Agricultural Water Use

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Factors Impacting Agricultural Water Use

- Irrigated Acres
- Cropping Systems
  - Type of crop
  - Season/season length
  - Double vs single crop
- Irrigation Management & Efficiency

Source: Census of Agriculture

Decreased ~10,000/acres/yr since 1978
Growing Season & Crop Water Use

- **Evaporative Demand**
  - 4-fold seasonal change
  - Peak in late June/early July
  - Minimum: Dec/Jan

- **Crop Water Requirements**
  - Reflect growing season
  - Vary ~15% across AZ
  - Double cropping
    - Vegetables/wheat
  - Highest
    - Perennial/summer crops
  - Lowest
    - Winter/shoulder season crops

Sources: Erie et al. 1981; recent research by Brown, Walworth, Papuga, Sanchez

Source: Arizona Meteorological Network
Irrigated Agriculture in Arizona
Irrigated Area: ~850,000 Acres

Northwest AZ
12% of Ag
Elevation: 400-3000’
Rain: 4-8”
Surface Water (CO River)
Groundwater (“Inland”)

Central AZ
51% of Ag
Elevation: 600-3000’
Rain: 4-12”
Ground/Surface Water

Southeast AZ
12% of Ag
Elevation: 3000-4400’
Rain: 10-16”
Surface Water (Gila V)
Groundwater (Cochise Co.)

Southwest AZ
25% of Ag
Elevation: < 600’
Rain: <4”
Surface Water
Cropping Trends: Southwest AZ

Now dominated by vegetable production; durum wheat often double cropped with vegetables

Source: National Agricultural Statistics Service & Yuma irrigation districts
Switch to winter-centric production focused on vegetable and durum wheat has reduced water use ~19% since 1975
Cropping Trends: Northwest AZ

Mohave and LaPaz Counties

Significant shift to alfalfa production; majority of irrigated land on CRIT & FMIT land

Source: National Agricultural Statistics Service
Dramatic reduction in cotton production; increased acres devoted to alfalfa, corn/sorghum silage and wheat. Corn & sorghum silage now estimated at 50,000 acres (not shown on graph).
Increased Forage Production

- Forages replacing cotton
  - More profitable
  - Higher water use
    - Alfalfa: 60”+
    - Cotton: 32-42”
- Growing animal demand
  - 193,000 dairy cows*
  - 173,000 horses
  - 279,000 cattle on feed
- Proximity important
  - Transport costs

* ~160,000 acres of alfalfa required for AZ dairies

Graph courtesy of Dr. Russ Tronstad, Extension Economist, Univ. of AZ
Cropping Trends: Southeast AZ

Significant reduction in cotton; expanded production of nut trees, corn and alfalfa

Source: National Agricultural Statistics Service; *2015 data for orchards estimated
Southeast Arizona
Tree Nut Production

Nut trees have replaced cotton & alfalfa as a way to improve farm profitability in Southeast Arizona where problems with groundwater depletion are already severe. Studies are underway to quantify the water use of tree nuts in an effort to better understand the potential impacts on regional water use and to assist growers with irrigation management. Most new plantings use drip/micro-irrigation to apply water.
Arizona Irrigation Systems

Arizona Irrigation Systems: 2011

- **Gravity**: 780,000 acres
- **Center Pivot**: 80,000 acres
- **Solid Set**: 60,000 acres
- **Drip/Micro**: 50,000 acres

**Surface Irrigation**
- Deep Percolation
- Root Zone

**Center Pivot Irrigation**
- Spray Evaporation
- Runoff
- Limited Deep Percolation

**Drip Irrigation**
- Uniform water application & reduced surface evaporation

*College of Agriculture & Life Sciences
Cooperative Extension*
Improved Surface Irrigation Efficiency
Yuma County

Wellton Mohawk IDD
Sprinkler Irrigation Trends

• Center Pivots
  • Improved efficiency
    • Automation, nozzle improvement
    • Precision technologies
  • Most popular in SE Arizona
    • Some replaced with micro-irrigation
    • Orchards & wine grapes

• Solid Set
  • Growing popularity in SW Arizona
    • Crop establishment
    • Wide bed produce
    • Wheat production
Subsurface Drip Irrigation

- Regional Experience
  - Row Crops
    - Reduced Water Use
  - Forage Crops
    - Similar Water Use
    - Improved Yields
  - Vegetables
    - Limited Use
    - Germination
    - Salinity
    - Field Flexibility

- Concerns
  - Costs/Financing
    - $2500/a
  - Management
  - Salinity
    - Leaching Required
    - Maintain Surface System
    - Sprinklers During Establishment

Source: Burt et al., 2003

Figure 7. Change of ECe (dS/m) as a function of depth in inches in Field 1.
Subsurface Drip Irrigation

**Increasing grower interest**
- Lack of water/fear thereof
- Yield enhancement
- Labor

**From Industry Sources**
- Last 5 years
  - ~30,000 acres installed
- Statewide acreage
  - ~75,000 acres
- Forage crops
  - ~45,000 acres

Arizona Irrigation Systems: 2017 Estimates
## Improving Irrigation Efficiency

### Barriers

<table>
<thead>
<tr>
<th>Barriers to Irrigation Improvements</th>
<th>Farms</th>
<th>Land (a)</th>
<th>Water (a-ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landlord will not share costs</td>
<td>297</td>
<td>192,388 (23%)</td>
<td>919,114 (17%)</td>
</tr>
<tr>
<td>Improvement won’t cover install. costs</td>
<td>560</td>
<td>124,760 (15%)</td>
<td>572,066 (11%)</td>
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<tr>
<td>Cannot finance improvements</td>
<td>1209</td>
<td>121,436 (14%)</td>
<td>519,227 (10%)</td>
</tr>
<tr>
<td>Will not be farming long enough</td>
<td>243</td>
<td>97,354 (10%)</td>
<td>520,142 (10%)</td>
</tr>
<tr>
<td>Uncertainty about water future</td>
<td>598</td>
<td>114,054 (13%)</td>
<td>443,406 (8%)</td>
</tr>
</tbody>
</table>

2013 Farm and Ranch Survey

Values in ( ) represent % of irrigated land or % of ag water use

### Remote Land Ownership

#### Financing

Urbanization/Age: 10%

### Water Future

NRCS EQIP for irrigation improvements (since 1997): $74 Million
NRCS EQIP for sprinkler/drip irrigation: $42 Million on 182,000 acres
Abandonment

- May eliminate water use
- Re-vegetation
  - Slow/non-existent
  - No re-veg requirement
- Dust
  - Non-attainment
  - Dust storms
    - Serious traffic safety issue
- NRCS Plant Materials Center
  - Re-vegetation projects
The Future

- Acreage Will Decrease
  - Urbanization
  - Water issues
    - Urban valuation
    - Shortage/energy costs

- Future Crop Production
  - Vegetables/specialty crops
  - Forages
  - Strong tribal component
  - Shifting production seasons/areas
    - Warming
    - Lack of water
  - Technological advances
    - Water use efficiency
    - Stress & salinity tolerance