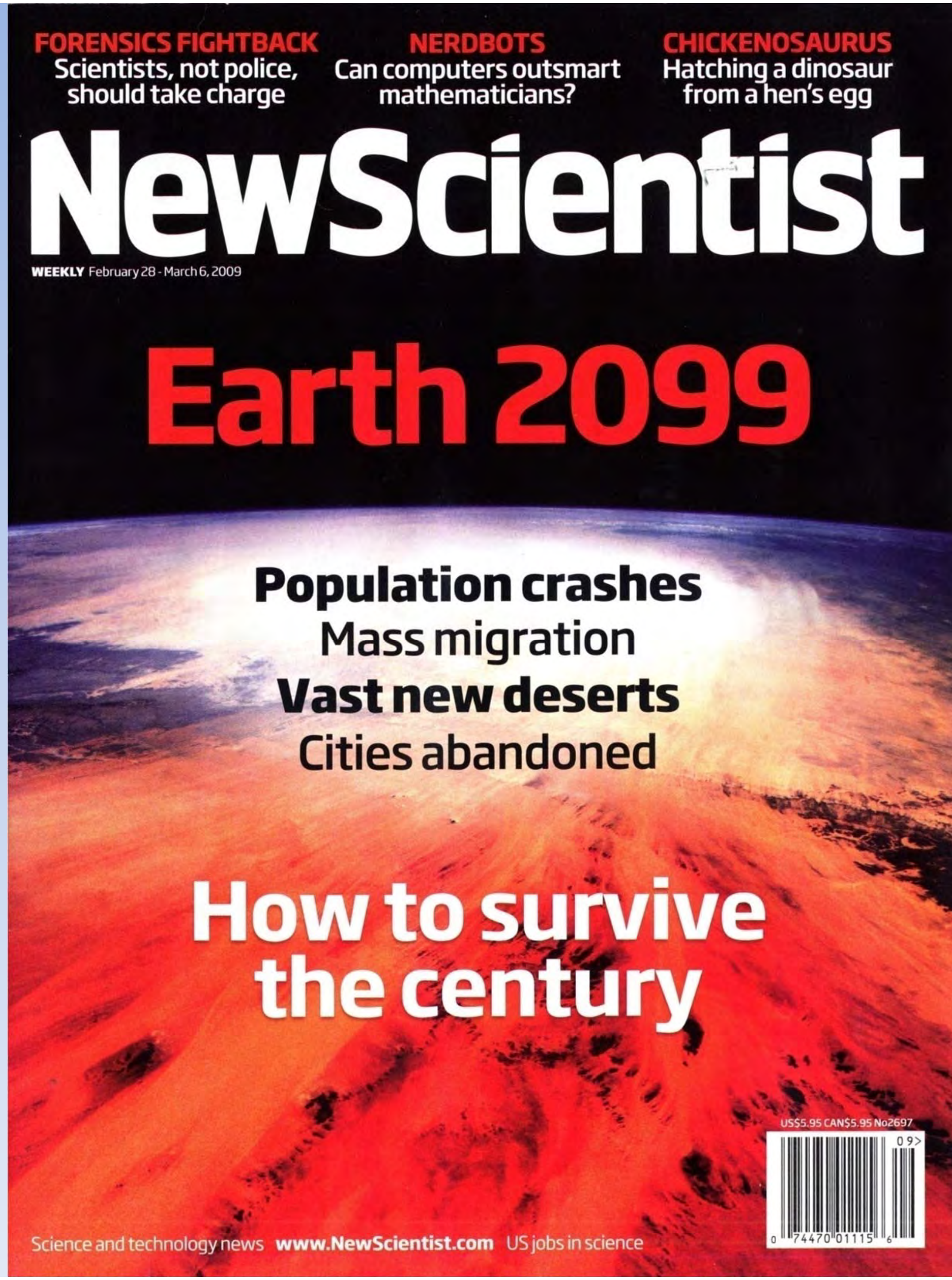
  = Share the dream, share the goals

- **Empowerment**

  = Joint decision making, power sharing

- **Enactment**

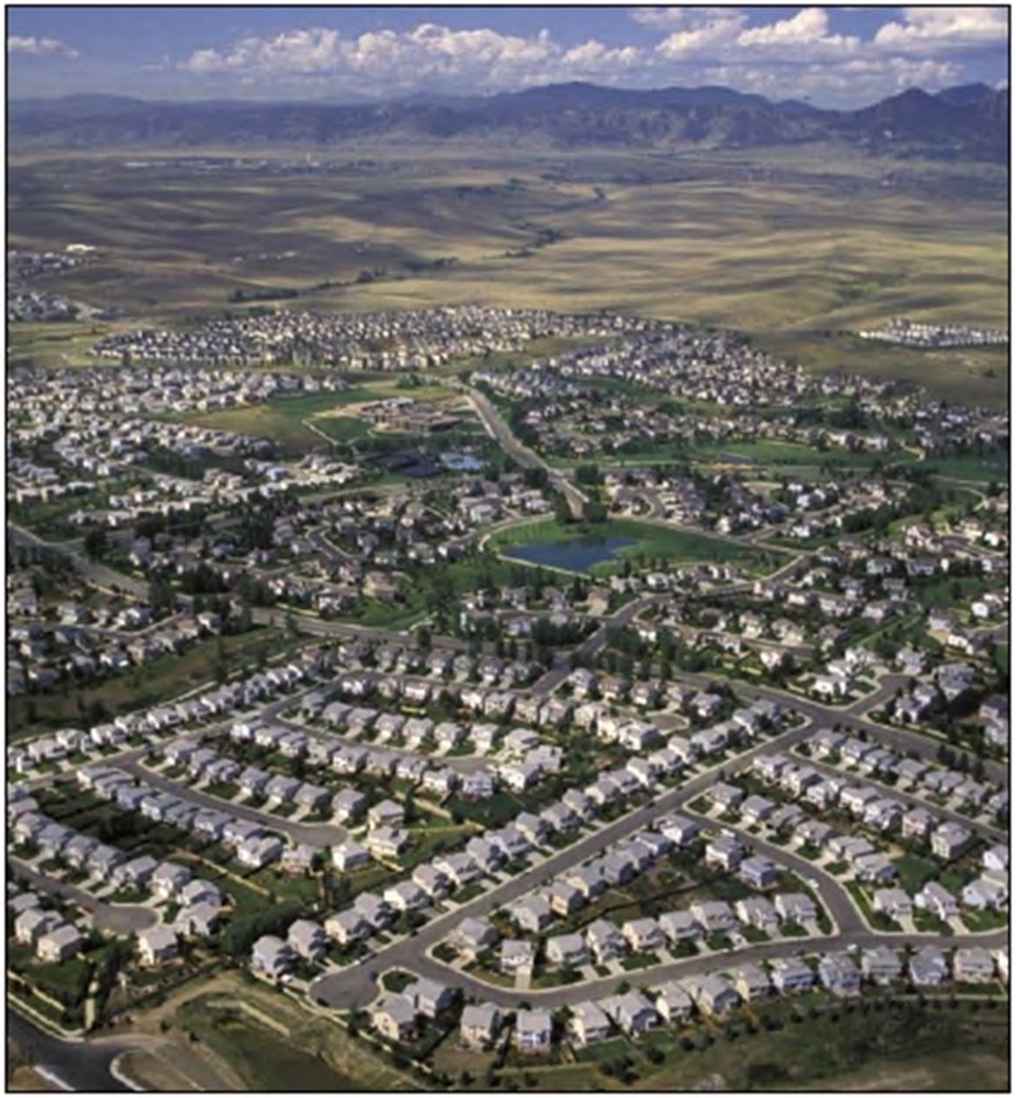
  = Implementation, civic engagement



FORENSICS FIGHTBACK
Scientists, not police, should take charge
NERDBOTS
Can computers outsmart mathematicians?
CHICKENOSAURUS
Hatching a dinosaur from a hen's egg
NewScientist
WEEKLY February 28 - March 6, 2009
Earth 2099
Population crashes
Mass migration
Vast new deserts
Cities abandoned
How to survive the century
US$5.95 CAN$5.95 No2697
Science and technology news www.NewScientist.com US jobs in science

LOSING GROUND

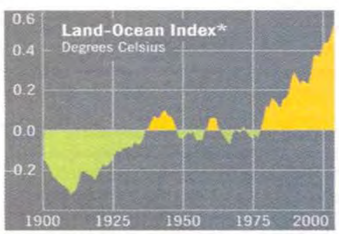
COLORADO'S VANISHING AGRICULTURAL LANDSCAPE



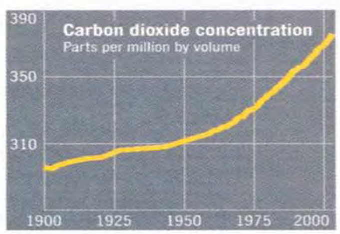
Environment Colorado Research And Policy Center | March 2006

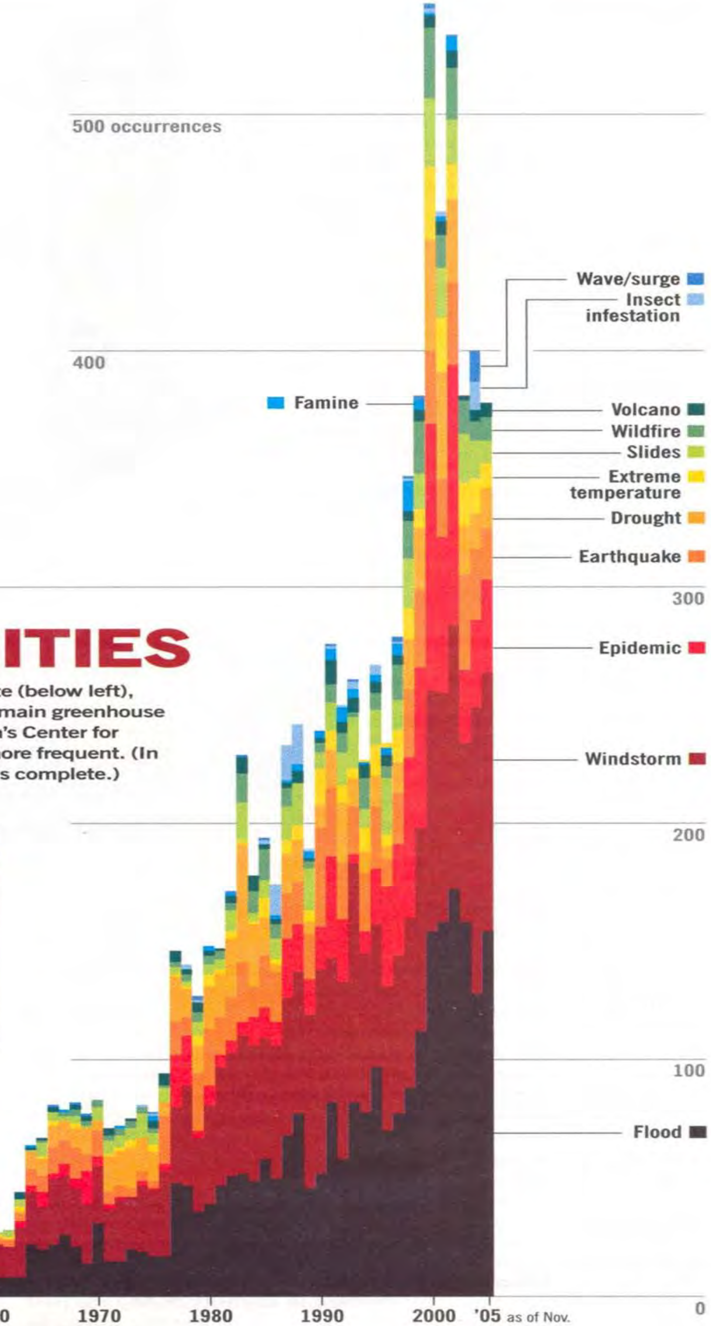
MOUNTING CALAMITIES

Since the 1980s, the Earth's temperature has risen at an increasing rate (below left), probably in response to rising concentrations of CO_2, the atmosphere's main greenhouse gas. Signs of climate change are obvious in data assembled by Belgium's Center for Research on the Epidemiology of Disasters: Calamities have become more frequent. (In part because the center only started in 1974, earlier data may not be as complete.)



*Global annual temperature relative to the 1951–80 mean.

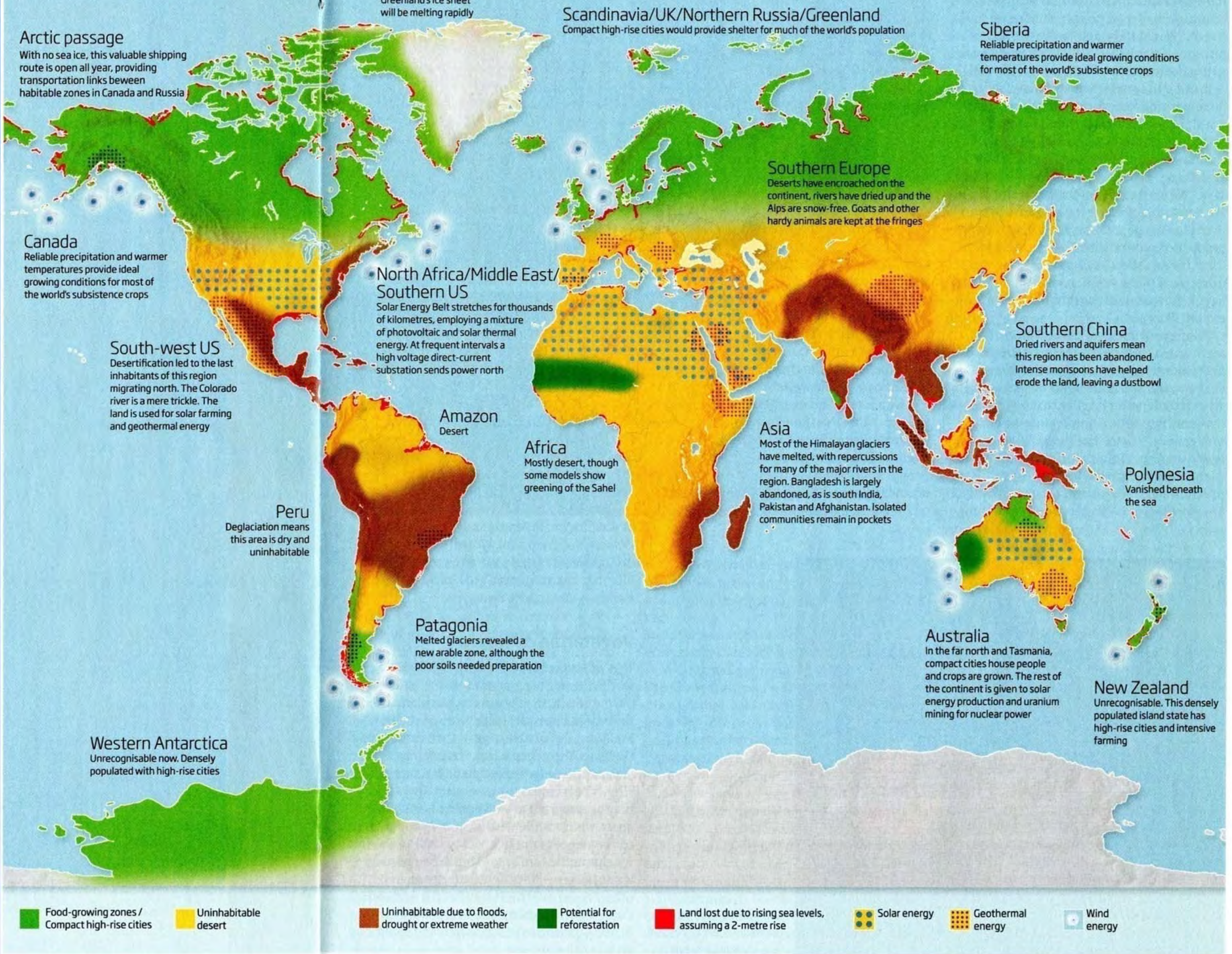


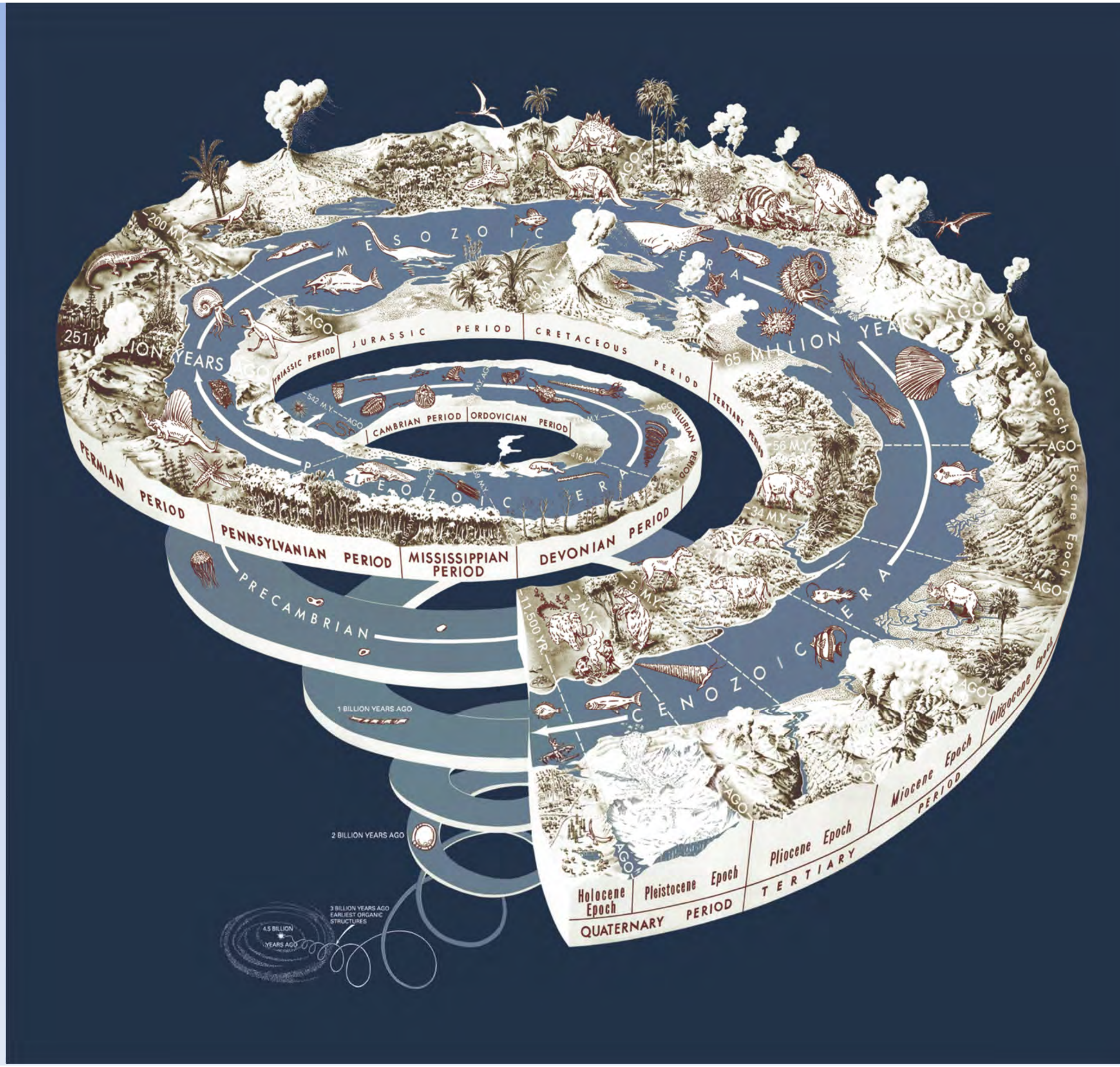


Number of natural disasters recorded each year worldwide
1900–2005

The world: 4°C warmer

No one knows exactly what this world will look like, but models provide insights into forced human migrations and our future power generation





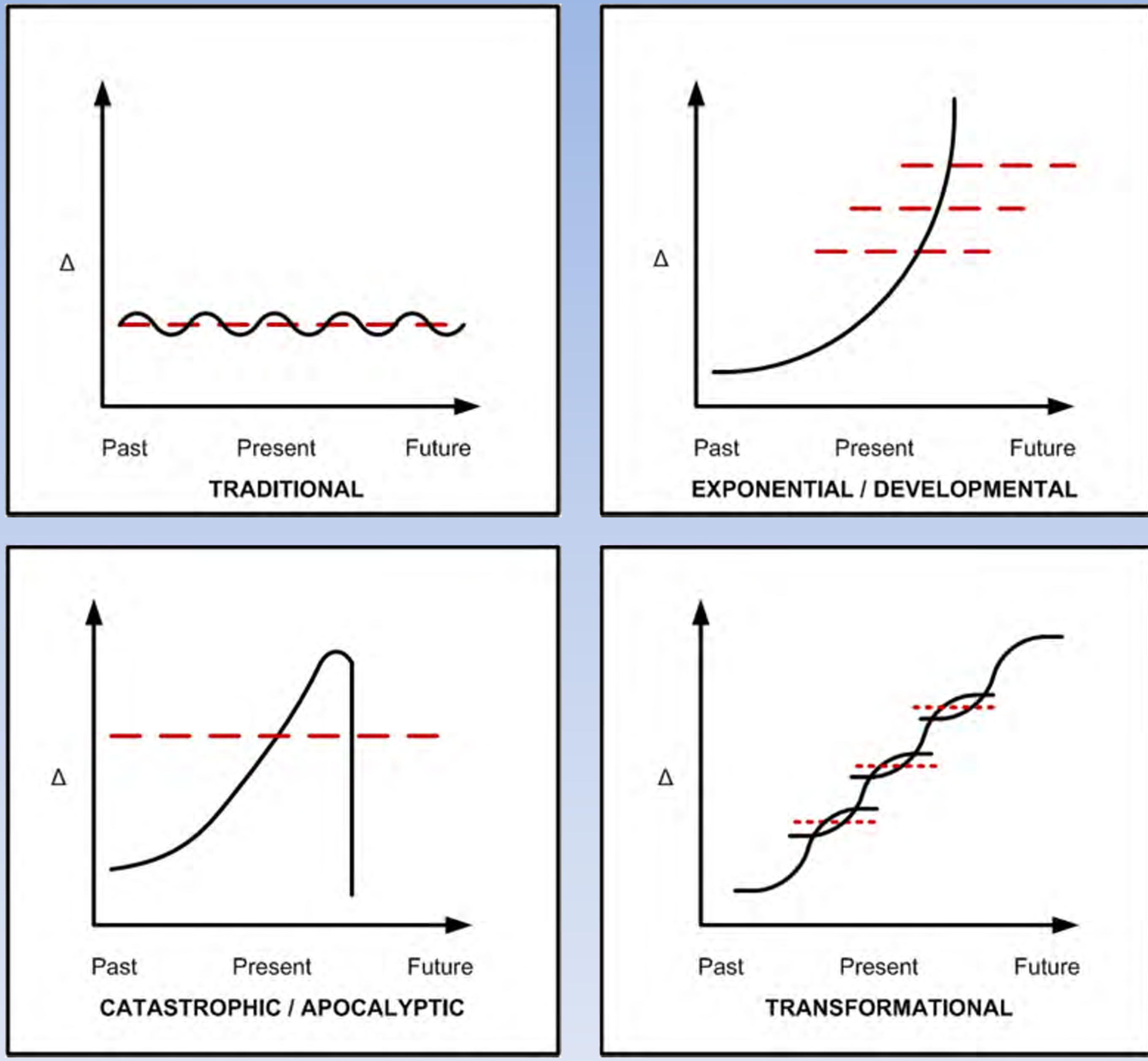
MESOZOIC ERA
200 M.Y.
251 MILLION YEARS AGO
TRIASSIC PERIOD
JURASSIC PERIOD
CRETACEOUS PERIOD
65 MILLION YEARS AGO
Paleocene Epoch
Eocene Epoch
Oligocene Epoch
Miocene Epoch
Pliocene Epoch
Pleistocene Epoch
Holocene Epoch
TERTIARY PERIOD
QUATERNARY PERIOD
CENOZOIC ERA
56 M.Y.
34 M.Y.
11,500 YR.
PALEOZOIC ERA
542 M.Y.
CAMBRIAN PERIOD
ORDOVICIAN PERIOD
SILURIAN PERIOD
416 M.Y.
DEVONIAN PERIOD
MISSISSIPPIAN PERIOD
PENNSYLVANIAN PERIOD
PERMIAN PERIOD
PRECAMBRIAN
1 BILLION YEARS AGO
2 BILLION YEARS AGO
3 BILLION YEARS AGO
EARLIEST ORGANIC STRUCTURES
4.5 BILLION YEARS AGO

Oil transformed Dubai in the 1970s. The city now boasts the world's tallest building, giant malls, and some two million residents, who depend on desalinated seawater and air-conditioning—and thus on cheap energy—to live in the Arabian desert.

JENS NEUMANN / EDGAR RODTMANN

ENTER THE ANTHROPOCENE AGE OF MAN

It's a new name for a new geologic epoch—one defined by our own massive impact on the planet. That mark will endure in the geologic record long after our cities have crumbled.


Δ
Past
Present
Future
TRADITIONAL
Δ
Past
Present
Future
EXPONENTIAL / DEVELOPMENTAL
Δ
Past
Present
Future
CATASTROPHIC / APOCALYPTIC
Δ
Past
Present
Future
TRANSFORMATIONAL

Premises of Foresight

1. Trend is not destiny
2. Those who live by the crystal ball are bound to eat groundglass
3. It is better to be approximately right rather than precisely wrong

Requisites for the Transition

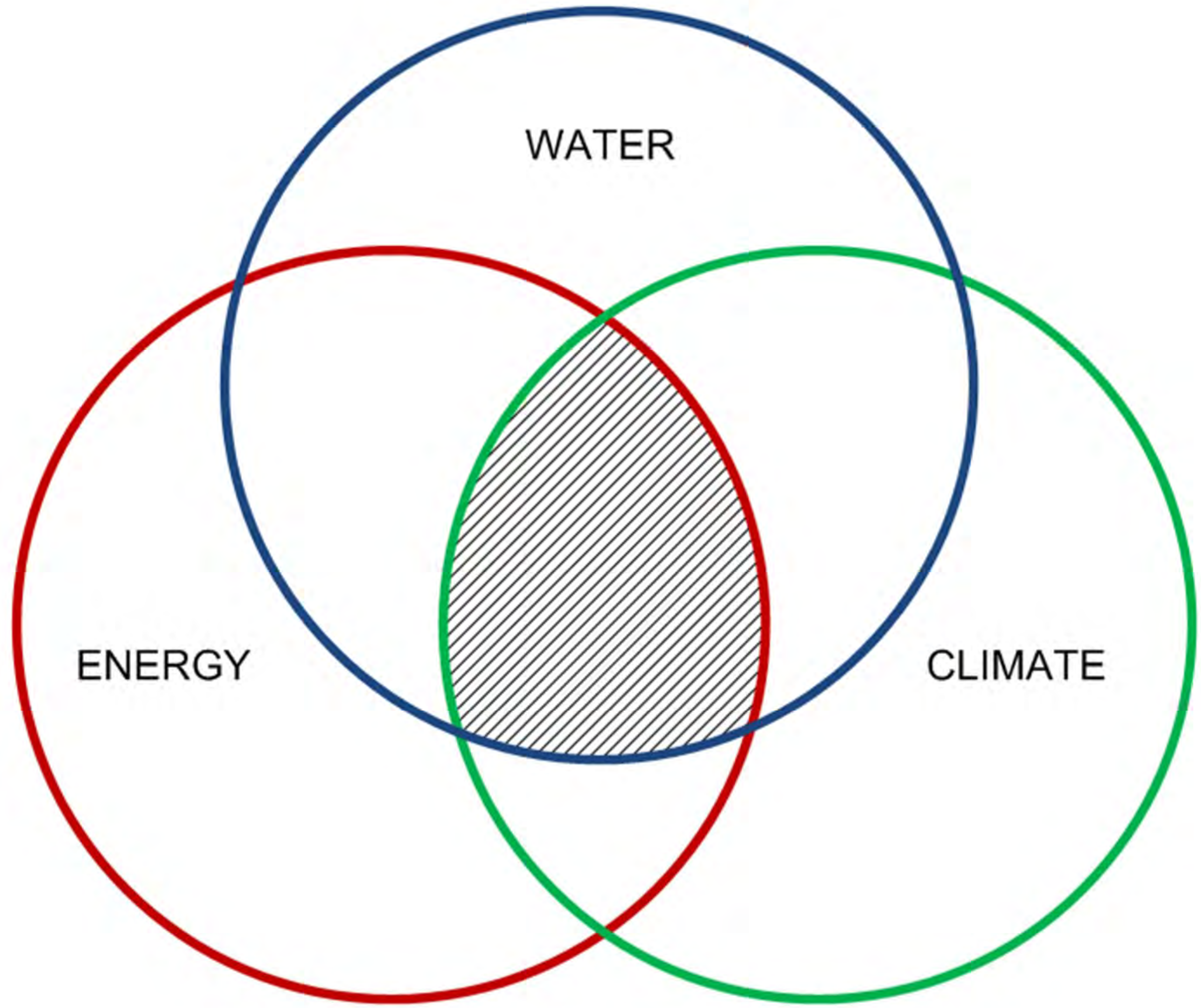
- **The Need for New Paradigms**
  - Sustainability, heterarchy, co-evolution
- **The Understanding of New Contexts**
  - “Raplexity,” interdependence, globalization
- **The Emergence of New Methodologies**
  - Cumulative, synergistic, diachronic impacts
  - Indicators, DSS, data-information, judgment
  - Computational prowess

[Pronounced "wēi - drōng - jī"]

CRISIS & OPPORTUNITY

"Opportunity in the Midst of Crisis" is the literal translation of this Chinese phrase. The Chinese word for "crisis" (危机) is comprised of two parts: "danger" (危) and "opportunity" (机 or 機), and the character " 中 " means "center". The ancient form for "danger" is " [illegible] " depicting a person on the edge of a precipice. The ancient form for "opportunity" is " [illegible] ". " [illegible] " is believed to depict the cocoon – a symbol of transformation.

– Words and Calligraphy by Yunn Pann


WATER
ENERGY
CLIMATE

“The future is not result of choices among alternative paths offered by the present, but a place that is created --- created first in mind and will, created next in activity. The future is not some place we are going to, but one we are creating. The paths to it are not found but made, and this activity of making them changes both the maker and the destination.”

John Schaar

Structuring University-Wide Centers and Institutes: Issues and Solutions

Dr. Bob Shulstad

THE UNIVERSITY OF GEORGIA
COLLEGE OF AGRICULTURAL & ENVIRONMENTAL SCIENCES

1785

Basic Rules for Success

- Key ingredient is "Value Added" - break down silos of departments, schools or colleges
- Mission with measurable outcomes, defined policies, operating procedures, and review process, where mission cannot be accomplished by existing university units
- Passionate leaders who are willing to share the credit, the glory, the IDC and the royalties.
- Division of IDC, royalty, student credit hour generation funds and academic credit must be agreed in writing between all affected department heads, deans of schools and C/I directors prior to initial operation of the C/I.

Basic Rules for Success

- Personalities do matter - C/I membership is generally voluntary though in some cases recruited and evaluated for potential contribution.
- Success may require upper levels of administration to double count the measurable outcomes in order to get long term support and success.
- If Deans and department heads are evaluated on number of majors or Masters and PhD students they are likely not to support Institutes that can offer degrees.
- Board of Regents have moved for elimination of department’s base on insufficient numbers of majors or degrees awarded without recognizing that those majors and degrees are being offered by an Institute and taught by the tenured faculty of the department identified for elimination.

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The University of Georgia

- Institute of Plant Breeding, Genetics and Genomics (IPBGG) R/T
- Center for Urban Agriculture (CUA) E/R
- Center for Food Safety (CFS) R
- Center for Agribusiness and Economic Development (CAED) E/R
- Bioenergy Systems Research Institute (BSRI) R

How are faculty assigned to the Center/Institute?

- **<u>IPBGG:</u>** Tenure track UGA faculty - entirely voluntary.
- **<u>CUA:</u>** Tenure track voluntary; Director and Public Service faculty and support budgeted to Center thru Assistant Dean Griffin Campus.

How are faculty assigned to the Center/Institute?

- **CFS:** Director and initial faculty and staff transferred from Dept. of Food Science and Technology. New core faculty hired directly into the CFS, housed in the CFS and devote 100% of research to CFS projects. Additional faculty recruited from University community and USDA.

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How are faculty assigned to the Center/Institute?

- **<u>CAED:</u>** Budgeted members appointed - joint decision of Associate Deans for Research and Extension and Head, Agricultural & Applied Economics. Additional faculty from the University community can be associated with the Center on either ongoing or temporary basis for the duration of a project, subject to their department head's approval.
- **<u>BSRI:</u>** Founding members by invitation. Formal agreement required to devote a portion of efforts to institute activities, post their research program on website and expertise database. After third-year review, a formal evaluation procedure will be established for renewal of institute memberships, based on contributions made by the member.

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What is faculty relationship to the C/I vs. home department?

Heads of all potentially impacted departments and all Deans are asked to provide letters of support during the faculty governance approval process.

- **IPBGG:** All members of the Institute will spend approximately 15% of their time on Institute activities related to cultivar development, collaborative research, graduate education, and organizational tasks.
- **BSRI:** Each application for membership must contain a written commitment from the Promotion/Tenure Unit (PTU) head, dean or director that the member will be allowed to devote a minimum amount of effort (at least 5%, 0.05 EFT, 2 hours per week average) to Institute initiatives.

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What is faculty relationship to the C/I vs. home department?

- **CFS:** While core faculty are salaried and housed separately, they remain on tenure track with FST Dept. They need to actively participate in departmental activities.
- **CAED:** Tenure track faculty must remain connected with home department. Public service faculty and staff salaried through CAED have detached to a great degree.

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How are P/T decisions made and by whom?

- For all Centers and Institutes at UGA, tenure track faculty are appointed to departments or schools.
- If >1/3 time in C/I then advice and recommendations of the C/I Director will be reflected in the P/T decision.
- If department is supportive and C/I is not, department keeps the faculty and comes up with needed salary.
- If C/I is supportive and department is not, tenure will not be awarded.
- If salary is budgeted between departments and C/I, then merit pay is decided jointly.

How are IP and royalty issues handled?

All IP owned by the

University of Georgia Research Foundation

- **IPBGG:** Faculty membership requires that member's originating unit reallocate to the Institute 15% of that member's departmental indirect cost returns and 15% of that member's departmental royalty returns.

THE UNIVERSITY OF GEORGIA
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How are IP and royalty issues handled?

- **<u>CFS:</u>** All departmental IDC and royalty accrue to the CFS.
- **<u>BSRI:</u>** If BSRI staff are involved in grant submission, 15% of departmental IDC will be given to the BSRI. All departmental royalty remains with the home department.

What is/are the funding mechanism(s)?

- **IPBGG:** No faculty time budgeted to Institute. Faculty and their hard funded staff retained in departmental budgets. Office operations supported by IDC and royalty. Administrative support from AES. Faculty research programs supported by competitive grants, contracts, and gifts. Cultivar Development Research Program funded by 30% of all plant royalties provides a competitive pool to support plant breeding.

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What is/are the funding mechanism(s)?

- **CUA:** Director and public service faculty are partially budgeted to Center. Space and initial funding for the Center provided by the AES and CES. The Center Director and External Advisory Committee pursue gifts, grants, and sponsored work to strengthen the resources of the Center.

What is/are the funding mechanism(s)?

- **<u>CFS</u>**: Core faculty and staff are salaried and housed in CFS. All hard funds and extramural funds budgeted to the CFS. Those housed outside of the CFS are budgeted in home departments.
- All CFS faculty have access to the internal competitive grant pool funded by CFS Advisory Board Members ($20K) or Patrons ($5k) to address Food Industry issues.

What is/are the funding mechanism(s)?

- **<u>CAED:</u>** Redirected funds from AES and CES and extramural grant funding. Additional Experiment Station and Extension funding may be provided, mainly in the form of faculty and/or staff salary support for people who work on specific Center projects on a temporary basis.
- Extramural grant funding sought mainly from in-state commodity groups, agribusinesses, and State Ag Innovation Center.

How are departments given credit for their faculty's outputs?

- All faculty submit a Faculty Activity Report through the unit where they are budgetary home based; this is generally the department.
- The **CFS** and the Public Service faculty of the **CAED** are the only exceptions.

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Do departments share in funds generated, such as grant overhead?

- UGA policy returns 20% of the F&A reimbursement from every sponsored project to the “generating” unit. By default, this is the unit indicated as the administrative unit on the proposal transmittal form. However, current practice allows PIs and co-PIs to specify (with unit leader approval) on the transmittal form how the 20% return should be distributed to multiple units with which the investigator is associated.

How are graduate/undergraduate student hours credited?

- Student credit hours are credited to the unit providing the teaching salary for the instructor of record. When a course is cross-listed, credit will go to tenure home department of the actual instructor.
- Conflict arises with Majors and Graduates from degrees within Institutes; these are currently not credited to the home department of the instructor.

Do departments receive salary release funds to assist in teaching when faculty are assigned to a C/I?

- Generally, yes. Teaching assignment is a joint decision of the department head and C/I director. We strive to have all research/teaching faculty on 100% hard funds at the beginning of each fiscal year. The department head has full flexibility to move funds across their faculty to reflect their actual responsibilities. Salary savings from movement to external funds stays within the home budgetary unit.

THE UNIVERSITY OF GEORGIA
COLLEGE OF AGRICULTURAL & ENVIRONMENTAL SCIENCES

Do departments receive salary release funds to assist in teaching when faculty are assigned to a C/I?

- **<u>IPBGG:</u>** The Institute does not have teaching faculty or teaching EFT, both of which are maintained by each member's home department. However, the Director may recommend course assignments for PBGG courses to the relevant department head. The Director will also coordinate student and peer evaluations with the corresponding department head, if the department head wishes to do so.

Experience with setting up and structuring one or more C/I's?

- Department Head of Ag and Applied Economics when the Center for Agribusiness and Economic Development was created.
- Served on the Executive Committee of the Bioenergy Systems Research Institute when it was proposed and structured.
- Reviewed all documents and negotiated most side agreements associated with the formation and approval of the Institute of Plant Breeding, Genomics and Genetics.

WORKSHOP ON CENTERS AND INSTITUTES: ISSUES AND SOLUTIONS

Colin Kaltenbach
Vice Dean and Director
Arizona Agricultural Experiment Station

Information based on agreements with the VPR and BIO5 a University Institute that involves 5 Colleges (Agriculture, Medicine, Science, Engineering and Pharmacy)

- How are faculty assigned to the C/I?

By invitation or common interest

- What is the relationship to the C/I vs. their home department?

Faculty retain their academic appointment in their home department

- How are tenure/promotion decisions made and by whom?

All P & T decisions are made in the home department with input from the Center/Institute

- How are IP and royalty issues handled?

Intellectual property is a University issue. Royalties are handled primarily based on salary split unless some other agreement is reached

- What is/are the funding mechanisms?

Salary splits are determined at the time of appointment

- How are departments given credit for their faculty’s outputs who are assigned to the C/I; grants, pubs, etc?

Credit is assigned primarily based on salary split

- Do departments share in funds generated by their faculty such as grant overhead?

Faculty with appointments in a department who are not working within another center:

University	65%
College	20%
BIO 5	15%

- Do departments share in funds generated by their faculty, such as grant overhead?

Faculty with appointments in a department who are working with a center such as the Arizona Cancer Center:

University	60%
College	10%
Department	10%
Center	10%
BIO5	10%

- Do departments share in funds generated by their faculty, such as grant overhead?

Faculty with appointments within BIO 5 but not affiliated with a specific department or college:

University	70%
Bio5	30%

- If graduate students are involved in the C/I that generate student credit hours, how is that credited?

Credit hours are tracked according to salary split

- Do departments receive salary release funds to assist in teaching when a research/teaching faculty is assigned to a C/I?

Faculty with a partial teaching appointment are expected to continue with their teaching obligations. Their teaching salary dollars would become available if the faculty member no longer teaches