Southern Outlook Conference
September 23-25, 2013

WATER RESOURCE ISSUES: *AN OVERVIEW*

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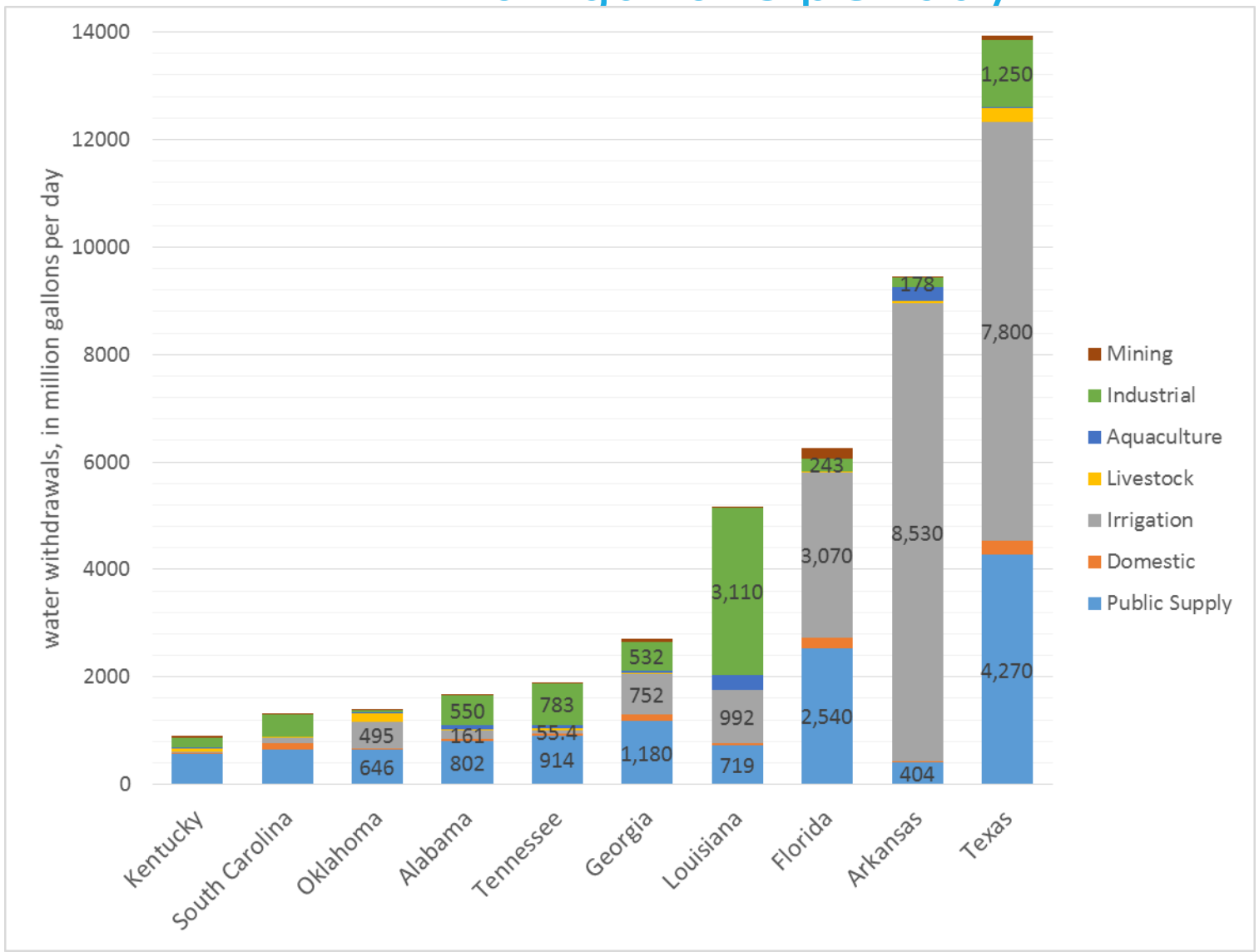
UF | UNIVERSITY of FLORIDA
IFAS Extension

The time when water resources were abundant is over

- Increasing demands
  - Population growth (public water supply, agricultural irrigation)
  - Changing environmental attitudes
  - Climate change

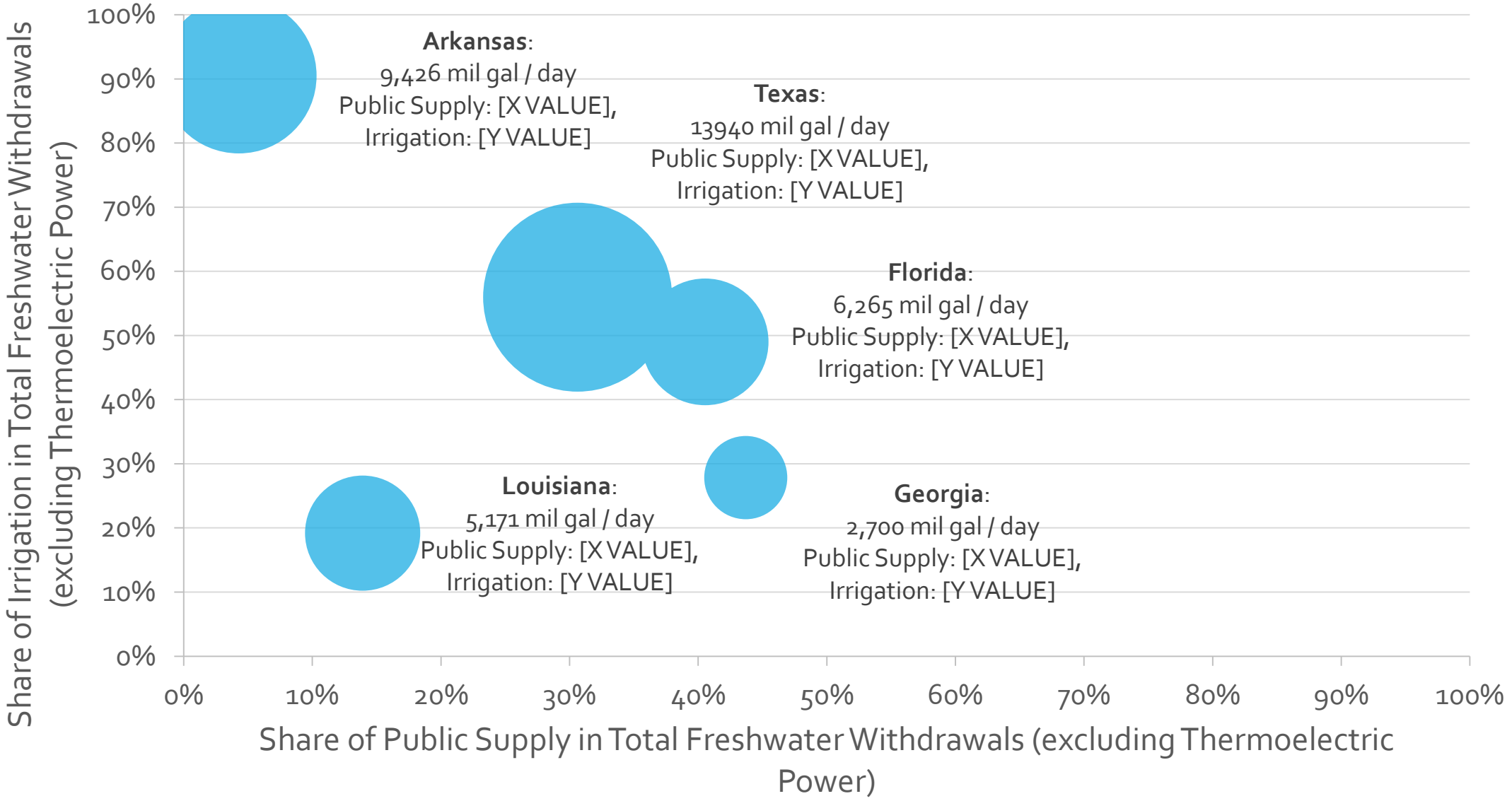
- Decreasing supply
  - Climate change
  - Past unsustainable use

Total water withdrawals by water-use category (excluding thermoelectric power), 2005, in million gallons per day



Source:
Based on Kenny, J.F., Barber, N.L., Hutson, S.S., Linsey, K.S., Lovelace, J.K., and Maupin, M.A., 2009, *Estimated use of water in the United States in 2005*: U.S. Geological Survey Circular 1344, 52 p

Total Freshwater Withdrawals (excluding thermoelectric power) and the %% of public supply and irrigation withdrawals



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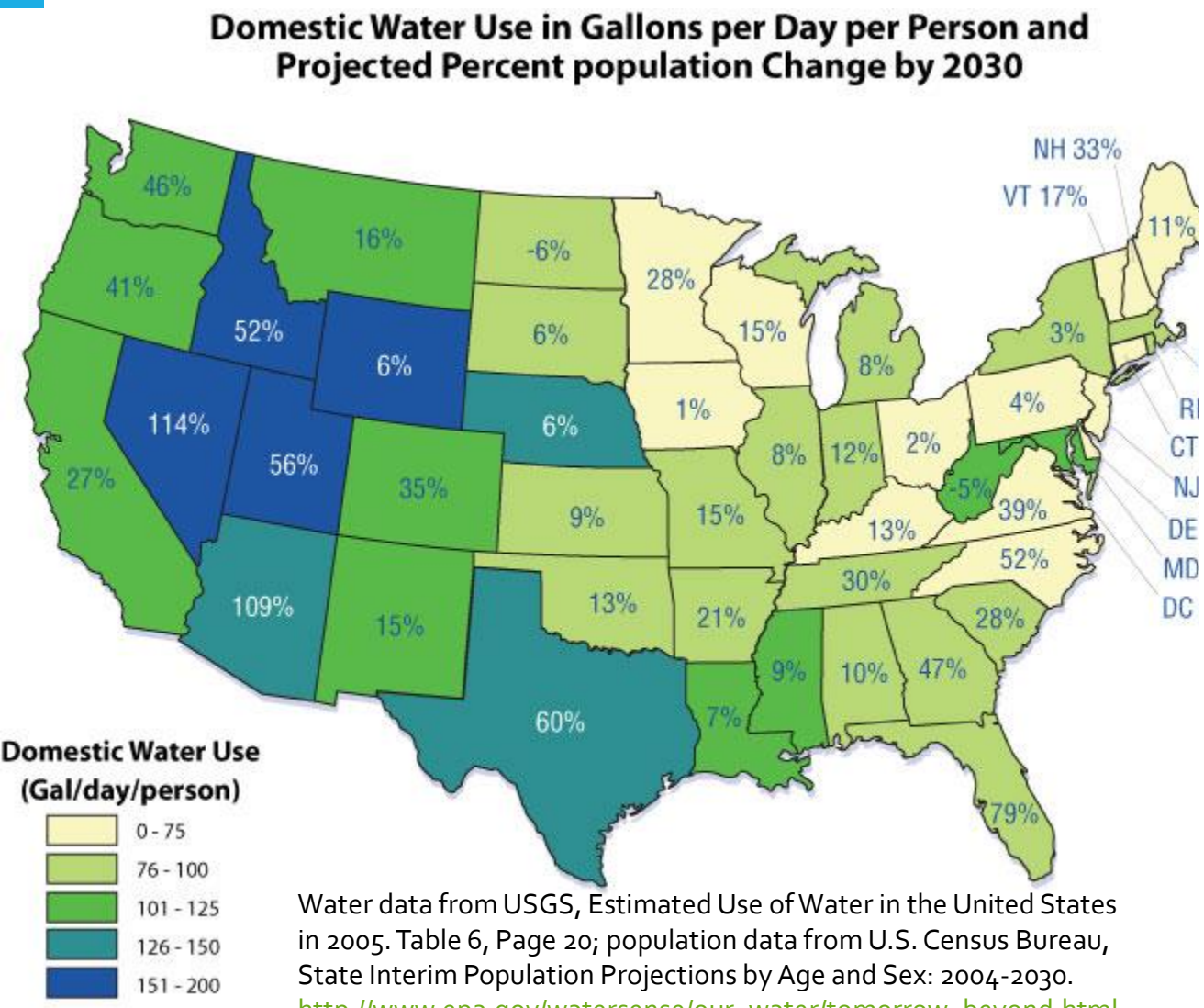
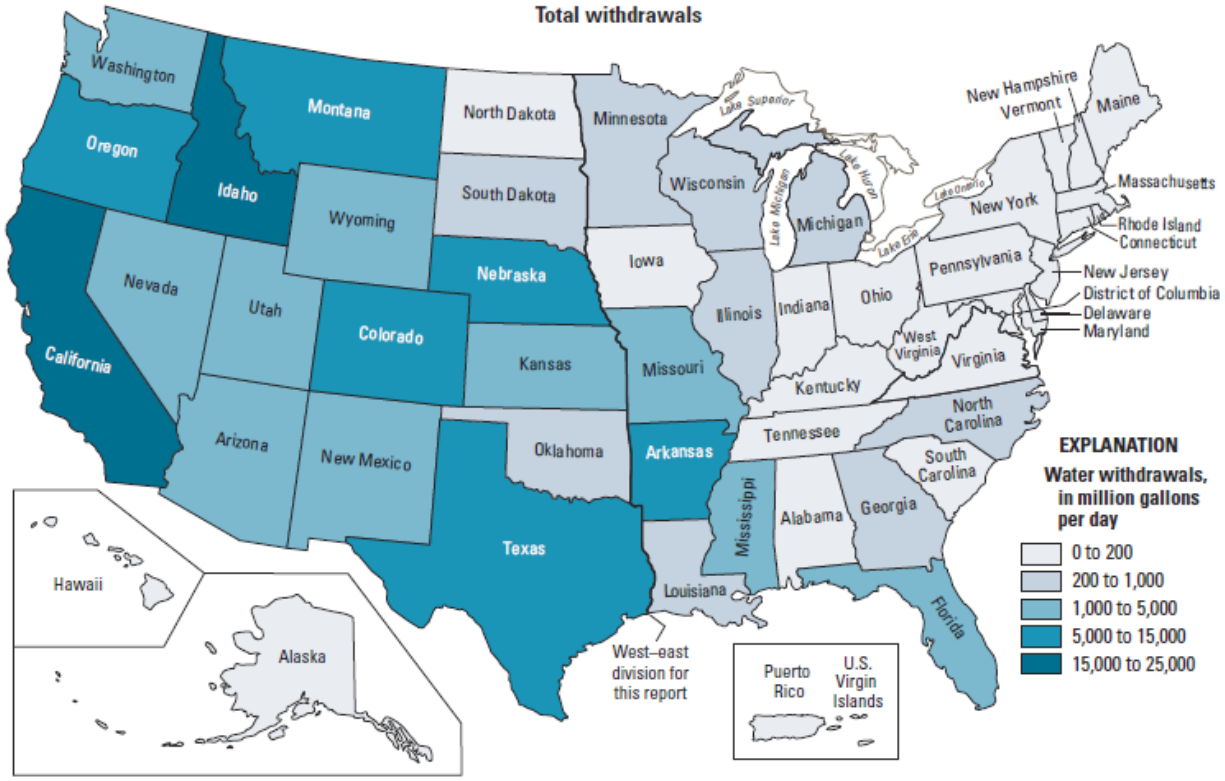
Population Growth and Irrigation Water Withdrawals



Water data from USGS, Estimated Use of Water in the United States in 2005. Table 6, Page 20; population data from U.S. Census Bureau, State Interim Population Projections by Age and Sex: 2004-2030. http://www.epa.gov/watersense/our_water/tomorrow_beyond.html

- **Irrigation Water Withdrawals (USGS 2005)**



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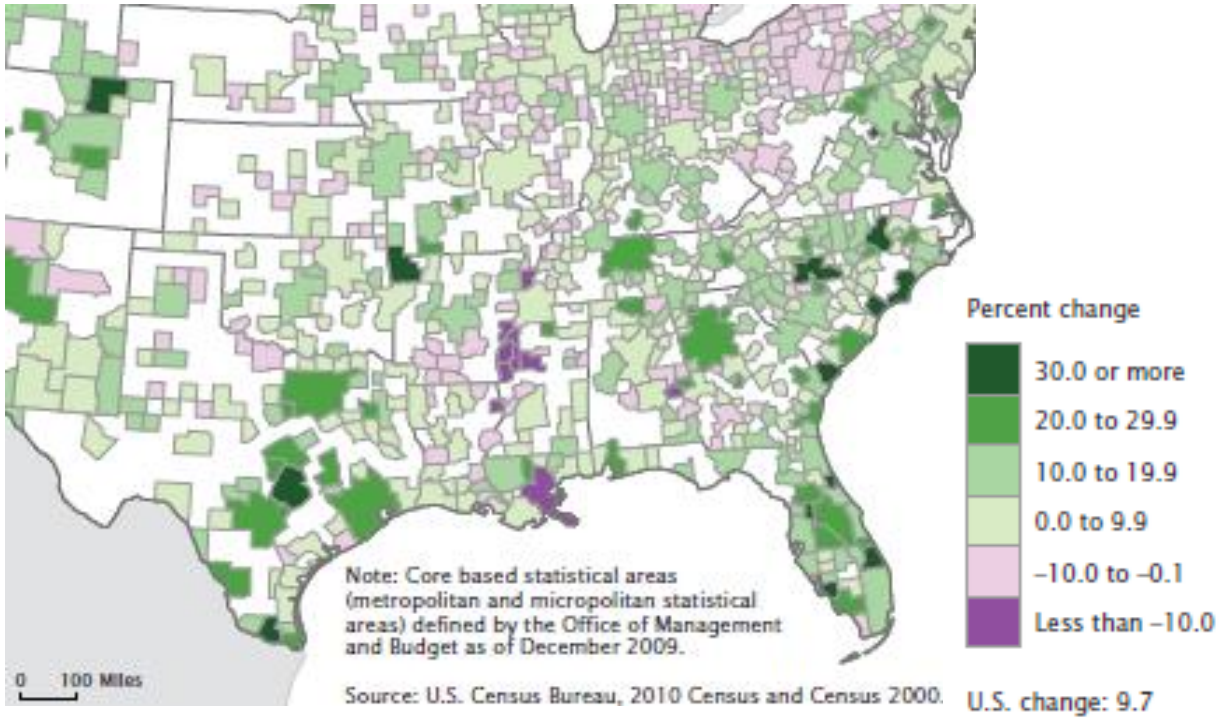
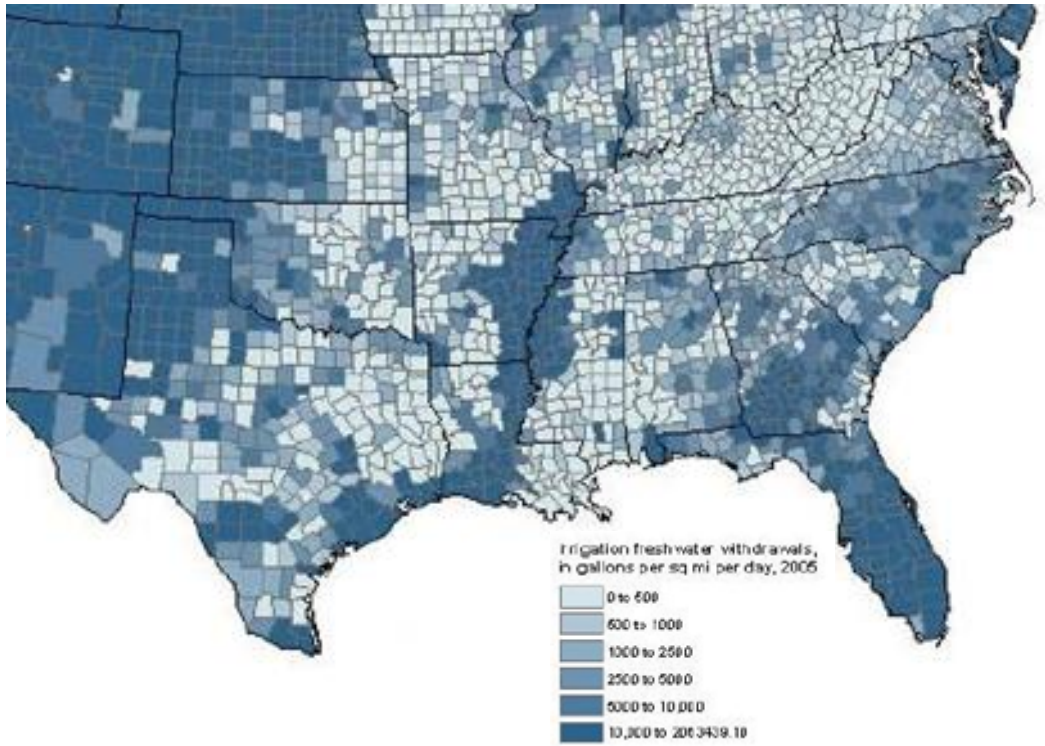
Public Supply and Irrigation

Percentage Change in Population by Core Based Statistical Area: 2000 to 2010



Wilson et al. 2012. *Patterns of Metropolitan and Micropolitan Population Change:2000 to 2010*. 2010 Census Special Reports, C2010SR-01, US Census Bureau

Irrigation Freshwater Withdrawals, gal per sq mile per day, 2005 (USGS)



http://water.usgs.gov/watercensus/image/freshwater_withdrawals_lg.jpg

Future:
Changes in the acreage of agricultural crops?

United States Department of Agriculture

USDA

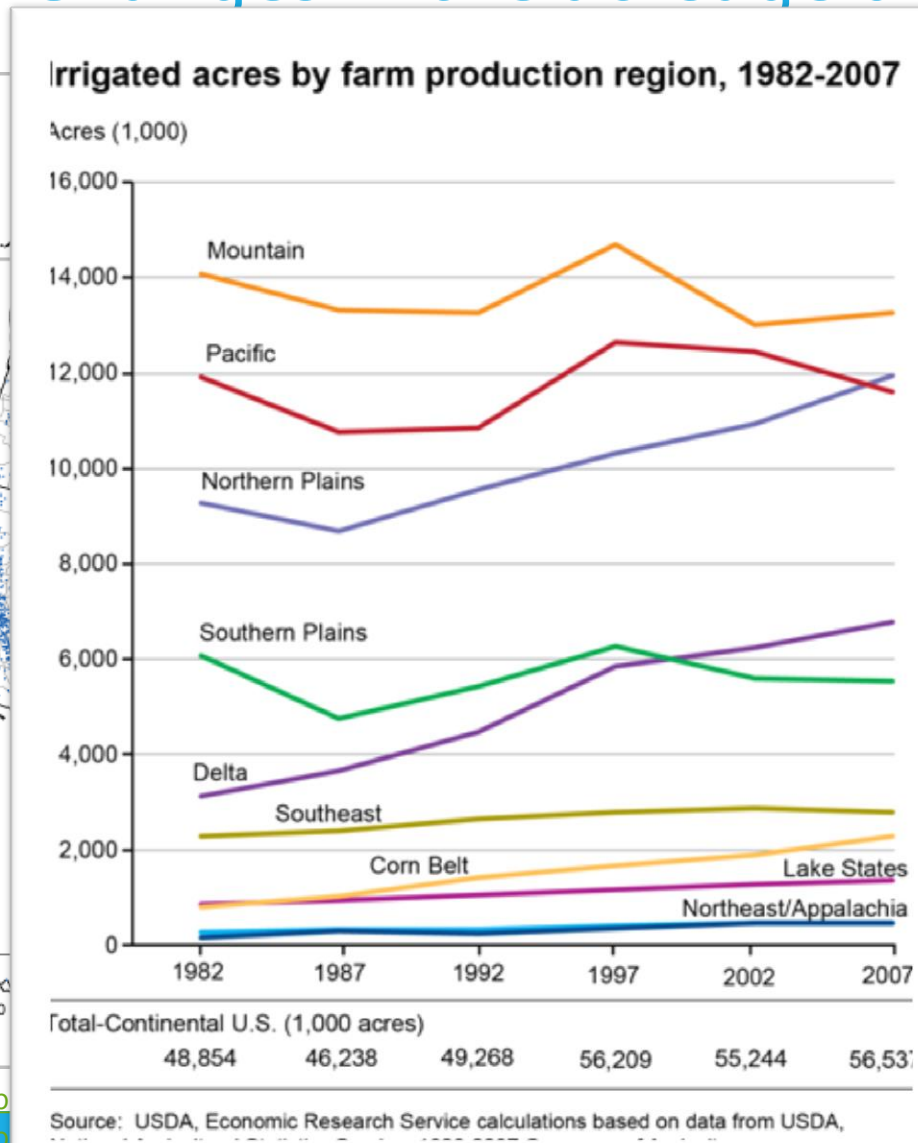
Economic Research Service

Economic Information Bulletin Number 99

September 2012

Water Conservation in Irrigated Agriculture: Trends and Challenges in the Face of Emerging Demands

Glenn D. Schaible and Marcel P. Aillery



http Farms_and_Land_Use/slides/Irrigated%20Land%20-%20Change%20in%20Acreage.html

http Farms_and_Land_Use/slides/Acres%20of%20Irrigated%20Land.html

Water Supply Side:

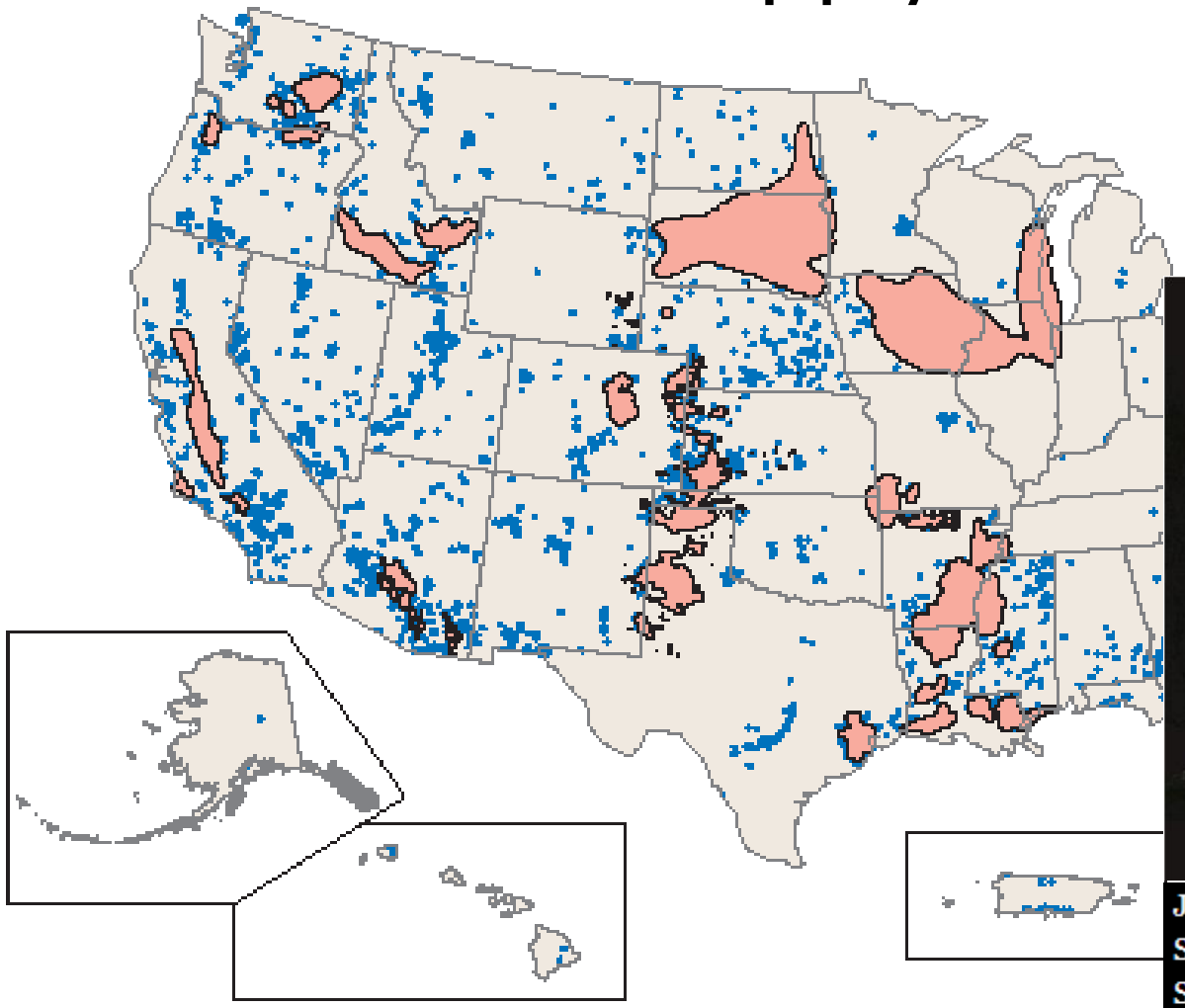
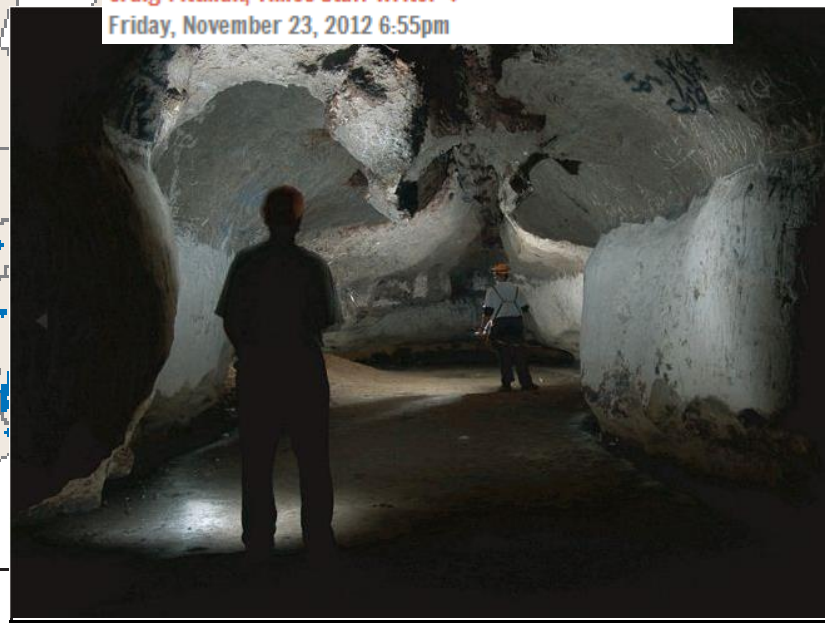


Figure 12. Water-level declines. Red regions indicate areas in excess of 500 square m
level decline in excess of 40 feet in at least one confined aquifer since predevelopmen
decline in unconfined aquifers since predevelopment. Blue dots are wells in the USGS
System database where the measured water-level difference over time is equal to or greater than 40 feet.

Tampa Bay Times

Florida's vanishing springs

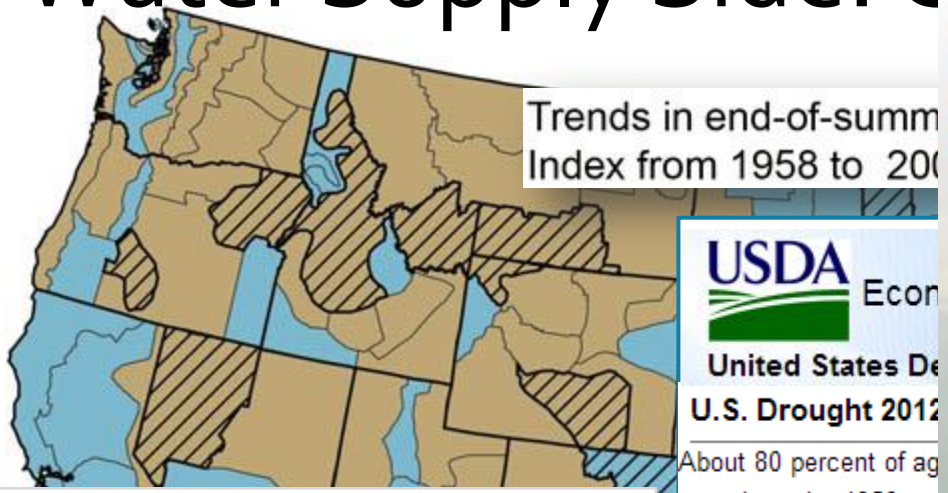
Craig Pittman, Times Staff Writer
Friday, November 23, 2012 6:55pm



Jason Polk of Western Kentucky University and Gary Shindele explore an underground cave near Rainbow Springs that used to have up to 8 feet of water in it. "Places you used to swim through, now you have to walk through," Polk said. "It's a permanent decline." Photo courtesy of Jason Polk

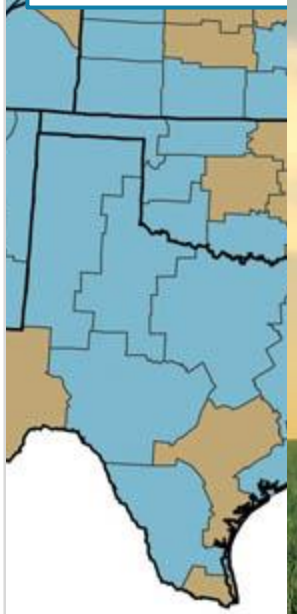
Source:Reilly, T.E., Dennehy, K.F., Alley, W.M., and Cunningham, W.L., 2008, Ground-Water Availability in the United States: U.S. Geological Survey Circular 1323, 70 p., also available online at *http://pubs.usgs.gov/circ/1323/*

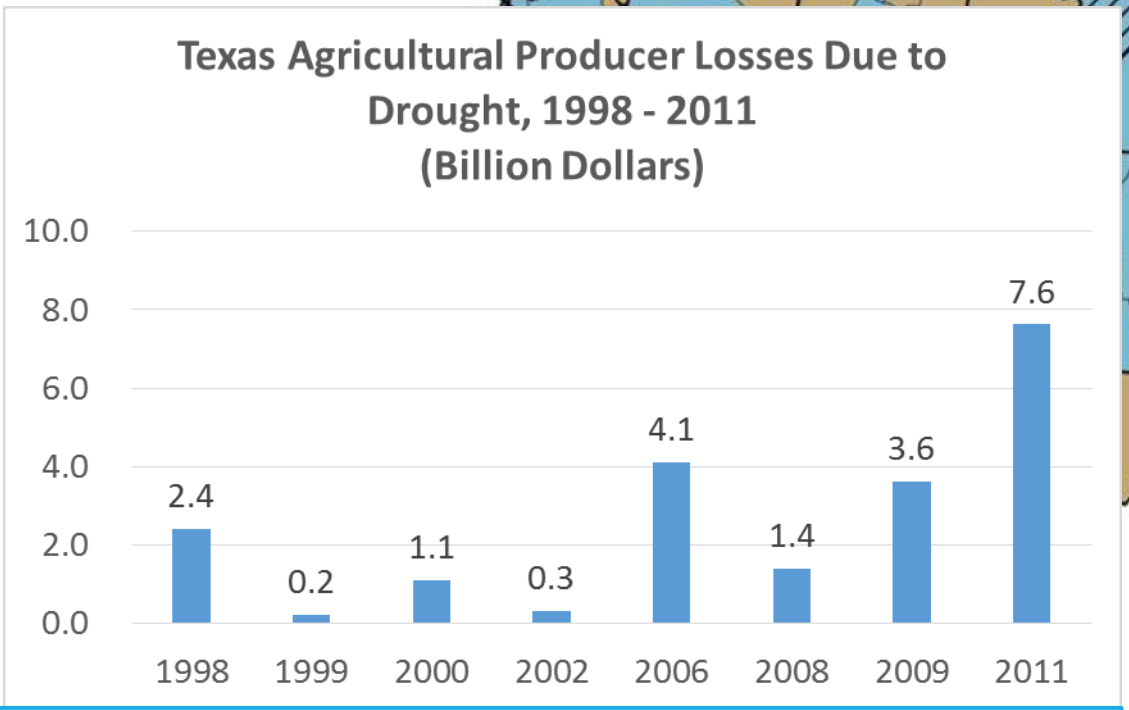
Water Supply Side: C



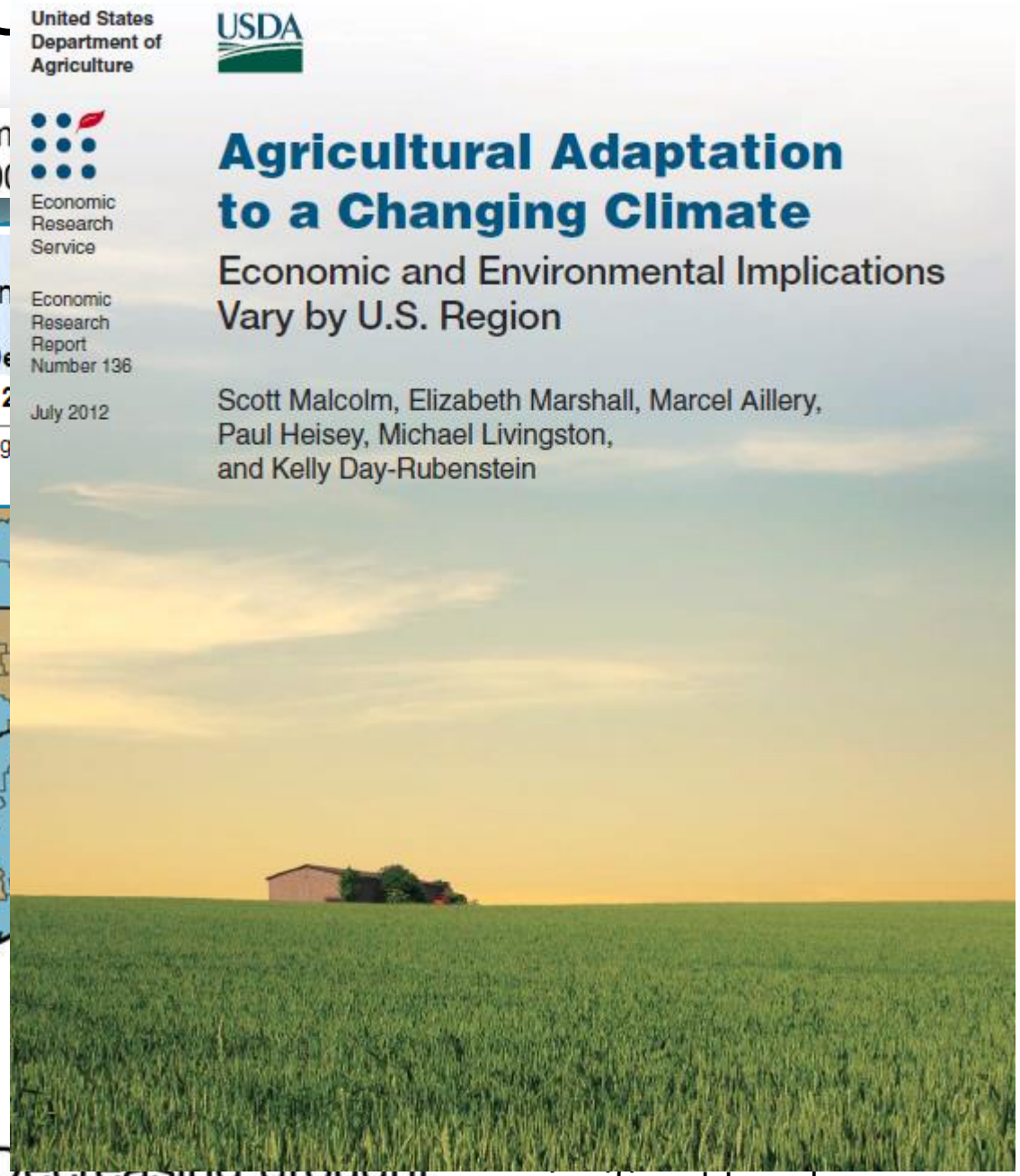
Trends in end-of-summ
Index from 1958 to 20

USDA Econ
United States De
U.S. Drought 2012
About 80 percent of ag
any since the 1950s.





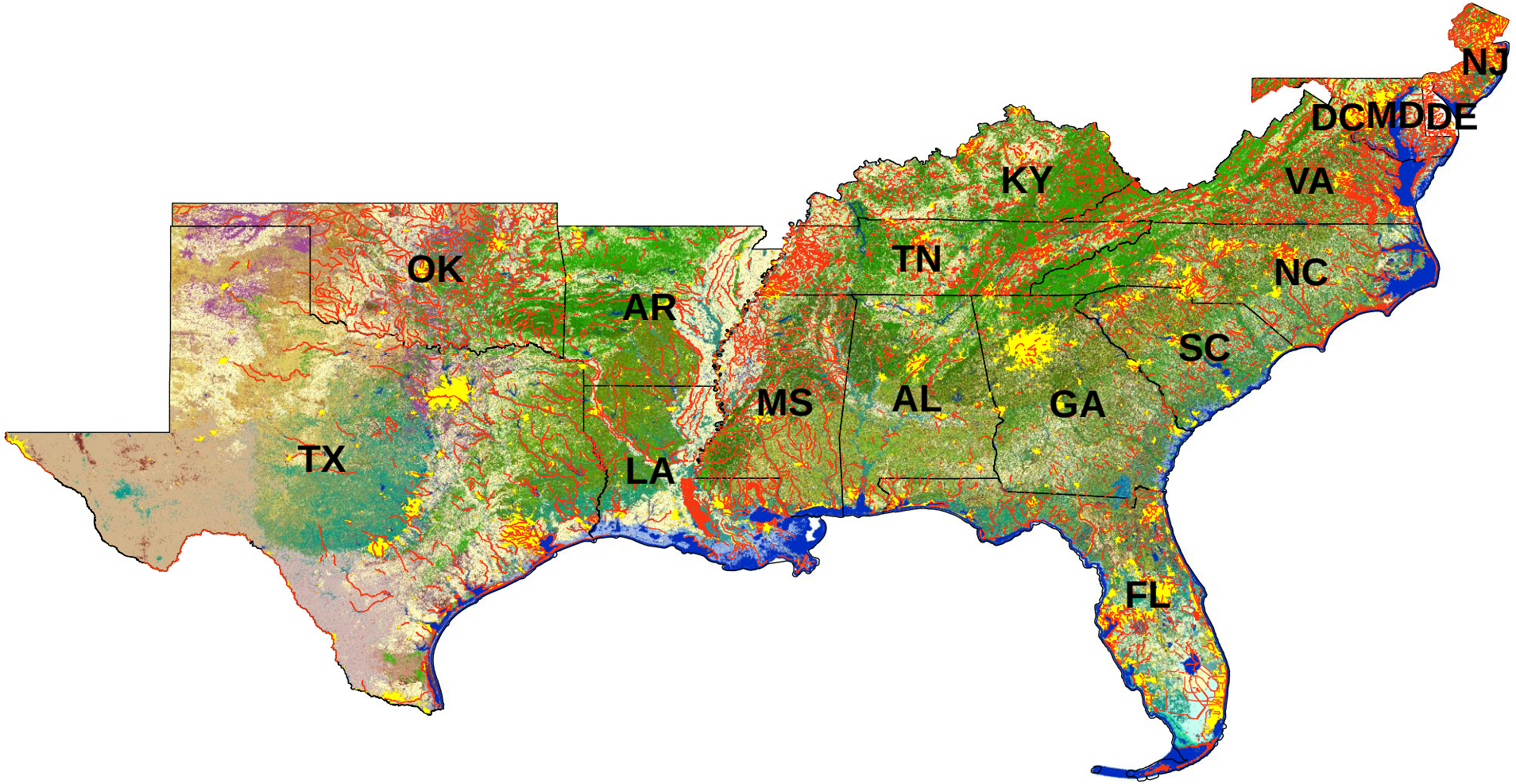
Based on AgriLife Extension, as reported on http://www.statesman.com/news/news/state-regional/drought-cost-texas-close-to-8-billion-in-agricultu/nRmNt/



Decreasing drought

significant trend.

303(d) List of Impaired Waters



Source:
Data downloaded from U.S. EPA
Watershed Assessment, Tracking & Environmental ResultS
(http://www.epa.gov/waters/data/downloads.html)
Download date: January 21, 2013

Competition for Water: Examples

The New York Times

Florida Struggles to Ove Springs

By LIZETTE ALVAREZ
Published: June 22, 2012

The sudden attention on Silver Spring
St. Johns River Water Management I
the same amount used by the city of
a Canadian auto parts magnate and h
nearby, a 25,000-acre cattle ranch ar
beef.

Mr. Stronach's ranch is expected to pr
perhaps more as the operation grows.
carefully monitor fertilizer use, which
will only use the amount of water nec

Scientists commissioned by Adena Spr
the property's water use will have an

"The experts we have hired say that th
insignificant," said Ed de la Parte, a lawyer who is representing Adena Springs Ranch in its permit application.

WUFT NEWS

Adena Springs Faces Deadline on Water Use Permit

By **Yelena Orrelly** and **Donna Green-Townsend** *on September 17th, 2013*

Update Tuesday 10:03 a.m.: Adena Springs Ranch's third Request for the Additional Information Letter (RAI) has been extended to Dec. 11.

Donna Green-Townsend / WUFT News

One of many protest signs outside building dedication ceremony in 2012 to honor Adena Springs owner, Frank Stronach.

Hank Largen, spokesperson for the St. John's River Water Management District, said his staff still needs more information to decide whether to approve the consumptive use permit. The district wants Adena Springs to conduct tests to explore what changes withdrawing water would have on the environment.

He said the ranch is currently requesting for 5.3 million gallons of water a day, less than their previous request of 13 million gallons of water a day.

Peaceful Protest

150 protesters picketed against Stronach's bid for a permit to pump more than 13
for a cattle operation he plans near Fort
e ribbon cutting ceremony for UF's Plant
a. Stronach donated $1.5 million to fund

http://wateractionteam.org/peaceful-protest/

Competition for Water: Examples

THE TEXAS TRIBUNE

Amid Drought, a Water Fight Spills Into Legal Territory

Spencer Selvidge for the Texas Tribune

A case involving an aquifer authority and the operators of a pecan farm fueled an already fiery debate over whether groundwater can be protected alongside private property rights.

By NEENA SATIJA
Published: September 14, 2013

The ruling in Edwards Aquifer Authority v. Glenn and JoLynn Bragg fuels an already fiery debate over whether groundwater can be protected alongside private property rights. "Despite our best efforts, the aquifers are dropping," said Greg Ellis, a former general manager of the Edwards Aquifer Authority, one of the state's largest and most powerful groundwater regulation bodies. The authority has asked its users, which include the city of San Antonio, to reduce demand by 35 percent this year amid the drought.

"The district has to have the ability to cut people back," he added.

The authority's existence illustrates Texas' underground conundrum. A federal judge ordered its creation in 1993, finding that over-pumping from the aquifer without proper management was threatening endangered species. But Glenn and JoLynn Bragg had invested more than $2 million to grow pecans over the aquifer long before that. When the authority restricted the amount of water they could pump, they sued, saying their property rights had been violated.

The state's Fourth Court of Appeals agreed. Writing the court's opinion, Justice Sandee Bryan Marion said last month that the restriction "forces the Braggs to purchase or lease what they had prior to the regulation — an unrestricted right to the use of the water beneath their land." Some environmentalists and water lawyers now fear that every attempt to protect aquifers will end up in court. Property advocates disagree.

"Pay them," said Paul Terrill, the Braggs' attorney. "You took their property. Just pay them." (How much the Braggs are owed is still up for debate, according to the ruling.)

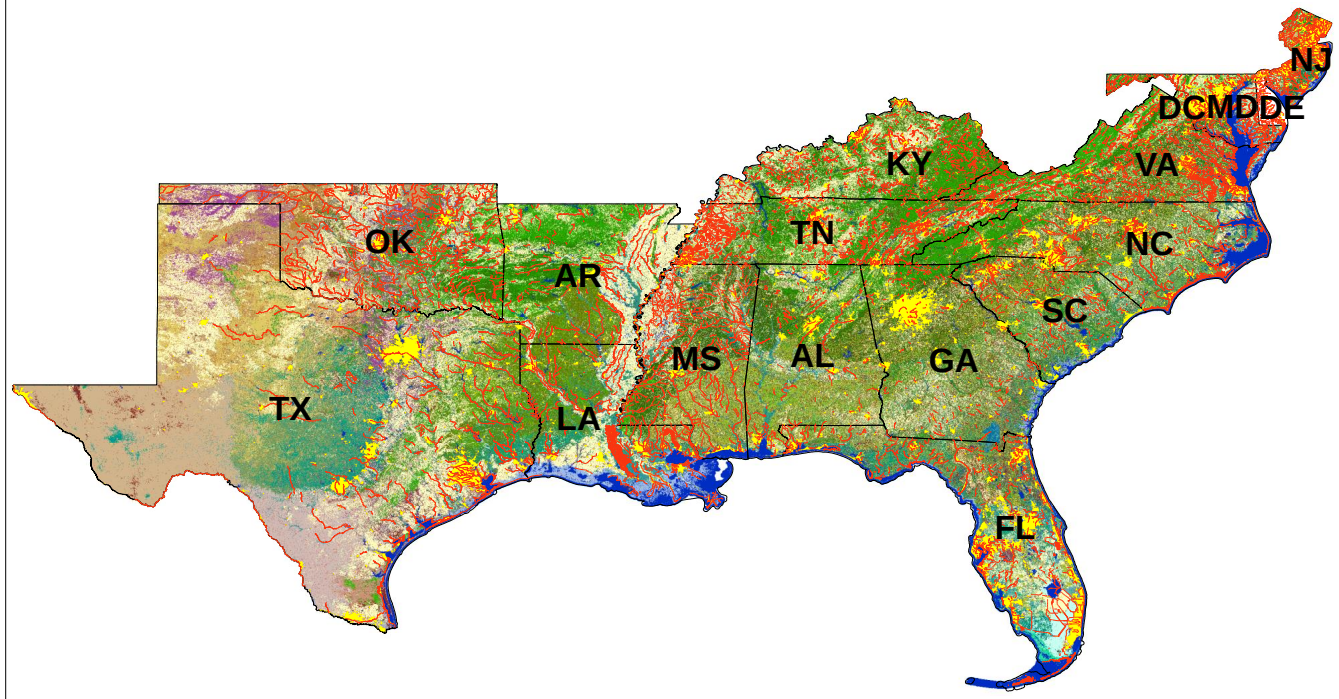
But cities and industries looking for new groundwater are unlikely to be satisfied with compensation. They are pushing state lawmakers to limit local groundwater regulating abilities.

http://www.nytimes.com/2013/09/15/us/amid-drought-a-water-fight-spills-into-legal-territory.html?_r=0

Policy Changes

- Statewide numeric nutrient criteria
- Mandatory water quality BMPs
- Monitoring agricultural water use
- State water supply plans

303(d) List of Impaired Waters



Source:
Data downloaded from U.S. EPA
Watershed Assessment, Tracking & Environmental ResultS
(http://www.epa.gov/waters/data/downloads.html)
Download date: January 21, 2013

Statewide numeric nutrient criteria

- Narrative criterion: "In no case shall nutrient concentration of a body of water to be altered so as to cause an imbalance in natural populations of flora or fauna" (Florida)

- Justification for numeric nutrient standards (EPA)
  - Easier and faster identification of impaired waters
  - Easier and faster development of TMDL / restoration
  - Facilitate protective permitting
  - Facilitate evaluation process of load reduction programs
  - Provide measurable baseline and goals
  - Avoid ad hoc evaluation of water bodies

James E. Charles and Wayne E. Flowers . Numeric Nutrient Criteria for Surface Waters: "Coming to a Neighborhood Near You" Lewis, Longman & Walker, P.A.. http://www.llw-law.com/files/articles/NNC_for_Surface_Waters_JEC_WEF_00059893.PDF

Progress towards Adopting Statewide TN and TP Numeric Water Quality Standards

State	Watertype	1. Planning for Criteria Development	2. Collection of Information & Data	3. Analysis of Information & Data	4. Proposal of Criteria	5. Adoption of Criteria (EPA-Approved)
Alabama	Lakes/Reservoirs/Rivers/Streams	Dec. 2016	Dec. 2015	Dec. 2015	Dec. 2015	Dec. 2016
	Estuaries	Dec. 2013			Dec. 2016	Dec. 2017
Florida	Lakes/Reservoirs	Complete				Complete
	Rivers/Streams / Estuaries					Sept. 2013
Georgia	Lakes/Reservoirs	Complete	Dec. 2017		Jun. 2019	Dec. 2019
	Rivers/Streams		Jun. 2018		Dec. 2019	Jun. 2020
	Estuaries		Dec. 2018		Jun. 2020	Dec. 2020
Kentucky	Lakes/Reservoirs	Complete	No Date Provided		Dec. 2018	Dec. 2018
	Rivers/Streams - Non-Wadeable		Collection Underway		TBD	
	Rivers/Streams - Wadeable				Dec. 2016	Dec. 2018
Mississippi	Lakes/Reservoirs/Rivers/Streams - Delta	Complete	Mar. 2014		11/30/2014	6/30/2015
	Lakes/Reservoirs/Rivers/Streams -Non-Delta		Dec. 2012	Dec. 2012	Jun. 2013	Dec. 2013
	Estuaries		Dec. 2012	Dec. 2012	Dec. 2013	Dec. 2013
South Carolina	Lakes/Reservoirs > 40 acres	Complete				
	Lakes/Reservoirs <= 40 acres	No Date Provided				
	Rivers/Streams	No Statewide Development Intended				
	Estuaries	No Date Provided	Dec. 2012	Dec. 2013		Dec. 2014

Arkansas,
Louisiana,
New Mexico,
North Carolina,
Oklahoma,
Tennessee,
Texas:

No Dates Provided

Your state is next!

- Nutrient pollution is a priority issue for EPA
- Environmental groups can take control of the process (lawsuit)
- State and local governments and regulated community should be proactive in developing / implementing NNC
  - Land use planning as a mean to address nutrient loading on a going forward basis
  - Establishing financial mechanisms upfront as a part of a plan for compliance
  - Develop / refine TMDL process to insure cost-effective and successful implementation of NNC

James E. Charles and Wayne E. Flowers . Numeric Nutrient Criteria for Surface Waters: "Coming to a Neighborhood Near You" Lewis, Longman & Walker, P.A.. http://www.llw-law.com/files/articles/NNC_for_Surface_Waters_JEC_WEF_00059893.PDF

SUNSHINE
STATE NEWS

Nutrient Criteria Battle: Florida, Not EPA, Knows Best How to Care for Its Waters

By: ANNE SMITH | Posted: March 15, 2013 4:30 PM

Attorney General Pam Bondi and Agriculture Commissioner Adam Putnam

The Florida Department of Environmental Protection (DEP) and the U.S. Environmental Protection Agency (EPA) reached an agreement Friday that grants the state the right to set nutrient limits for its waterways.

Florida has been at odds with EPA since 2009 when the agency announced Florida would be the first state to have statewide federal nutrient limits imposed on its waterways. The decision, which resulted from an environmentalist-driven lawsuit led by EarthJustice, was met with an uproar from state lawmakers, business leaders and utilities, who assailed EPA's standards as flawed and inappropriately costly and burdensome to Florida taxpayers. Reports were commissioned that estimated the standards would cost Florida tens of billions of dollars to implement and maintain.

The state recoiled against the Obama administration's intrusion and filed a lawsuit against EPA in 2010. In February 2012, the state won its argument on a key provision. At the time, Florida Sen. Marco Rubio minced no words in expressing his distaste for the whole affair. “Florida has one of the most aggressive water-quality protection programs in the nation, implemented by the people who know our state best, and it’s time EPA stop bullying us into accepting another Washington-contrived mandate that would devastate job creation," said the Miami Republican.

In another win for the state in November, EPA approved Florida’s scientifically-based criteria for its lakes, rivers, streams, springs and estuaries. The new agreement announced Friday will allow DEP to move forward with rule-making and legislation this session to finish setting limits for Florida's waterways.

State-Wide Numeric Nutrient Criteria for Surface Water: *Cost estimates for original EPA proposal*

ESTIMATED ANNUAL COSTS OF IMPLEMENTATION OF NUMERIC NUTRIENT CRITERIA IN FLORIDA BY STAKEHOLDERS, EPA AND CARDNO ENTRIX, LISTED BY NUTRIENT SOURCE

Nutrient Source	Stakeholders*	EPA	Cardno ENTRIX
Municipal WWTPs	$2-4.6 billion	$22.3-38.1 million	$41-395 million
Industrial Facilities	$2.1 billion	$25.4 million	$270-1,973 million
Urban Stormwater	$2 billion	$60.5-108 million	$61-629 million
Agriculture	$0.9-1.6 billion	$19.9-23 million	$33-969 million
Septic Systems	$0.9-2.9 billion	$6.6-10.7 million	$8-65 million

*Includes the Florida Department of Environmental Protection, Carollo Engineers and Budell *et al.* Source: National Research Council

Source: American Water Intelligence, Vol 3, Issue 5 (May 2012)
EPA data understates value of nutrient recovery market
http://www.americanwaterintel.com/archive/3/5/market-analysis/epa-data-understates-value-nutrient-recovery-market.html

- What water bodies will incrementally be affected?
- What sources will incrementally be affected?
- What projects will be needed? At what costs?

Example: Florida's Implementation of NNC for Streams

For streams, if a site specific interpretation pursuant to paragraph 62-302.531(2)(a), F.A.C. (TMDL, SSAC, Level II WQBEL or RA Plan) has not been established, Nutrient Thresholds are used to interpret the NNC in combination with biological information. The NNC in paragraph 62-302.530(47)(b), F.A.C., shall be interpreted as being achieved in a stream segment if:

- *Information on chlorophyll a levels, algal mats or blooms, nuisance macrophyte growth, and changes in algal species composition do not indicate an imbalance in flora or fauna; AND EITHER*
- *The average score of at least two temporally independent SCIs performed at representative locations and times is 40 or higher, with neither of the two most recent SCI scores less than 35 (i.e., no faunal imbalances), OR*
- *The Nutrient Thresholds (expressed as annual geometric means) in **Table 2** are not exceeded more than once in a three year period (see **Figure 3** for regions).*

Table 2. Reference stream-based nutrient thresholds.

Nutrient Region	Total Phosphorus Threshold	Total Nitrogen Threshold
Panhandle West	0.06 mg/L	0.67 mg/L
Panhandle East	0.18 mg/L	1.03 mg/L
North Central	0.30 mg/L	1.87 mg/L
Peninsula	0.12 mg/L	1.54 mg/L
West Central	0.49 mg/L	1.65 mg/L
South Florida	No numeric nutrient threshold. The narrative criterion in paragraph 62-302.530(47)(b), F.A.C., applies.[2]	

Source: FDEP, 2013. Implementation of Florida's Numeric Nutrient Standards. http://www.dep.state.fl.us/water/wqssp/nutrients/docs/NNC_Implementation.pdf

Policy Changes

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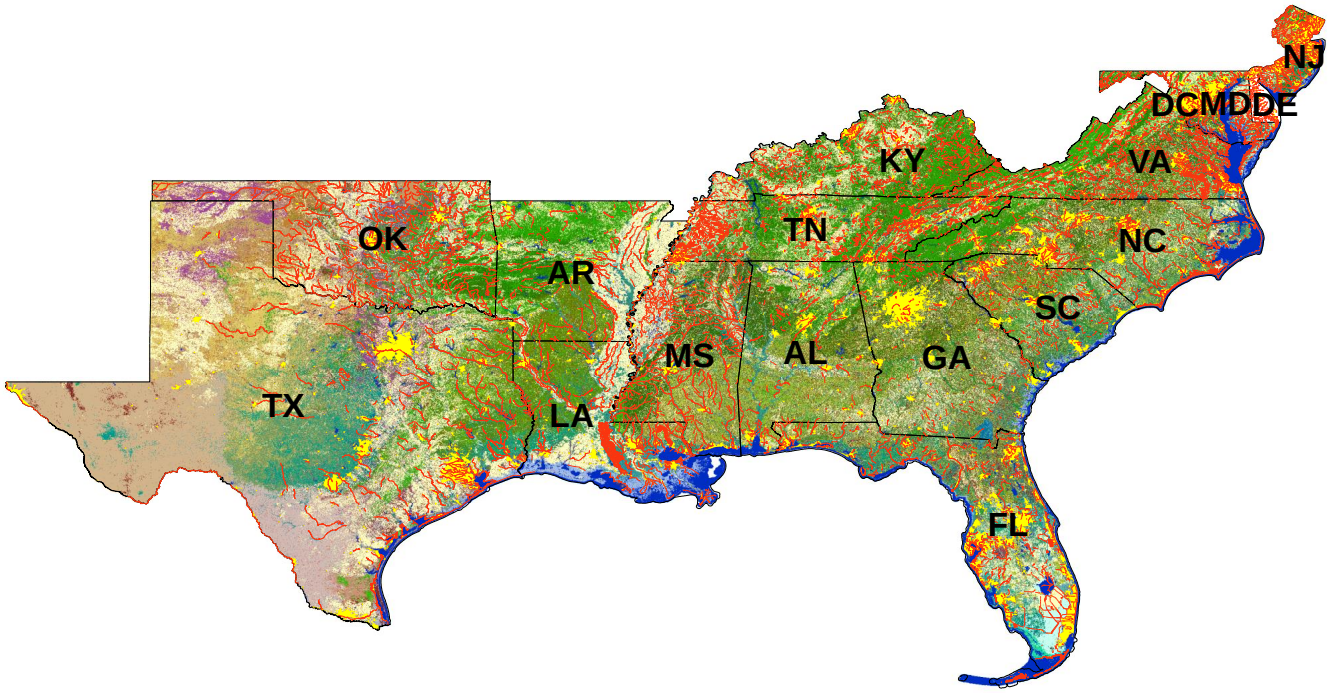


Source:
Data downloaded from U.S. EPA
Watershed Assessment, Tracking & Environmental ResultS
(http://www.epa.gov/waters/data/downloads.html)
Download date: January 21, 2013

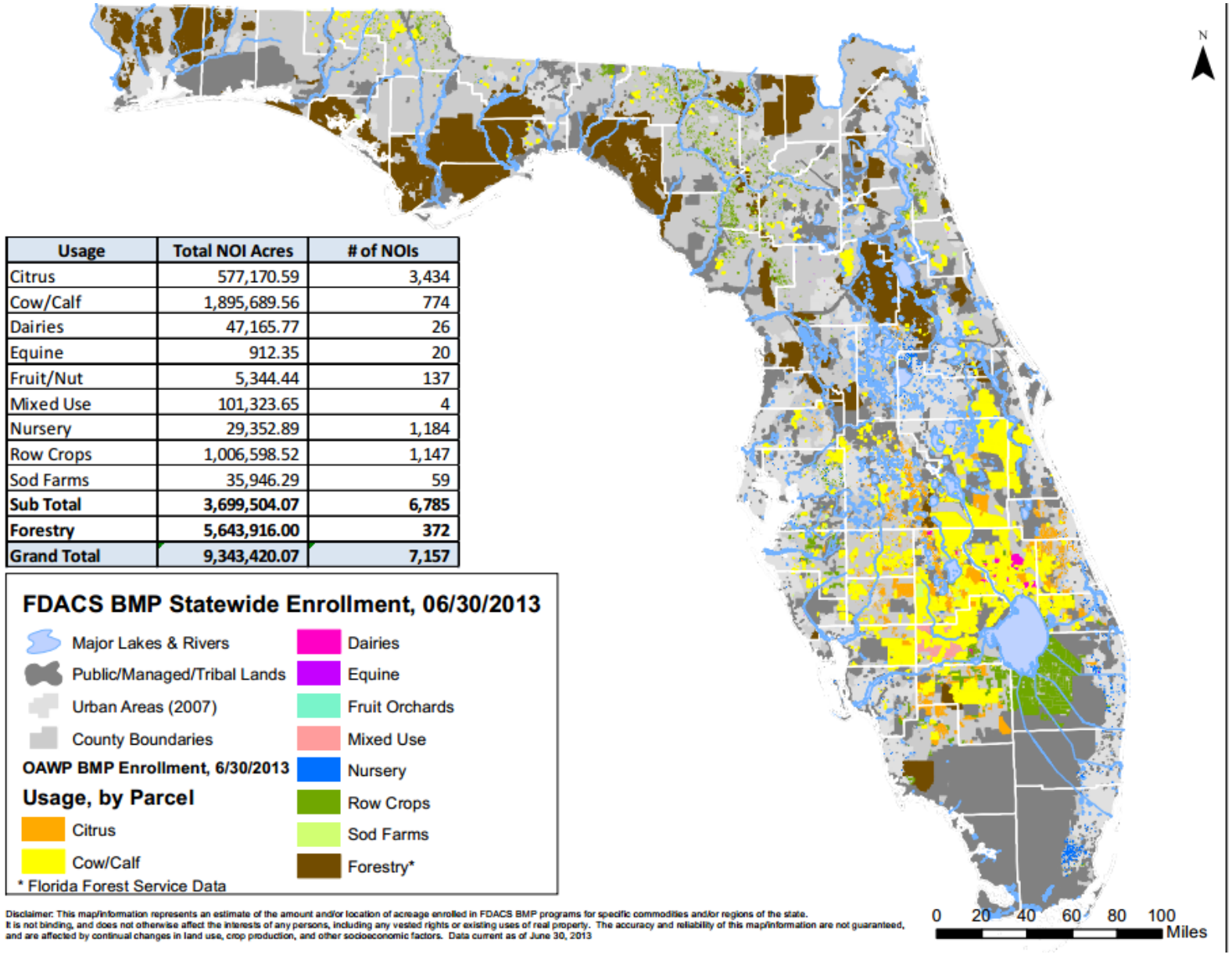
Florida: Mandatory water quality BMP implementation

- Ag BMPs are mandatory in the areas with adopted Basin Management Action Plans (BMAPs)

  Give the presumption of compliance with state water quality standards

- Ag BMPs are "practical, cost-effective actions … designed to protect or improve water quality while maintaining or even enhancing agricultural production".

Florida: BMP Statewide Enrollment



Usage	Total NOI Acres	# of NOIs
Citrus	577,170.59	3,434
Cow/Calf	1,895,689.56	774
Dairies	47,165.77	26
Equine	912.35	20
Fruit/Nut	5,344.44	137
Mixed Use	101,323.65	4
Nursery	29,352.89	1,184
Row Crops	1,006,598.52	1,147
Sod Farms	35,946.29	59
Sub Total	**3,699,504.07**	**6,785**
Forestry	**5,643,916.00**	**372**
Grand Total	**9,343,420.07**	**7,157**

Disclaimer: This map/information represents an estimate of the amount and/or location of acreage enrolled in FDACS BMP programs for specific commodities and/or regions of the state. It is not binding, and does not otherwise affect the interests of any persons, including any vested rights or existing uses of real property. The accuracy and reliability of this map/information are not guaranteed, and are affected by continual changes in land use, crop production, and other socioeconomic factors. Data current as of June 30, 2013

South Florida Farmers Set Standard For Water Quality

Implementation of BMPs leads to historic achievement in runoff reduction goals.

July 30, 2012

For the 17th consecutive year, water flowing from farmlands in the Everglades Agricultural Area (EAA) achieved phosphorus reductions that exceeded those required by law. Implementation of best management practices (BMPs) produced a 71% phosphorus reduction in the 470,000-acre EAA farming region south of Lake Okeechobee for the 2012 monitoring period. An approved model is used to compute the reductions and makes adjustments to account for the influences of rainfall.

Just west of the EAA, the C-139 Basin also met its goal of reducing phosphorus discharges to historic levels. The 170,000-acre C-139 farming region consists primarily of pasture land, row crops, citrus and sugarcane. Results show 15 metric tons flowed from the basin during the 2012 monitoring period, less than half the target load of 32 metric tons.

"Year after year, science-based best management practices deliver reductions in nutrients that are greater than required by state law, helping to significantly improve Everglades water quality," said Joe Collins, chairman of the South Florida Water Management District Governing Board. "Together with treatment wetlands, BMPs provide a solid foundation for our collective efforts to achieve the ultra-low water quality standards in the River of Grass."

In the EAA, the most commonly used BMPs are more precise fertilizer application methods, refined stormwater pumping practices, and erosion controls to reduce the amount of phosphorus transported in stormwater runoff to the Everglades and connected water bodies. In the C-139 Basin, the District recently worked with landowners to develop more comprehensive and stringent BMP plans for each farm that better address the unique nutrient challenges in this basin. These plans are anticipated to result in greater phosphorus reduction results.

Source: South Florida Water Management District

http://www.growingproduce.com/article/30421/south-florida-farmers-set-standard-for-water-quality

Policy Changes

- Statewide numeric nutrient criteria
- Mandatory water quality BMPs
- Monitoring agricultural water use
- State water supply plans

Monitoring agricultural water use

- **Georgia**: In 2004, the Georgia General Assembly passed and the governor signed House Bill 579, which required all permitted irrigation withdrawals in Georgia to be metered by 2009, depending on available funds.

USGS science for a changing world

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GSWCC
Georgia Soil and Water Conservation Commission

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PROJECT LINKS
Project home

Georgia Agricultural Water Conservation and Metering Program, 2012

This web site presents results of a cooperative investigation of agricultural water use in Georgia Water Planning Regions and selected basins/subbasins (HUC-8s) during 2012.

This web site uses the following terms to describe results of the metering program:

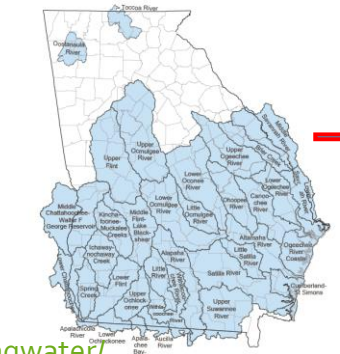
Metered acres - the amount of agricultural acres equipped with water meters and represented in graphs, tables, and illustrations on this web site

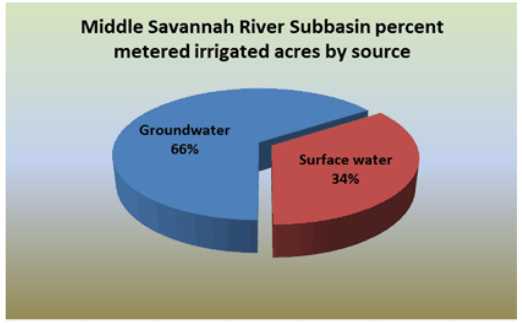
Irrigated acres - the amount of metered acres that received irrigation during the year.
NS indicates that either (1) metered and irrigated acres are not reported to preserve the anonymity of individual farms or, (2) the number of metered irrigation systems is insufficient for statistical analysis.

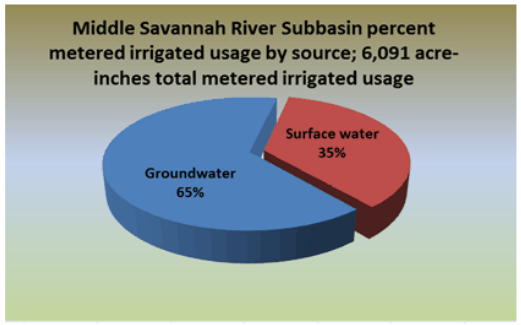
Middle Savannah River Subbasin

Water Planning Regions

Basins/Subbasins







http://ga.water.usgs.gov/projects/agwater/

Monitoring agricultural water use

- **Florida**:
  - Consumptive Use Permit Consistency initiative (discussed)
    - To incentivize conservation of water, if actual water use is less than permitted use due to documented implementation of water conservation measures, the permitted allocation will not be modified by the District
  - Suwannee River Water Management District:
    - The need for agricultural irrigation is proposed to be determined using Agricultural Fields Scale Irrigation Requirements Simulation (AFSIRS) model developed by UF
      - Input: crop types, irrigation system type, and efficiency, planting season(s), soil type(s), soil water holding capacity, water table depth, etc. Supplemental irrigation is evaluated based on the 1-in-10 year drought conditions

Posted on: September 13, 2012

[ACTIVE] SRWMD seeks to adopt monitoring requirements for largest water users

The new rule will require automated monitoring and reporting of withdrawals on a daily basis as a condition for new, renewed, and modified water use permits. The rule will apply to all groundwater wells with an inside diameter 8 inches or greater and to surfacewater withdrawals that have an outside diameter 6 inches or greater.

The Governing Board took the extra step that provides agricultural users a voluntary, convenient, no-cost method of measuring water use by calculating electric consumption. In cooperation with their electric utilities, producers would authorize the sharing of their power use data with the District. If electrical consumption data is not available, other run time monitoring methods may be used.

Suwannee River
WATER MANAGEMENT DISTRICT

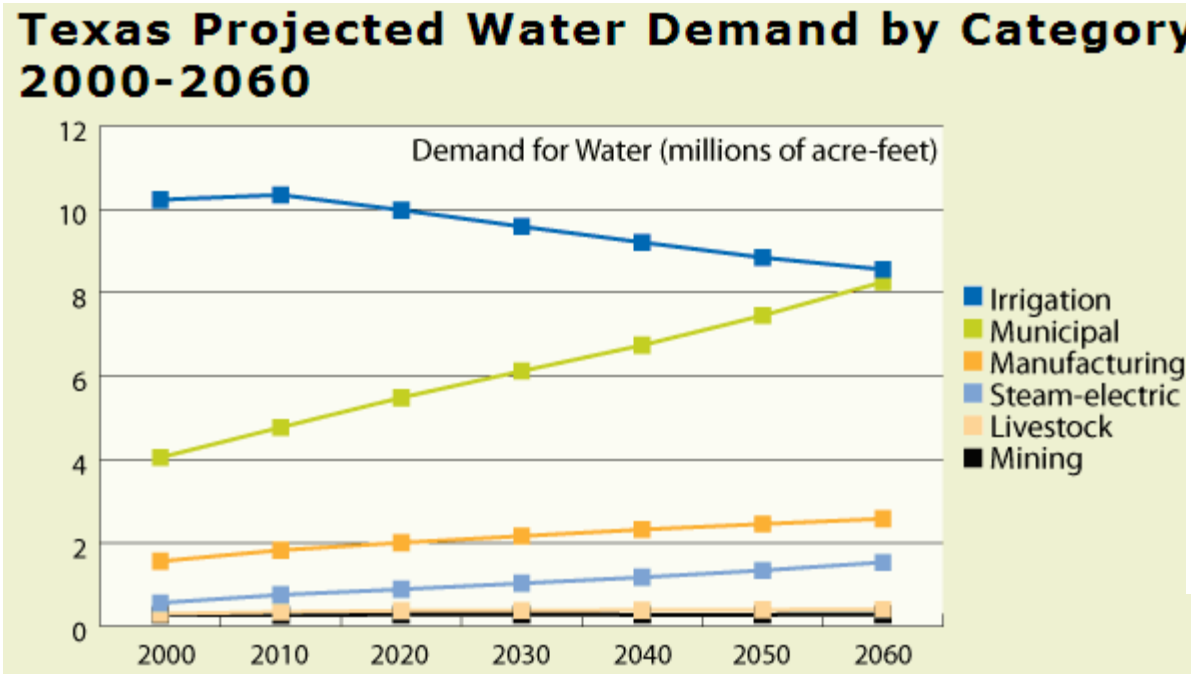
Policy Changes

- Monitoring agricultural water use
- Statewide numeric nutrient criteria
- Mandatory water quality BMP implementation
- State water plans

Texas: 2012 State Water Plan

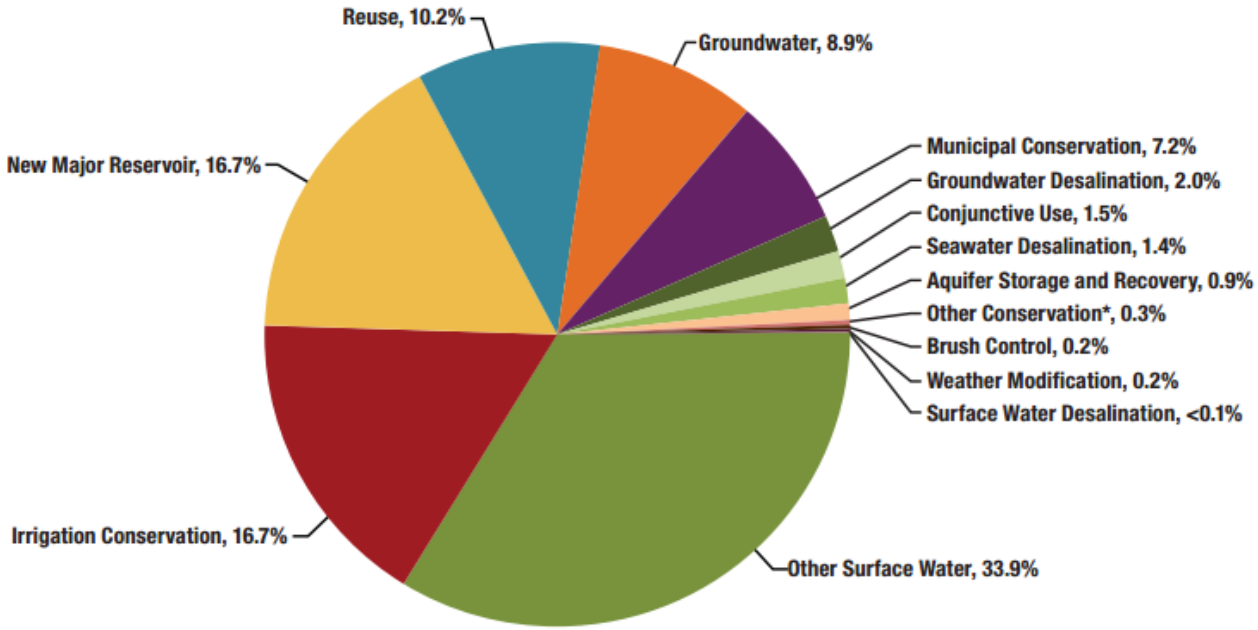
- Meet drought of record water needs
- 50-year planning horizon
- 5-year planning cycle

Sources:
Ag Water in the 2012 State Water Plan, Carolyn Brittin, Texas Water Developme
Board. http://texasagwaterforum.blogspot.com/
Texas Water Development Board. 2012 State Water Plan.
http://www.twdb.state.tx.us/waterplanning/swp/2012/



Source: Texas Water Development Board.

FIGURE 7.2. RELATIVE VOLUMES OF RECOMMENDED WATER MANAGEMENT STRATEGIES IN 2060.



Future:

- Improving irrigation efficiency
  - Improved irrigation water management technologies
  - Drought tolerant crop varieties
  - Improving irrigation scheduling
  - Conservation practice adoption (e.g., conservation tillage)
  - Improving irrigation conveyance system

Source: Wagner, K. 2013. Status and Trends of Irrigated Agriculture in Texas. http://waterpr.com/Trends-Wagner.pdf and http://twri.tamu.edu/docs/education/2012/em115.pdf

SCIENTIFIC AMERICAN™

Energy & Sustainability :: News :: May 22, 2012 :: 3 Comments :: Email :: Print

Can Soil Sensors Save Georgia Waterways from Drought?

An innovative effort would embed sensors in agricultural fields in a bid to cut down on irrigation--saving farmers money and preserving water for endangered species

By David Biello

DRY-BY-WIRE: Soil sensors, software and variable-rate technology will help cut down on unnecessary irrigation, saving water for rivers, streams and wildlife. Image: Calvin Perry / U.G.A.
Copied from Biello, 2012

Future:

- Improving irrigation efficiency

United States Department of Agriculture

USDA

Economic Research Service

Economic Information Bulletin Number 99

September 2012

Water Conservation in Irrigated Agriculture: Trends and Challenges in the Face of Emerging Demands

Glenn D. Schaible and Marcel P. Aillery

Onfarm Irrigation Investment Expenditures

The 2008 FRIS indicated a significant increase in onfarm irrigation investment expenditures relative to the 2003 survey year. Approximately $2.15 billion was invested in irrigation systems in 2008 (beyond expenditures for maintenance and repair of $820 million), compared with $1.12 billion in 2003. Higher investment expenditures reflect both an increase in the number of farms reporting irrigation investments (up 22 percent) and higher average expenditures per farm (up 73 percent). Investment in irrigation system upgrades, where water conservation was identified as the principal purpose, totaled $323 million in 2008—up by nearly 90 percent from 2003.

Expenditures for irrigation facilities and equipment, 2008

	Total expenditures	Average per farm	Purpose of expenditure			Source of funding assistance			
			Replacement	Water conservation	New equipment	No funding assistance	USDA's EQIP	Other USDA cost-share programs	Non-USDA cost-share programs
	$1,000	*Dollars*		*$1,000*			*Number of farms*		
All investment types;									
17 Western States	1,575,085	23,336	823,671	269,486	481,928	87,288	2,934	1,266	854
31 Eastern States	494,063	27,369	203,554	46,247	244,261	23,528	1,304	612	489
U.S. total[1]	2,149,007	23,628	1,077,192	323,083	748,732	111,317	4,240	1,878	1,343

EQIP=Environmental Quality Incentives Program, and NA = not applicable.
[1]U.S totals include statistics for Hawaii and Alaska.
Source: USDA, National Agricultural Statistics Service, 2008 Farm and Ranch Irrigation Survey, Vol. 3, Special Studies, Part 1, AC-07-SS-1, 2010,http://www.agcensus.usda.gov/.

Future:

- Improving irrigation efficiency

United States Department of Agriculture

USDA

Economic Research Service

Water Conservation in Irrigated Agriculture: Trends and Challenges in the Face of Emerging Demands

Glenn D. Schaible and Marcel P. Aillery

Economic Information Bulletin Number 99

September 2012

	17 Western States	31 Eastern States	United States
Farms implementing irrigation system improvements (since 2003)	62,189	11,926	74,846
		Percent	
Effect of system improvements:[1]			
Improved crop yield/quality	58.7	67.6	60.2
Reduced energy costs	43.6	56.5	45.6
Reduced water applied	60.6	54.1	59.4
Reduced labor costs	42.6	34.7	41.2
Reduced fertilizer/pesticide loss	18.3	16.1	17.9
Reduced soil erosion	29.8	25.9	29.1
Reduced tailwater runoff	23.6	11.5	21.5
Farms identifying barriers to energy and/or water conservation improvements (since 2003)	107,796	22,626	131,988
		Percent	
Barriers to making irrigation system improvements:[1]			
Investigating improvements was not a priority	34.6	39.6	35.5
Risk of reduced yield or poorer crop quality	14.2	13.5	14.1
Physical field/crop conditions limit system improvements	17.0	10.4	15.8
Improvements will not reduce costs enough to cover installation costs	26.3	2.2	25.6
Cannot finance improvements	29.6	23.1	28.4
Landlord will not share costs of improvements	4.5	8.0	5.2
Uncertainty about future availability of water	17.0	4.8	14.8
Will not be farming long enough to justify new improvements	13.4	11.3	13.1

Future:

- Improving irrigation efficiency

Florida

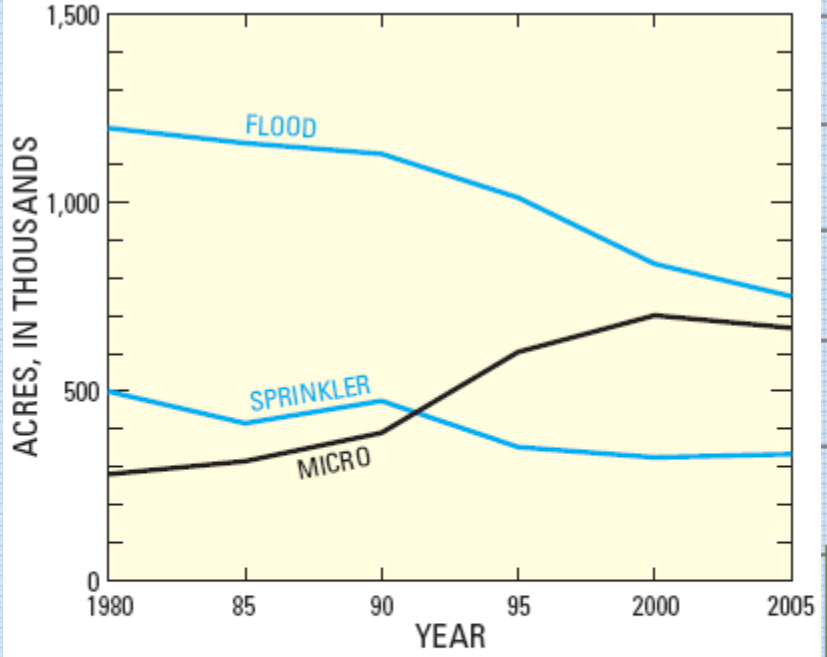


Figure 24. Historical agricultural acreage irrigated in Florida by major irrigation system type, 1980-2005. Modified from Marella (1997, 1999).

Source: U.S. Geological Survey
Scientific Investigations Report 2009–5125

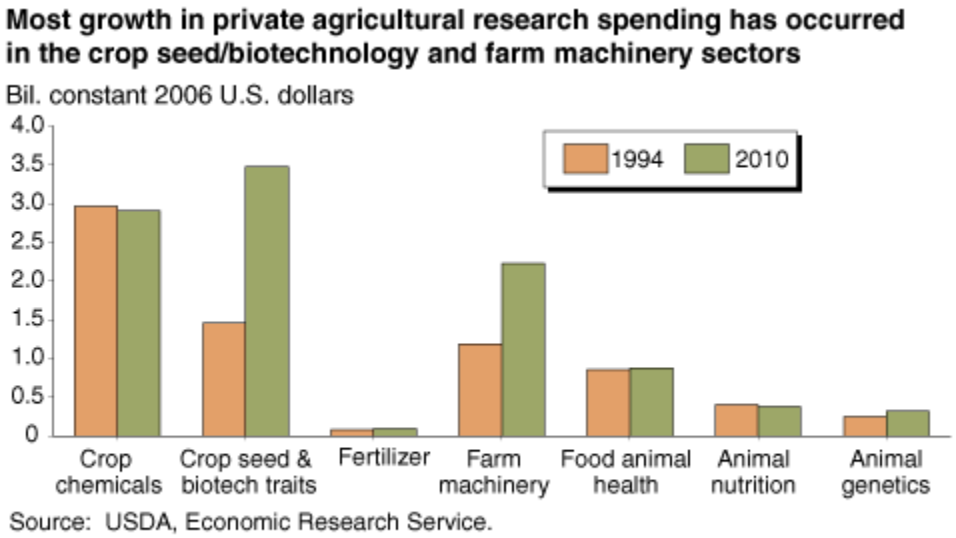
Texas

Adoption of efficient sprinkler systems

Source: Wagner K., 2013. Status and Trends of Irrigated Agriculture in Texas. Texas Water Resources Institute http://waterpr.com/Trends-Wagner.pdf

Future:

- Biotechnologies / drought tolerant crops?



Feature: Farm Economy June 05, 2012 PRINT PDF EMAIL

Private Industry Investing Heavily, and Globally, in Research To Improve Agricultural Productivity

by **Keith Fuglie**, **Paul Heisey**, **John King**, and **David Schimmelpfennig**

Private-Sector Investment in Agricultural Research

Total private R&D expenditures in the seven agricultural input sectors combined increased from $5.6 billion in 1994 to $11 billion in 2010--an average annual growth rate of 3.6 percent (or, in inflation-adjusted dollars, by 1.4 percent per year). Crop improvement accounted for most of the increase in R&D spending between 1994 and 2010, with inflation-adjusted R&D spending in the animal-related inputs remaining essentially flat. The most rapid growth in agricultural R&D over 1994-2010 was for crop seed and biotechnology traits. Seed-biotechnology research expenditures grew particularly fast in the 1990s and between 2007 and 2010. By 2008, they surpassed research expenditures in crop protection chemicals for the first time. Farm machinery research also increased substantially, with much of the growth Among all countries, the United States was the leader in private agricultural R&D during 1994-2010, accounting for over one-third of the global total. U.S. companies were particularly dominant in the crop seed/biotechnology and animal breeding/genetic sectors, where they made up about half of global private R&D investments.

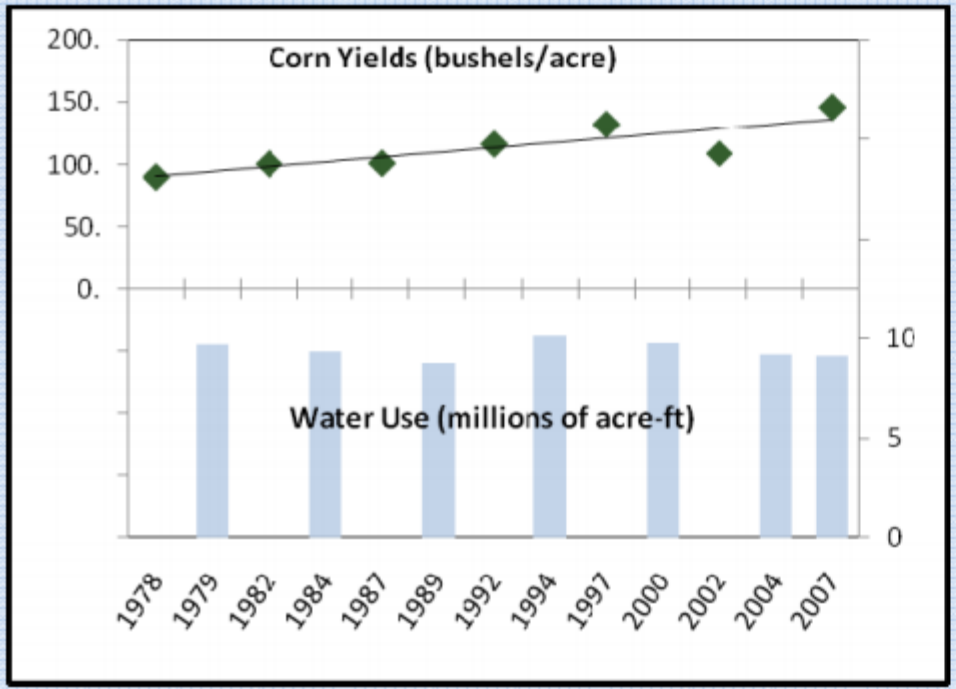
http://www.ers.usda.gov/amber-waves/2012-june/private-industry.aspx#.Uj8kLIZwpgh

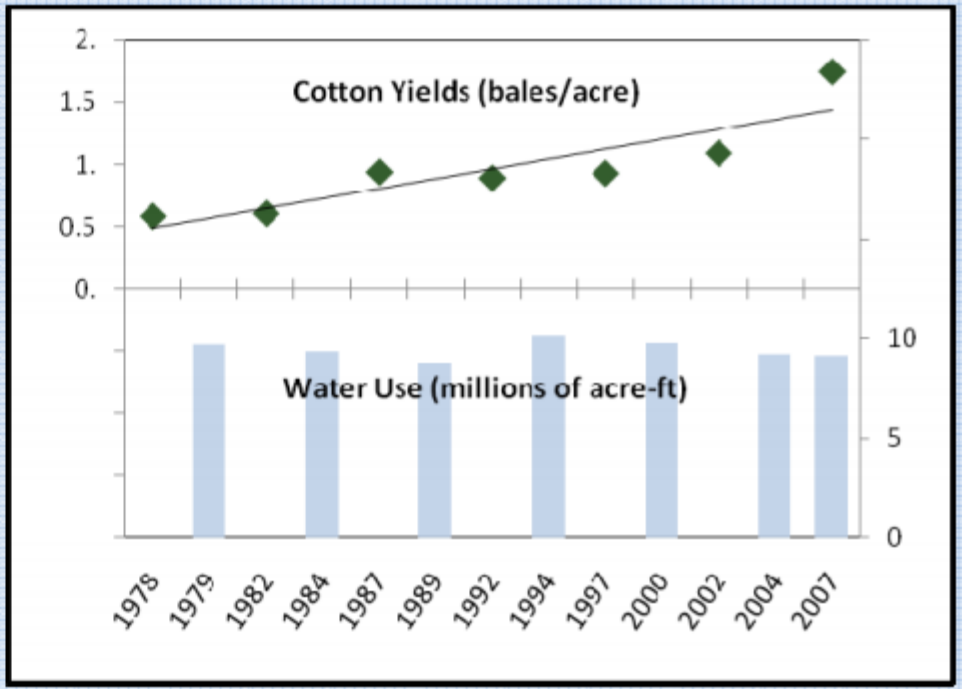
USDA Economic Research Service
United States Department of Agriculture

Future:

Increasing yields without increased irrigation

- Corn yields increased by 62% since 1975
- Cotton yields have doubled since 1975
- Improved irrigation technology/management, crop management & crop genetics





Source: Copied from Wagner K., 2013. Status and Trends of Irrigated Agriculture in Texas. Texas Water Resources Institute http://waterpr.com/Trends-Wagner.pdf

The newsletter of the
Indian River Citrus League
OCTOBER 2012

SFWMD to Initiate W
Farming Pilot Projec

By Boyd Gunsalus, Lead Environment Scient
South Florida Water Management District

The concept of "water farming" is based on utilizing fallow/out-of-production citrus lands to retain or store surface water, reduce nutrients and serve as an alternative water supply source. Water farming has been identified as a potential water management and land practice alternative that can assist in reducing the volume of harmful discharges and improve water quality to the St. Lucie and Caloosahatchee River estuaries.

In an effort to determine the overall feasibility of the water farming concept, information with respect to water resource benefits gained compared to the cost estimates associated with construction,

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resources restoration goals of the region. The benefit depends on the

is a cost-effective approach to obtain the services of water retention (acre/feet) or nutrient removal (lbs/year).

this issue

Growing Produce

Florida Agriculture Financial Management Conference

Vegetables | Fruits & Nuts | Citrus | Production | Crop Protection | Farm Mana

South Florida OKs Water Farming Pilot Project

Program's goals include reducing flow to the St. Lucie Estuary by increasing water storage on fallow citrus land.

August 28, 2013

Email Print +1 0 Tweet 3 Like 3

As part of the broad effort to restore and protect the St. Lucie River and Estuary, the South Florida Water Management District (SFWMD) approved a **water farming** pilot project to store excess water on fallow citrus land before it can flow to the estuary.

"Working with local landowners to identify property for water storage is an integral part of our strategy to address high flows into the estuaries," said SFWMD Governing Board Chair Daniel O'Keefe. "This pilot project on citrus land highlights the District's expanded efforts to implement near-term solutions that make a difference."

Under the pilot program, Caulkins Citrus Co. will pump water onto 450 acres of its property located along the St. Lucie Canal in Martin County. This can capture an average of 6,780 acre-feet of water a year that would otherwise flow along the canal from Lake Okeechobee and surrounding basins into the St. Lucie River and Estuary.

Northern Everglades Payment for Environmental Services

October 14, 2011

South Florida Water Managers Take Steps to Increase Water Storage

Dispersed water projects provide a cost-effective method of keeping water on the landscape

"…With a $7 million investment over 10 years, the eight contracts will provide 4,800 acre-feet of water retention in the Northern Everglades to assist with meeting the storage and water quality improvement goals for the watershed.

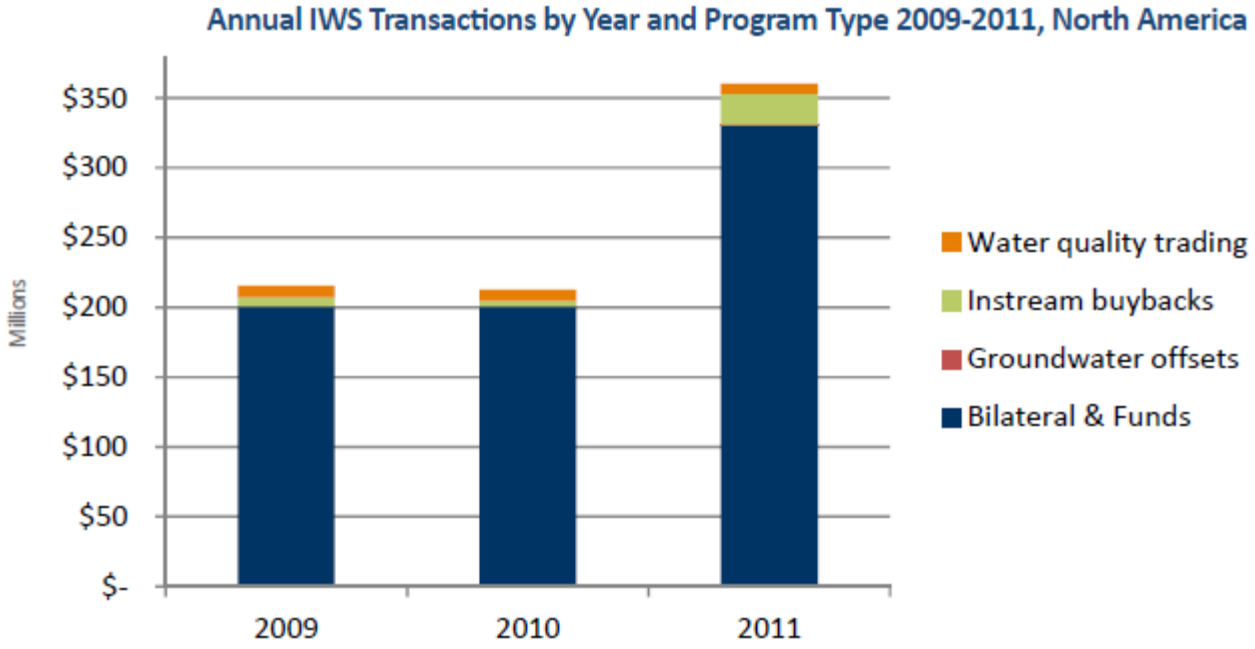
- Alderman-Deloney Ranch: 147 acre-feet
- Buck Island Ranch: 1,573 acre-feet
- Dixie Ranch: 856 acre-feet
- Dixie West: 315 acre-feet
- Lightsey Cattle Company: 887 acre-feet
- Lost Oak Ranch: 374 acre-feet
- Triple A Ranch: 397 acre-feet
- Willaway Cattle & Sod: 229 acre-feet

Northern Everglades Payments for Environmental Services Program

Ranch Name	Ranch size (ac)	Water Management Alternative (WMA) type (service area)	WMA Design and Operation and Purpose
Alderman-Deloney Ranch	3,353	Wetland water retention of on-site water sources (322)	Two culverts with riser structures installed in drainage ditches to retain water at set elevation in two natural depressional wetlands. Maintain water at higher stage than was possible previously.
Buck Island Ranch	10,494	Pasture water retention of on site-water sources (3,748 acres)	Thirty-six culverts with riser structures installed in network of drainage ditches to reduce P runoff and retain water in the ditches and subsurface inside 3,703 of agriculturally improved pasture. Maintain water at higher stage than was possible previously.
C. M. Payne and Son Josephine Road Ranch	783	Pasture water retention of on-site and off-site water sources (367 acres)	Existing culverts and newly installed culverts and berms to retain water in pastures; water includes both on-site rainfall and runoff from upstream developments. Maintain water at higher stage than was possible previously
Lightsey Cattle Co. XL Ranch	3,230	Pasture water retention of on-site water sources (364 acres)	Install culvert-riser board water control structures and several intervening fixed plates with bleed down holes in pasture drainage ditches to attenuate pasture runoff, maintain higher groundwater levels and increase water storage on-site.

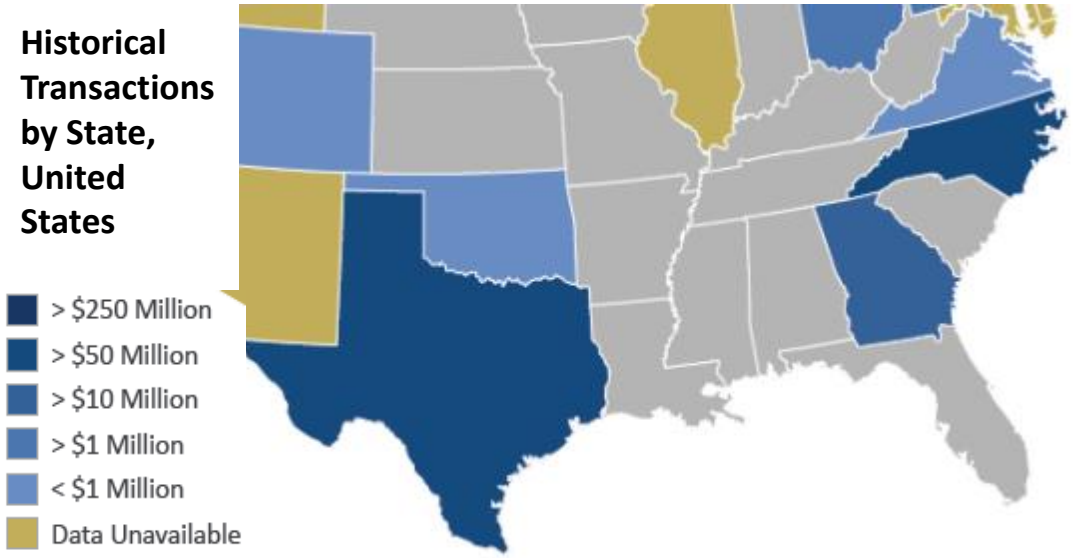
http://www.fresp.org/project_sites.php

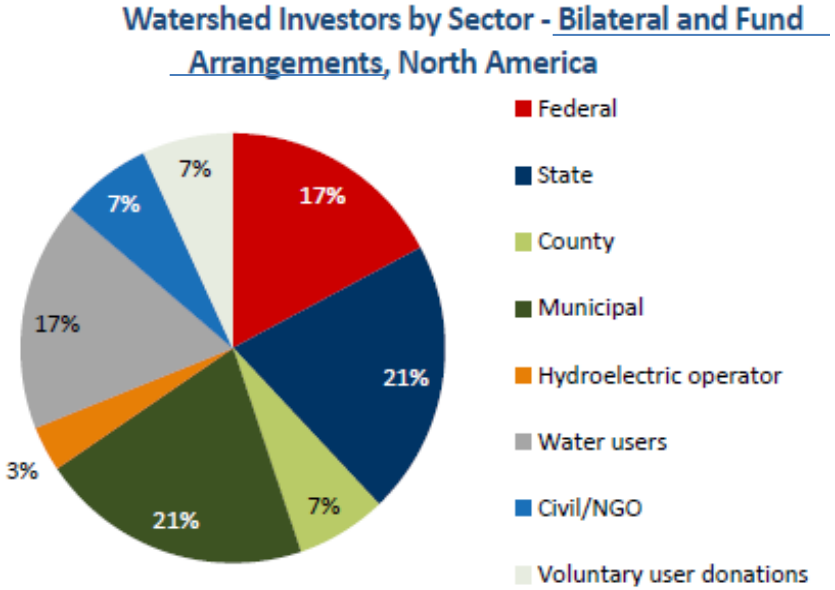
Watershed Payments: A Possible Solution?



Source: Bennett, G., N. Carroll, and K. Hamilton. (2013). *Charting New Waters: State of Watershed Payments 2012.* Washington, DC: Forest Trends. Available online at http://www.ecosystemmarketplace.com/reports/sowp2012

Historical Transactions by State, United States





Thank You!

- Questions?

Competition for Water: Examples

Governor sues Georgia over water as Rubio and Nelson blame Army for lost oyster industry

Craig Pittman, Times Staff Writer

Tuesday, August 13, 2013 5:52pm

A day after federal officials declared Apalachicola's oyster industry to be a disaster, Gov. Rick Scott announced Florida is going to sue Georgia for using too much water and causing the problem.

Meanwhile, Florida's two senators blasted the U.S. Army Corps of Engineers for giving Atlanta's lawns, taps and toilets preference over Florida seafood.

But the disaster declaration, the lawsuit and the attack on the Corps won't provide any immediate help in Apalachicola, where a seafood industry official estimates that in just the past year an estimated 60 people have quit the oyster business and moved away.

Florida, Georgia and Alabama have been wrangling for more than 20 years over where Atlanta gets its water, a fight dubbed the Tri-State Water War. To officials in Florida and Alabama, Atlanta is at fault for wasting water and failing to plan for its future. Atlanta officials insist they're now doing more water conservation than anywhere else in the nation, and Florida and Alabama's water demands are unreasonable.

Tampa Bay Times

05:20 PM, Sunday, September 22, 2013

http://www.tampabay.com/news/environment/governor-sues-georgia-over-water-as-rubio-and-nelson-blame-army-for-lost/2136319

The Changing Face of the Southern Region
Summary

- Half of US projected population growth will be in 13 southern states;
- Growth is expected to be primarily urban; positive and negative effects on rural economic development;
- Potential conflict at the expanded rural-urban fringe with competition for land uses;
- Can markets help with allocating water among competing uses and water quality?
- Role of economic research / extension education in public debate?

Consumptive Use Permits (SWFWMD)

Water Use Permit Types

There are three types of WUPs based primarily on the amount of water needed for a year.

1. **Individual:** 500,000 gpd or more
2. **General:** 100,000 gpd or more, but less than 500,000 gpd (also includes some uses less than 100,000 gpd)
3. **Small general:** most uses less than 100,000 gpd

Permit Quantities

Most WUPs have two types of quantities, but some have three.

1. **Annual average*** – Sum the gallons needed for a calendar year and divide by 365 days per year for an annual average gallons per day (gpd) total.
2. **Peak month** – sum the gallons needed for the month that you expect to be your highest water-use month and divide by the number of days in that month for a gpd per month total.
3. **Crop protection** (maximum daily) – If the application is for irrigation of temperature-sensitive crops (such as citrus, strawberries or tropical plants), water is permitted to protect them from frost and freeze damage. This amount may be limited by the 24-hour capacity of the withdrawal point (well or surface water withdrawal pipe). Know how many hours in a row the withdrawal point will likely be pumped during a freeze event, the pump capacity, and how many consecutive days the withdrawal point will likely be used during the freeze.

** In the Southern Water Use Caution Area (SWUCA), irrigation quantities for crops and plants which utilize rainfall to supply part of their irrigation needs are based on average rainfall conditions. A higher amount is given to use during times when there is less than average rainfall. An applicant may use the District's online irrigation calculation program (**AGMOD**) to determine quantities for all irrigation needs.*

http://www.swfwmd.state.fl.us/permits/wup/

The applicant submits the application form, all required supplemental information forms, and all required documentation so that the District Water Use Regulation evaluation staff (mostly geologists) can determine if the use of water is **reasonable and beneficial, does not impact an existing legal use, and is in the public interest**.

How state policies are changing to operate in "water-scarce" environment?

- Proposed Changes to Water Resource Implementation Rule:
  - Allow the WMDs to consider permit extensions as a possible incentive to implement water conservation strategies.
  - Water Utilities: "… In areas where withdrawals are unable to meet the conditions for permit issuance due to resource limitations, an applicant may propose the use of a substitution credit derived from the use of reclaimed water as part of a permit application. "
- CS/CS/HB 713: Water Quality Credit Trading
  - Authorizes DEP to implement water quality credit trading in adopted basin management action plans;

Future

- Increasing the "available" stock of water resources
  - Desalination
  - Water storage

- Improving efficiency
  - Biotechnologies
  - Precision ag
  - water reuse
  - Changing habits / lifestyle

- Reallocating water among competing demands?

Tampa Bay Seawater Desalination Plant

- up to 25 million gallons per day of drinking

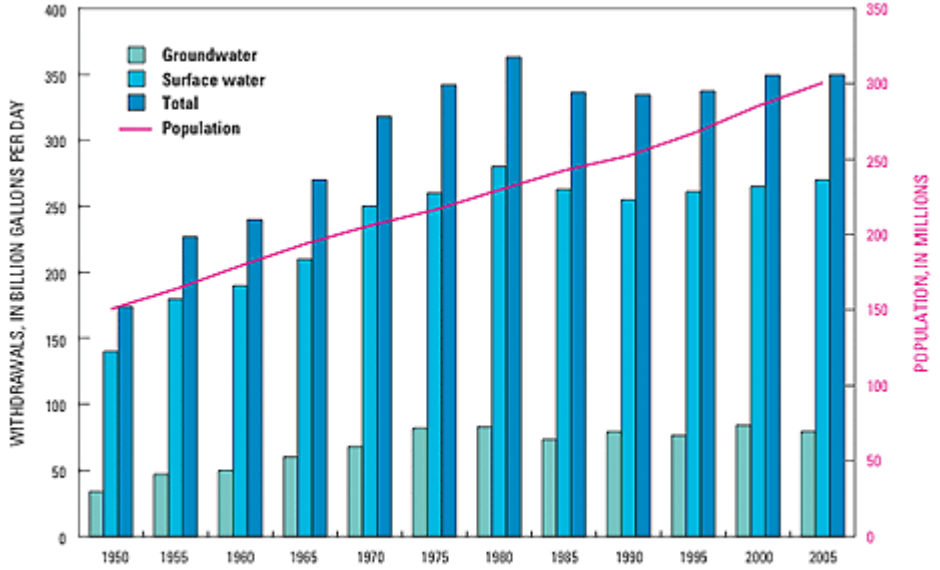
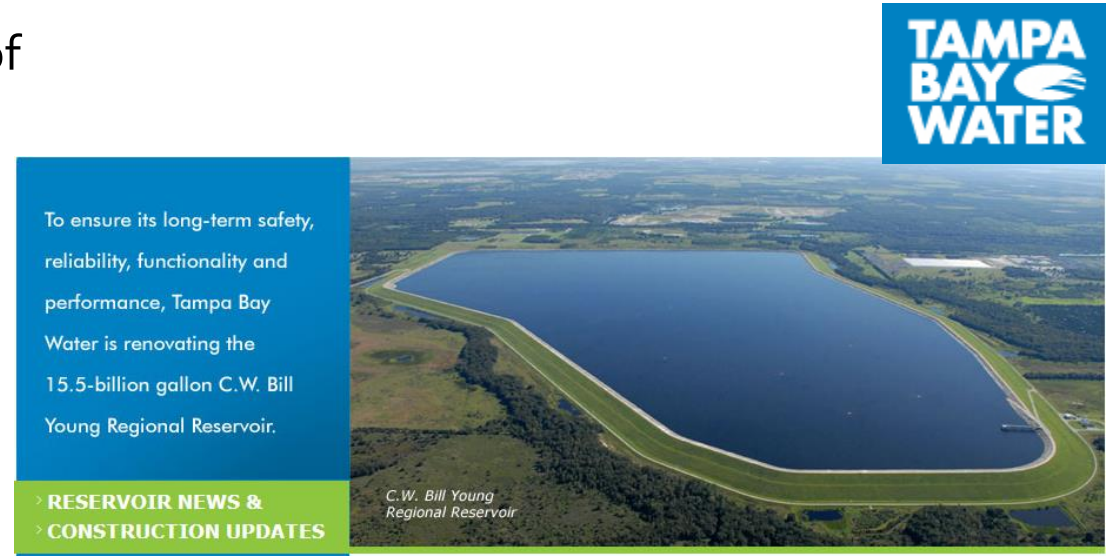


Figure 13. Trends in population and freshwater withdrawals by source, 1950–2005.

Sources: Schaible and Aillery, 2012; Turral, Svendsen, and Faures, 2010; Zotarelli, Fraisse, and Dourte, 2012 ; Biello 2012

Future

- Increasing the "available" stock of water resources
  - Desalination
  - Water storage

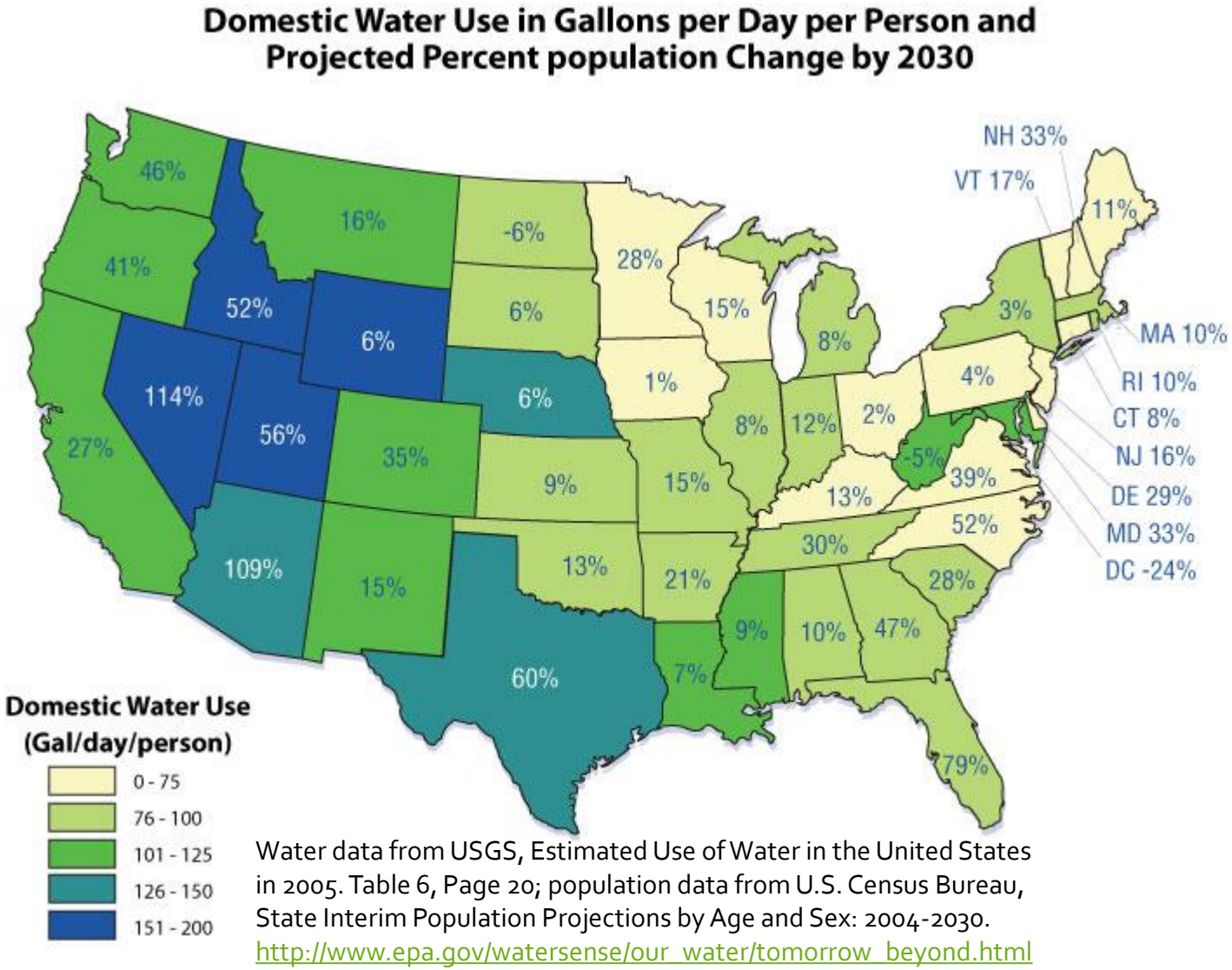


- Improving efficiency
  - Biotechnologies
  - Precision ag
  - water reuse
  - Changing habits / lifestyle

- Reallocating water among competing demands

Sources: Schaible and Aillery, 2012; Turral, Svendsen, and Faures, 2010; Zotarelli, Fraisse, and Dourte, 2012 ; Biello 2012

Population Growth and Domestic Water Use



Water data from USGS, Estimated Use of Water in the United States in 2005. Table 6, Page 20; population data from U.S. Census Bureau, State Interim Population Projections by Age and Sex: 2004-2030. http://www.epa.gov/watersense/our_water/tomorrow_beyond.html

Population and Freshwater Withdrawals, 1950 – 2005 (USGS 2005)

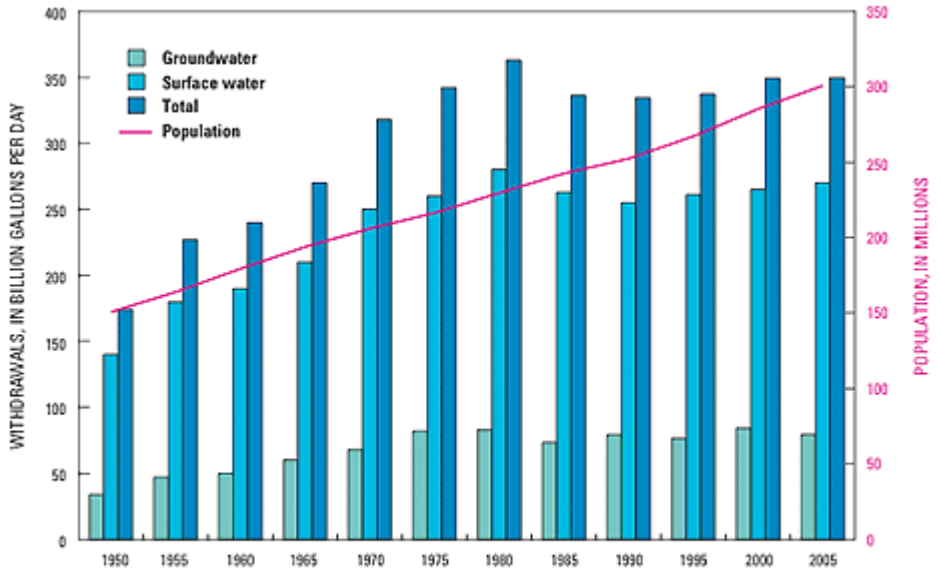


Figure 13. Trends in population and freshwater withdrawals by source, 1950–2005.

Source:
Based on Kenny, J.F., Barber, N.L., Hutson, S.S., Linsey, K.S., Lovelace, J.K., and Maupin, M.A., 2009, *Estimated use of water in the United States in 2005*: U.S. Geological Survey Circular 1344, 52 p

FARM OF THE FUTURE

Buck Island Ranch

As part of an ecosystem services pilot project, Florida ranchers are paid to retain water on their pasture. Buck Island Ranch restores seasonal wetlands while continuing to graze cattle amidst water control structures. Increased infiltration due to culverts and drainage ditches helps filter phosphorus from agricultural runoff and create wildlife habitat.

Northern Everglades

Buck Island and other Florida Ranchlands Environmental Services Project (FRESP) ranches are located in a region of central Florida known as the Northern Everglades. Over the last 100 years, the wetlands ecosystem of the Everglades has been drained for agricultural production and channelized for flood control. These shifts in water management have resulted in reduced biodiversity, degraded water quality, and low water table levels.

With 3,000 head of cattle on 10,500 acres, Buck Island Ranch is among the top 20 commercial cow-calf producers in Florida. In addition to cattle sales, the ranch also earns income from sod production, hunting leases, and cabbage palm harvesting.

Culverts with riser structures installed in a network of drainage ditches retain water on the ranch and reduce phosphorus runoff to the larger Everglades ecosystem.

As part of the FRESP pilot, Buck Island Ranch receives payments for land rental, foregone production, and consultation on project design. In a scaled-up program, payments will be based on either acre feet of water retention or nutrient load reduction, with precise payment levels established through a reverse auction process to ensure the efficient allocation of funds.

Researchers are assessing the anticipated benefits of the project's higher water levels and water retention to wetland plants, frogs, fishes, and other invertebrates.

Farm Revenue Sources (Gross), Average 2007-2009

Source	Revenue	Customer
Cattle sales	89%	Feedlots
Other agricultural revenue (sod, cabbage palm)	3%	Sod and tree harvesters
Hunting leases and nature tourism	3%	Sportsmen and tourists
Payments for water retention services	5%	FRESP pilot

Revenue calculations and all financial information provided by the landowner.

USDA

Farm of the Future posters were produced by