

Water and Energy Conservation in Agriculture

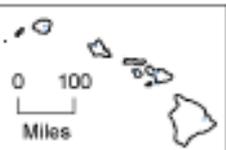
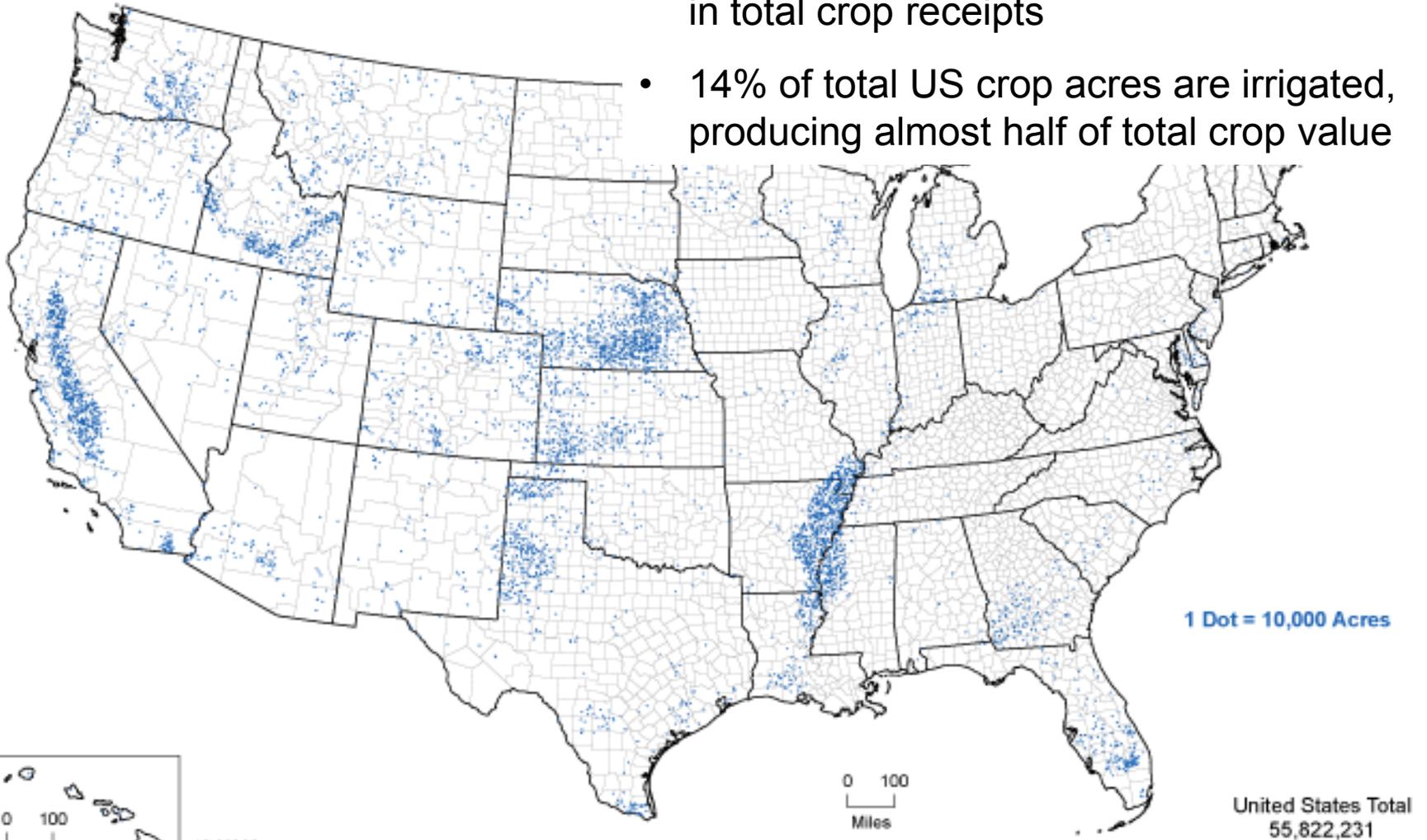


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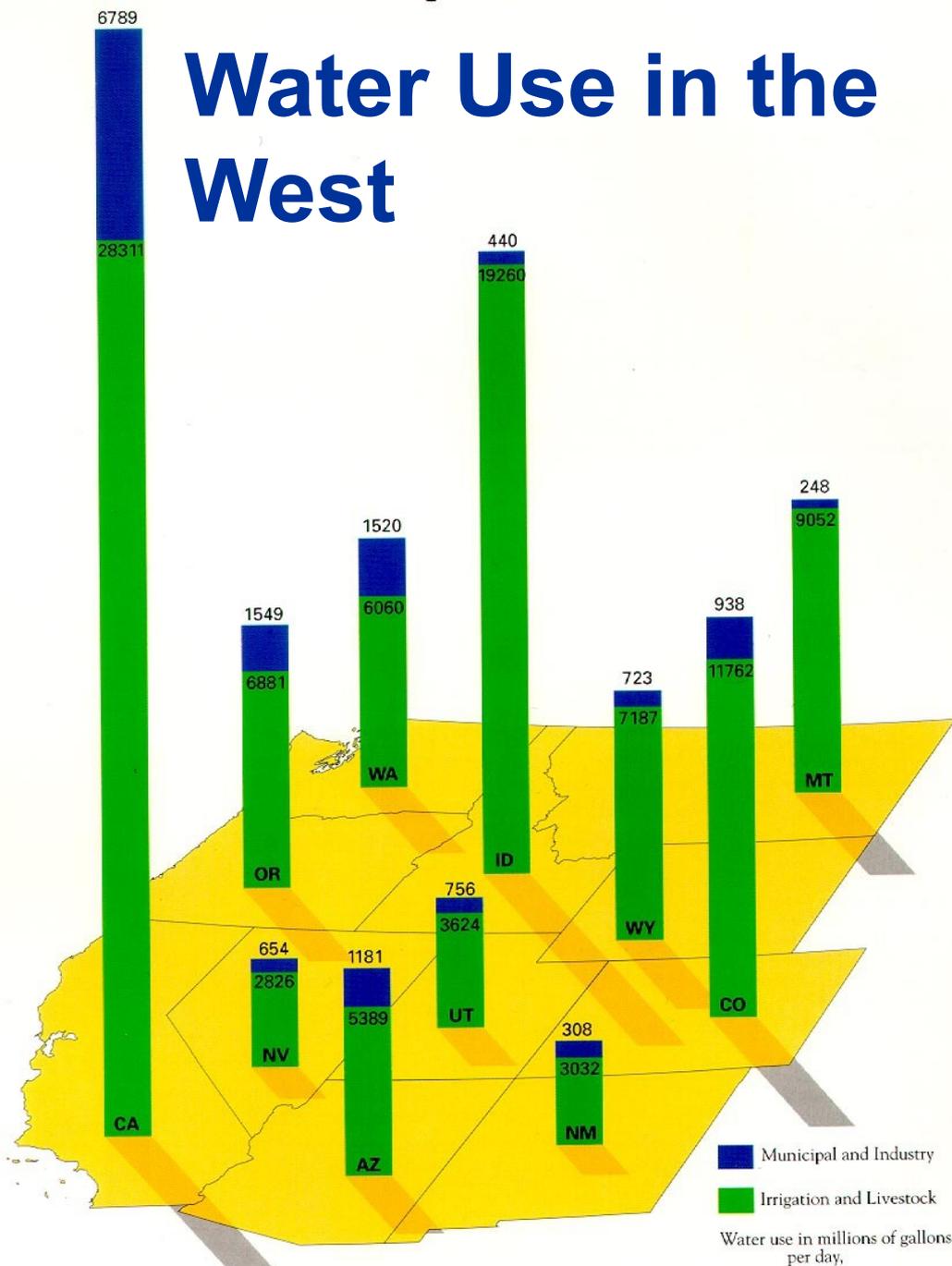


Acres of Irrigated Land: 2012

- 400 million acres of total crops. 55 Million irrigated acres. Over \$200 billion in total crop receipts
- 14% of total US crop acres are irrigated, producing almost half of total crop value

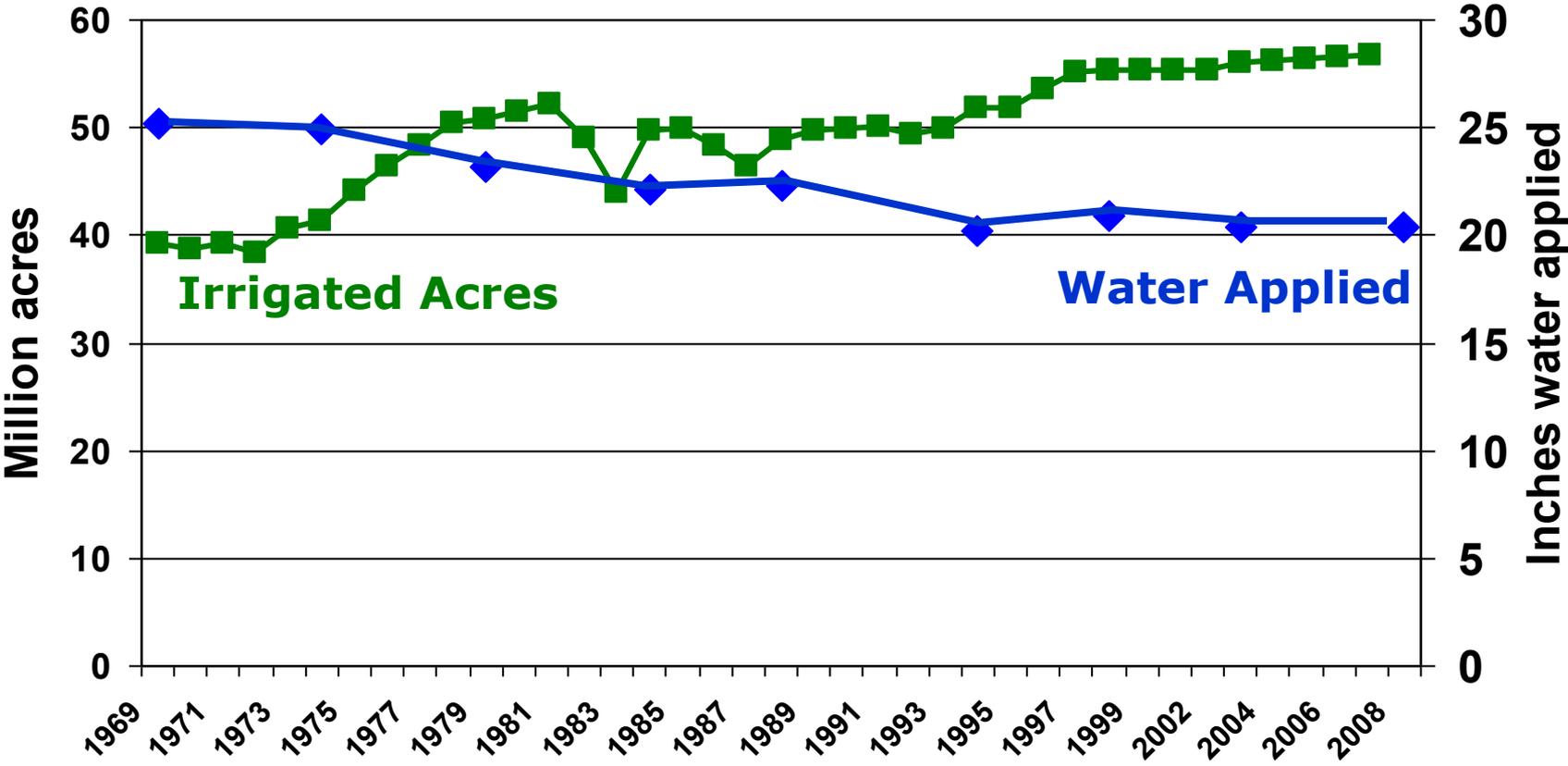


Water Use in the West



- Food production is water and energy intensive
- 73% of water withdrawals for irrigation
- Value of water in agriculture is ~ order of magnitude lower than value of water for M&I uses

U.S. irrigated acres & water applications



Source: USDA-NRCS, based Census of Agriculture Data

Irrigation Methods in US

Irrigation Method	US Totals
 A photograph showing a field of crops with long, straight furrows filled with water, illustrating surface irrigation.	Surface 39%
 A photograph of a center pivot irrigation system, showing a large circular structure with multiple arms extending over a field of crops.	Sprinkler 54%
 A photograph showing a close-up of a drip/micro irrigation system, with blue plastic mulch and small emitters visible in a field.	Drip/micro 7%

Source: USDA 2013 Census of Agriculture data

WHAT IS AG WATER CONSERVATION?

- **Improved irrigation application efficiency**
- **Increased capture and utilization of precipitation**
- **Increased water delivery efficiencies**
- **Conservation practices to reduce evaporation**
- **Decreased non-beneficial consumptive use**
- **Decreased crop consumptive use**

Ag Water Conservation: Opportunities and Challenges

Challenges

- Legal
- Financial
- Environmental
- Political
- Social

Opportunities

- Improved crop production
- Conserved water for additional beneficial uses
- Partnerships
- Financial incentives

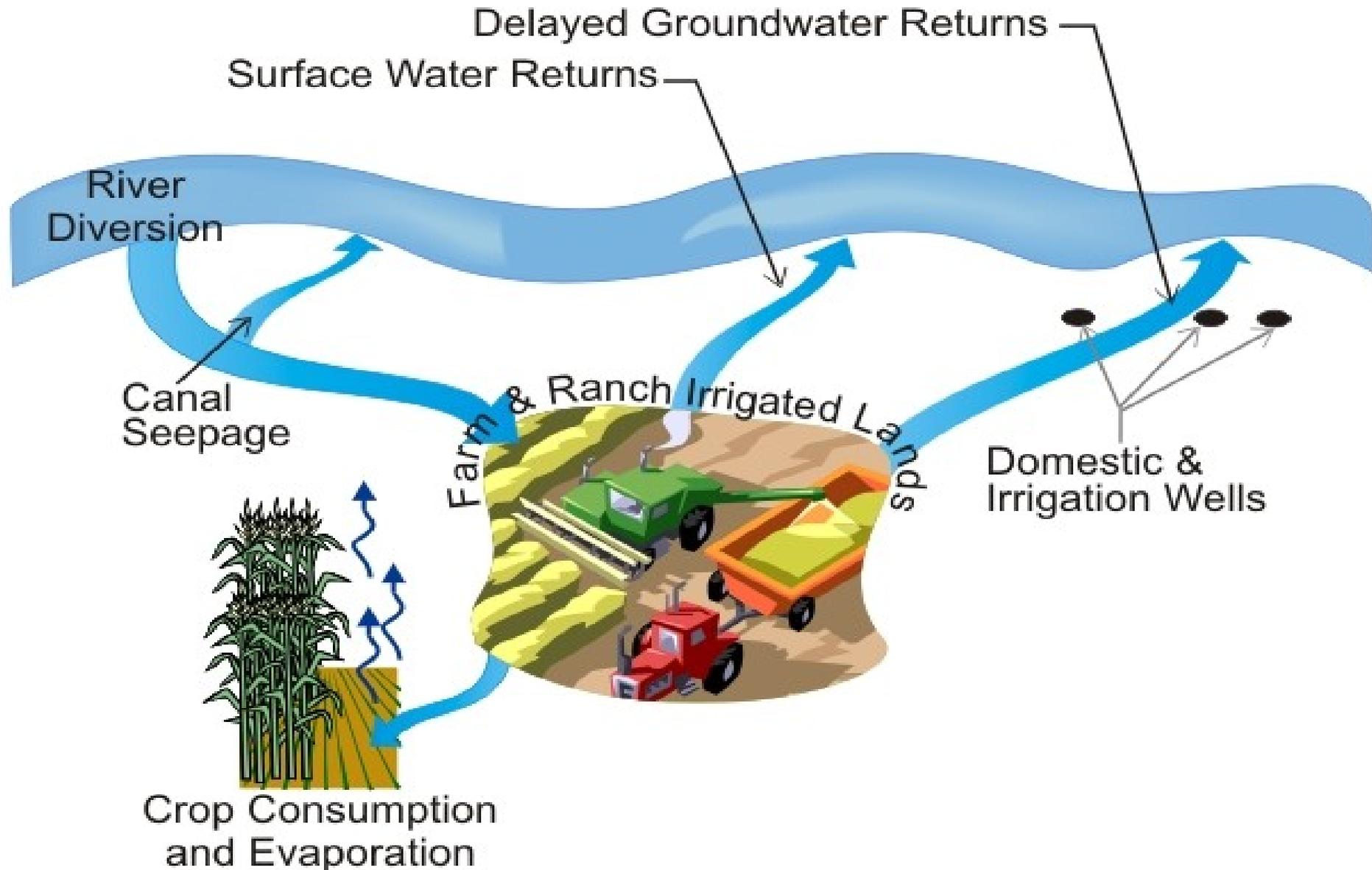


2013 USDA Farm and Ranch Irrigation Survey

The top barriers for farmers to make improvements to reduce energy use or conserve water in 2013:

- Investigating improvements is not a priority
- Cannot finance improvements
- Improvements will not reduce costs enough to cover installation costs
- Uncertainty about future availability of water

Return flows belong to downstream users



Two basic strategies to achieve
“forgone diversion”

Conservation and Efficiency

Efficiency vs. Water Conservation

- **Water use efficiency** is the ratio of water applied compared to water consumed by ET
- Irrigation efficiency may be improved, while **crop consumptive use** remains largely unchanged



Water efficiency measures

- Ditch lining
- Pressurized pipe
- Conversion of flood irrigation to gated pipe/surge/sprinkler/drip
- Land leveling to increase irrigation uniformity
- Furrow dikes and contour farming
- Crop residue management
- Water metering
- Irrigation scheduling
- Tail water recovery
- Polyacrylamide (PAM) use in ditches and furrows



**Conservation is about doing less
with less water diverted.**

**Conservation in agriculture and
food production has real financial
impact.**

**If producers cut back on irrigation,
there can be economic shortfalls.**

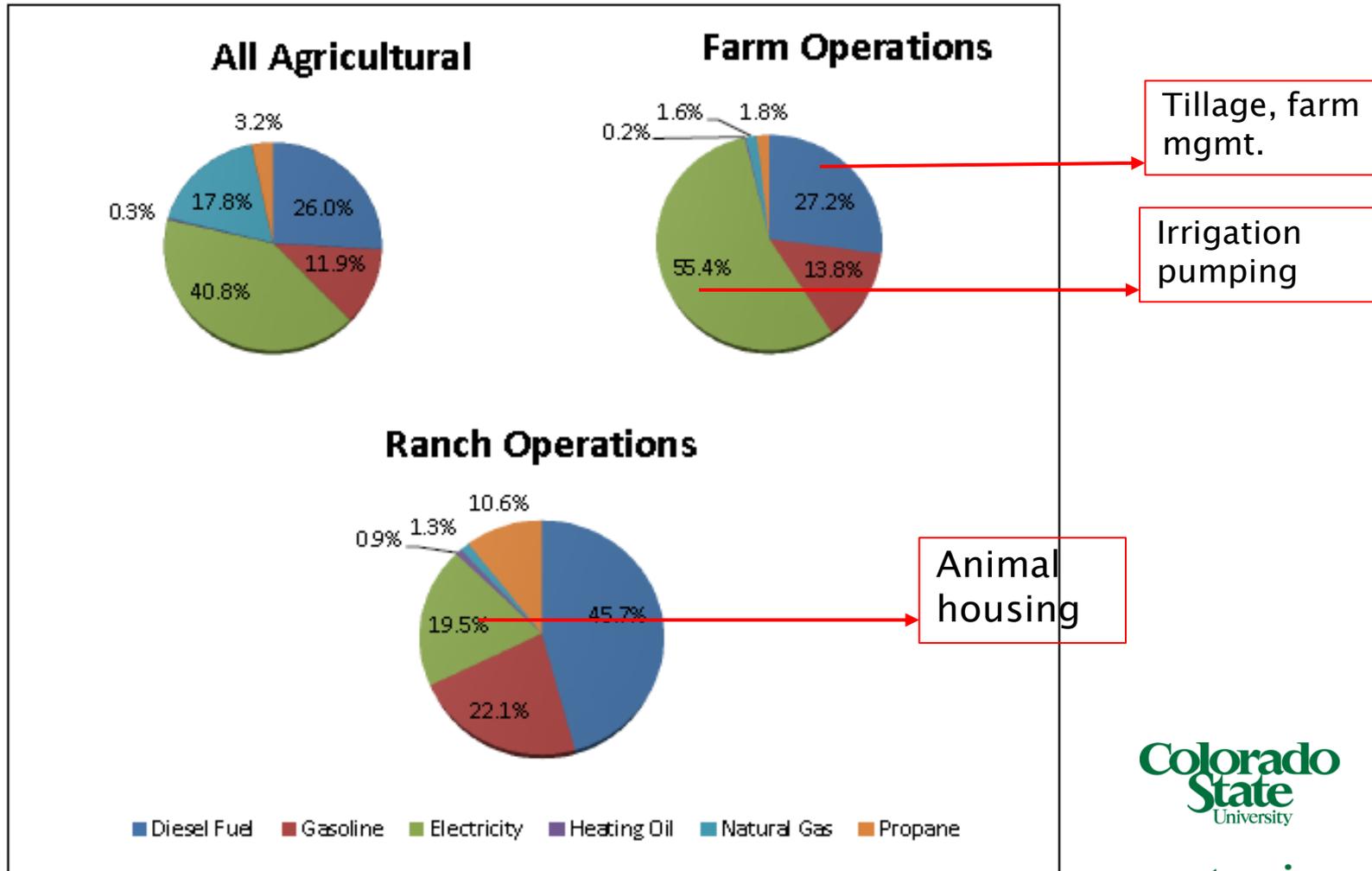
Reducing Crop Consumptive Use



- Crop consumptive use** is reduced when:
- 1) irrigated acres are decreased
 - 2) you switch to cool season crops or
 - 3) crops with a shorter growing season
 - 4) deficit irrigation is practiced
 - 5) Evaporative losses from the field surface are reduced as a result of conservation tillage, mulching, and or drip irrigation.

On-Farm Energy Opportunities

FIGURE 2: Percentage of Average Annual Energy Expenditures by Type



Source: Colorado Energy Office, Agricultural Market Survey.

Irrigation and Energy Savings

Energy costs are the largest operating expense in irrigation.

How can we reduce those costs?

Repair/maintenance of pumping plant

Update pumping plant

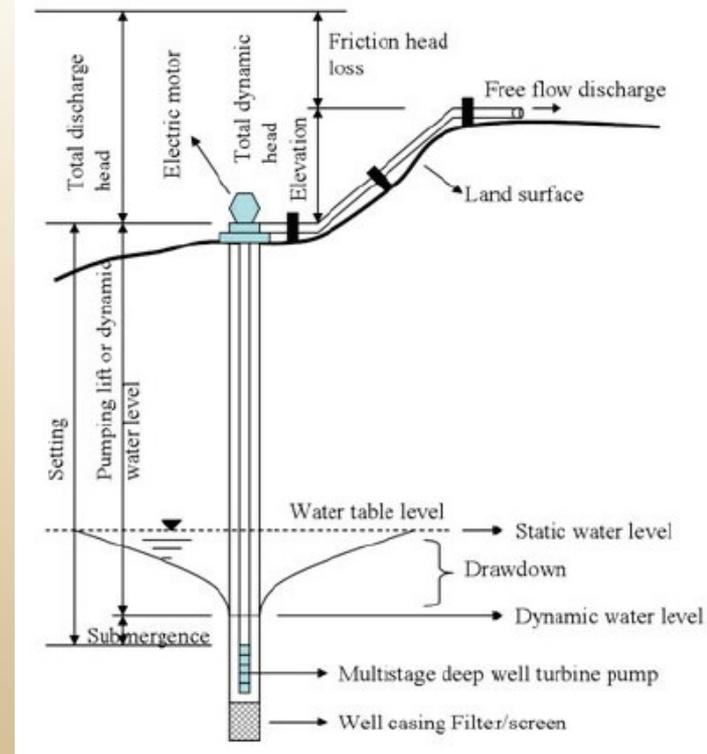
Irrigation Scheduling

Sprinkler Packages

Fundamental Pumping Opportunities

Pumping costs often are higher than they need be for two reasons:

- More water is pumped than is necessary
- The pumping plant operates inefficiently



Pump Inefficiency

- Field testing programs in Colorado, Wyoming, Nebraska, Texas, Louisiana and other states have shown that overall pumping plant or 'wire-to-wire' efficiencies for electrically driven pumps average 45-55%
- But a realistically achievable efficiency is 72-77%

Irrigation Pumping Plant Efficiency

Fact Sheet No. 4.712

Crop Series | Irrigation

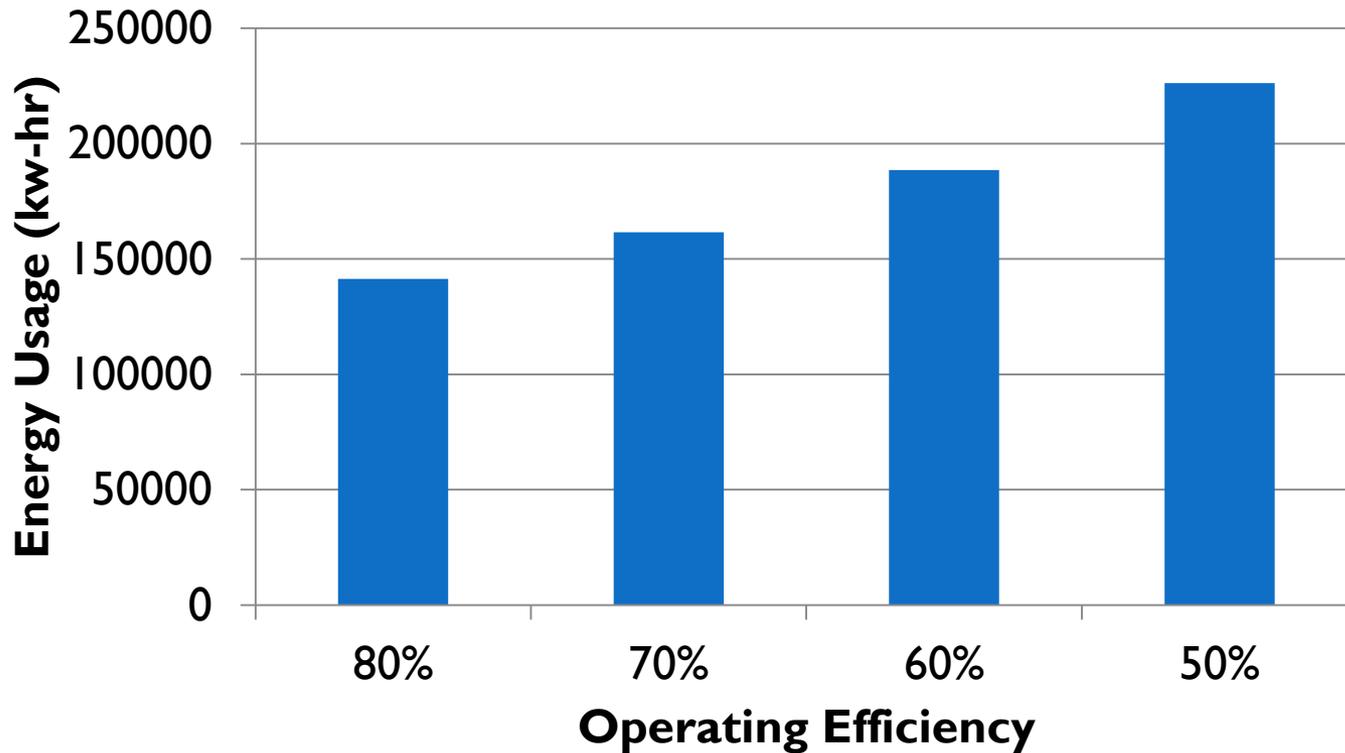
by J.L. Chávez, D. Reich, J.C. Loftis, and D.L. Miles*



Pumping Plant

Economics

Energy Usage



Sprinkler Packages

Why Reduce Pressure?

- Potential for decreased energy cost
 - reduced operating pressure
 - reduced water pumped
- Potential for increased application efficiency
 - reduced wind drift loss
 - reduced canopy evaporation loss



Irrigation Scheduling

Irrigation Scheduling

Proper amount of water at the right time

Do not allow the crop to go into water stress

Benefits

Reduced pumping costs

Energy and water

Potentially higher yields/quality

Extend life of systems

Reduced leaching of water and fertilizer

Methods

Checkbook – ET

Hand Feel

Soil Moisture Monitoring

How Do We Get It Done?



Reduce Disincentives to Ag Conservation

- ◆ Clarify Abandonment Statutes (NV)
- ◆ Conservation as a beneficial use (CA, TX, OR, ID, UT)
- ◆ Arkansas Basin Irrigation Improvement Rules (CO)



Create Incentives to Conserve

- ◆ Mechanisms to realize value for conserved water (CA, OR, WA, MT, NM)
- ◆ Make time, place & use more flexible (NV, OR)

AGRICULTURAL WATER CONSERVATION CLEARINGHOUSE

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PROJECT GOALS

- INCREASE access to information helping to build collaborative relationships between and among agencies region and nation-wide
- PROVIDE technical expertise regarding agricultural water conservation
- CIRCULATE materials on the management, policies, and laws surrounding agricultural water conservation



WHAT IS AG WATER CONSERVATION?

- Increased crop water use efficiency
- Improved irrigation application efficiency
- Increased capture and utilization of precipitation
- Decreased crop consumptive use
- Increased irrigation water diversion and delivery efficiencies
- Reduced water use through adoption of conservation measures and new technologies for water management

WHAT'S NEW:

REPORTS:

REPORT: Meeting Colorado's Future Water Supply Needs
September 2008
Colorado Agricultural Water Alliance

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EVENTS:

EVENT: 24th Annual WaterReuse Symposium;
September 13-16, 2009
Seattle, Washington
Water ReUse Association

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ANNOUNCEMENTS:

ANNCMNT: The 1st call for papers of the IAALD 2010 Congress

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