Remote Sensing in Water Management: *Economics $$*

Photo credit: Richard Doty

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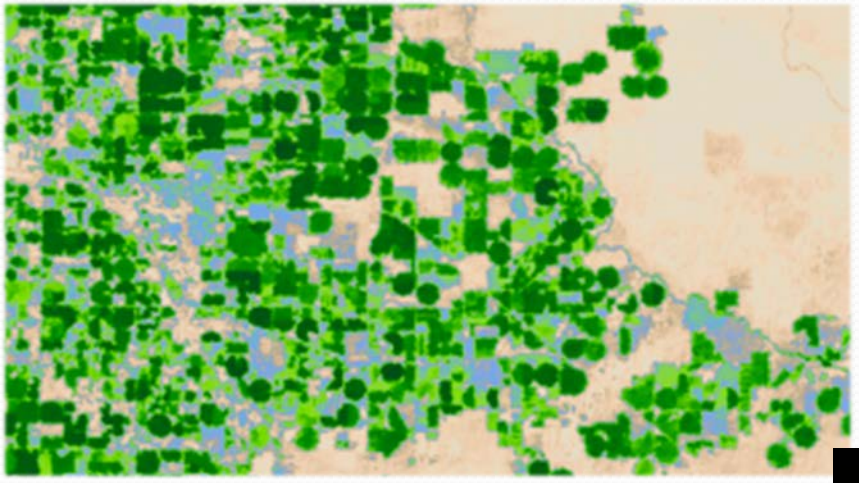
RS Economics - Key Points

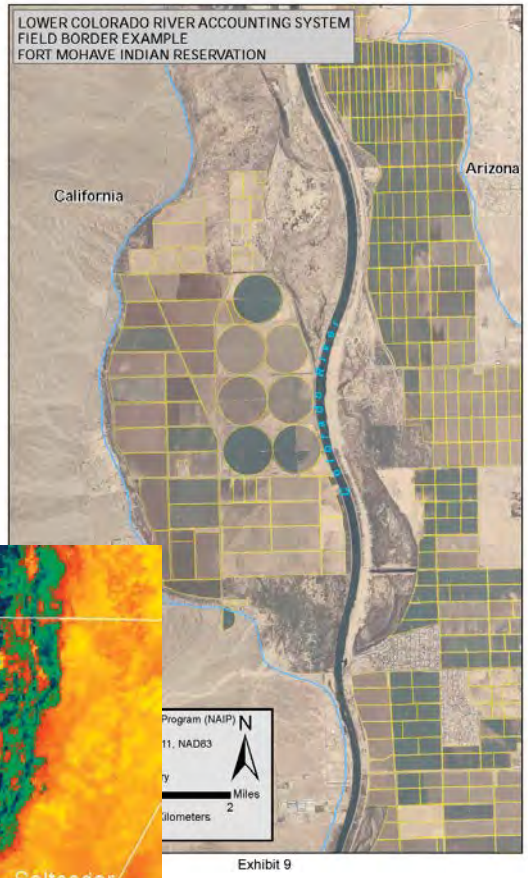
- RS facilitates new types of precision-timed, rapid response, cost-effective water trading
- Payoffs of investing in RS capacity
- Funding RS capacity in public agencies
  - who pays?
  - how do they pay?

Many examples of RS in water management

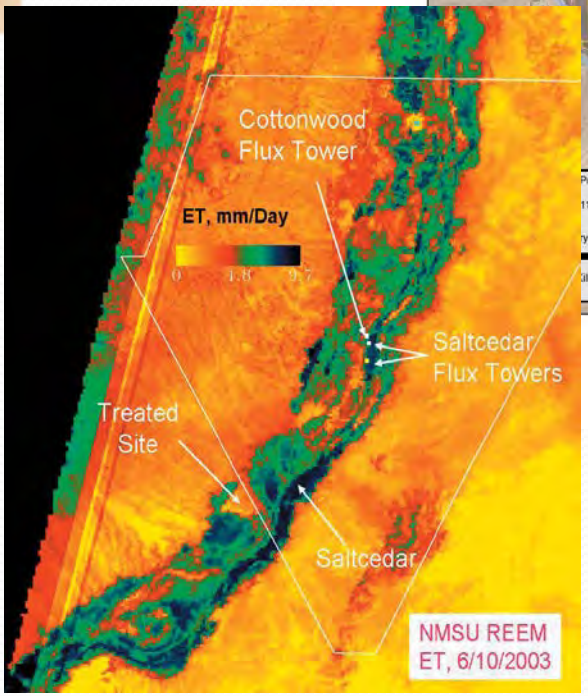


METRIC ET map, agriculture, Idaho

Lower Colorado River Accounting System



REEM riparian ET model, Bosque del Apache, New Mexico



Looking ahead – selective forbearance

- Temporarily reduce crop CU to free up water
- Voluntary, negotiated payments to growers, IDs
- contracts with ag negotiated in advance of need
- rapid response when water needed
- precisely timed – seasonal fish and habitat needs, M&I pipeline breaks, etc
- trades based on reduced consumptive use (afcu)

Contrast with old style “buy and dry”

- high conflict
- expensive
- payments based on acres fallowed not reduced CU
- slow - lengthy negotiations, regulatory processes
- imprecise measurement and monitoring - how much did ag CU actually decline?

Selective forbearance urgently needed

- No more deep pockets – fed? states? developers?
- Ecosystems in decline, dependent on ”leftovers”
- Aging water-energy infrastructure

Photo credit: Colorado River Water Users Association

Photo credit: Science Faction

Selective forbearance examples

- 2-4 weeks of summer irrig. forbearance for salmon streams - triggered by low flows, high temp
- Seasonal field crop forbearance to sustain orchards and vineyards
- Earthquake damage mitigation, Mexicali Valley irrigation infrastructure

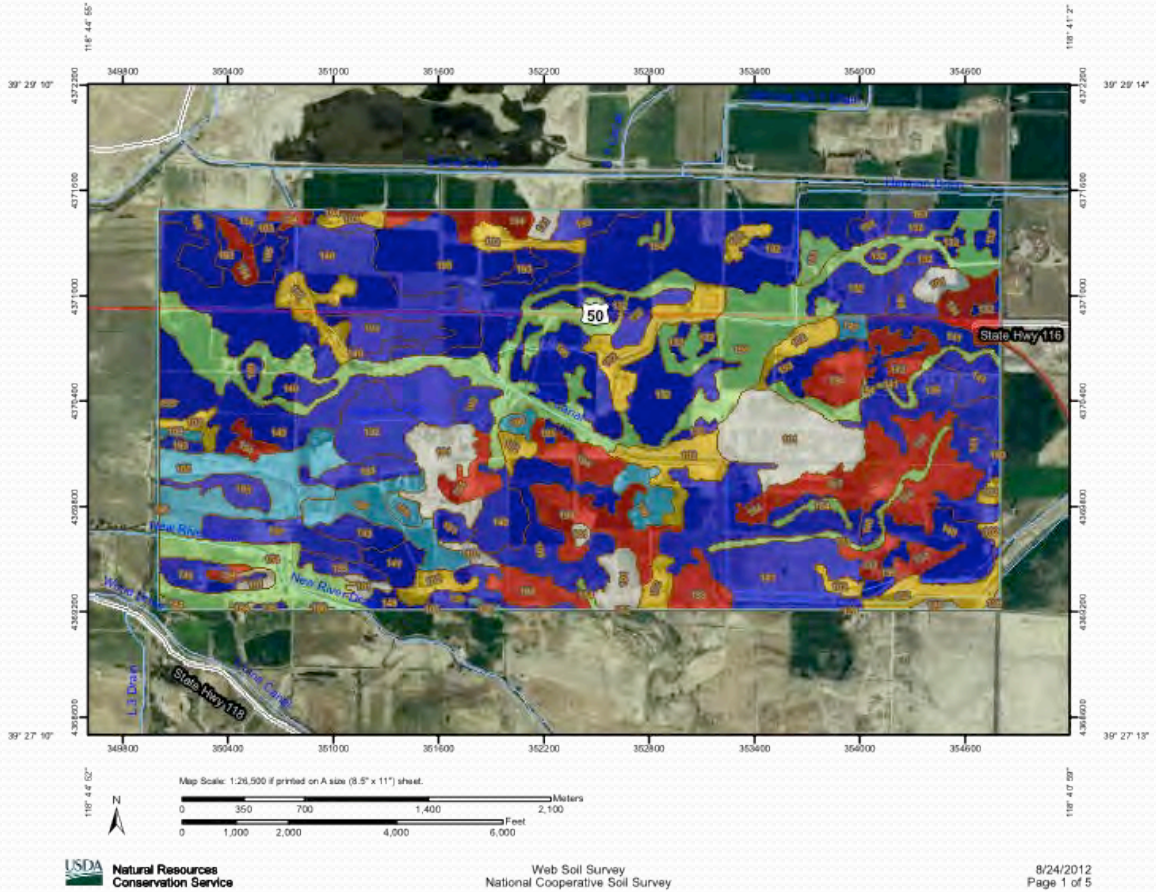
How RS Facilitates Selective Forbearance

- Improved near-time monitoring of reduced ag CU
- Prioritizing locations for forbearance – areas with lowest net crop revenues per acre-foot consumptive use (AFCU)

Web Soil Survey yield map for alfalfa, Lahontan Valley, NV

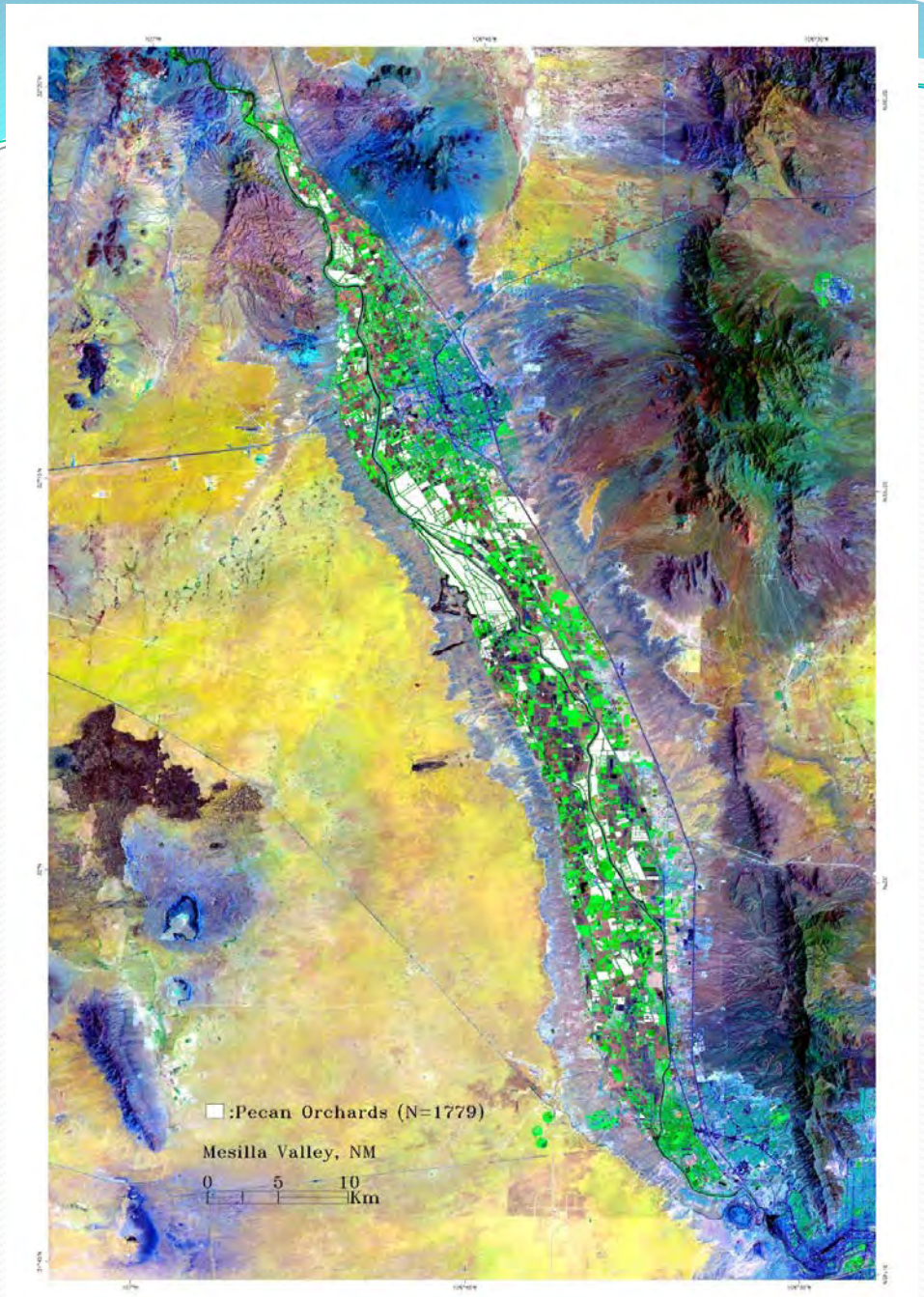
Yields of Alfalfa hay (tons), February 2012

Soil Data Mart, NRCS http://soildatamart.nrcs.usda.gov



<= 0.22 > 0.22 and <= 0.4 > 0.4 and <= 3.39

> 3.39 and <= 4.93 > 4.93 and 5.68 not available



tracking crop CU

- field, sub-field scale
- 2+ observations per month

Mesilla Valley, New Mexico. Landsat-7, pecan orchards (white polygons).

From New Mexico WRRI Technical Completion Report No. 357 ESTIMATING WATER USE THROUGH SATELLITE REMOTE SENSING

Selective Forbearance

If such a great idea – why not more of it?

- Seasonal, temporary trades easily dampened by high monitoring costs
- On-the-ground field checking – not “worth it”
- RS makes these arrangements practical
- Selective forbearance can protect and enhance regional economic and environmental assets

Benefits of Investing in RS Capacity

- Need more pilot programs to quantify $$ benefits
- Types of benefits:

  - lower cost to accomplish existing water mgt tasks

Remote Sensing - Cost Effectiveness

Idaho DWR - Landsat thermal data, METRIC ET model

Costs to monitor 3,830 irrigation wells
using power consumption coefficients = $120 per well

Using Landsat thermal data, cost = $30 per well

RS data significantly higher accuracy, as well as less expensive.

Cost Comparison For Monitoring Irrigation Water Use:
Landsat Thermal Data Versus Power Consumption Data
Anthony Morse, William J. Kramber Idaho Department of Water Resources

Benefits of RS Capacity

Types of Benefits:

- lower cost to accomplish existing water mgt tasks

- improved timeliness and precision in tracking CU
- transparency, reduced conflict
- new capabilities for small scale trading with big environ. payoffs
- better accounting in water banks around West
- other benefits we cannot yet anticipate

Benefits of RS Capacity

BIGGEST BENEFIT: avoiding the costs and conflicts related to decisions based on outdated and imprecise data

VALUE: One Landsat scene can easily have $500M in water assets (market values: $5,000 to $60,000 per afcu sold)

$100K – 150K cost per scene per year = a ***BARGAIN*** in many areas!

Invest first in regions with high water values: ag areas linked to growing cities, critical environ. assets

RS Capacity : Who Pays and How?

Fair to spread portion of costs across water users, rights holders -- broad improvements in water admin.

And – “beneficiaries pay” – fees on water trades

Base fees on ***value*** of water traded (amount paid, not quantity)

Assess fees to support RS on energy users too?

Partner with universities - training, capacity building, outreach (**NOT** a level playing field in capacity to use RS data)

Moving Ahead

Typical irrigation forbearance:

Inflexible - hard to change course, doesn't adapt to new conditions

Costly per unit of water obtained

Moving Ahead

Typical irrigation forbearance:

- Slow
- Inflexible
- Costly

What's needed?

Nimble – quick, cost-effective response to crises, new conditions

Moving Ahead

What's needed?

Nimble – quick, cost-effective response to crises, new conditions

Moving Ahead

Thank you!

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Guidebooks: Innovative Water Trading

- *Prioritizing Water Acquisitions for Cost-Effectiveness, November 2012*
- *Measurement, Monitoring and Enforcement of Irrigation Forbearance Agreements*, August, 2012
- *Understanding the Value of Water in Agriculture,* August, 2011
- *Entendiendo el Valor del Agua en la Agricultura,* October, 2011
- *Water Banks: A Tool for Enhancing Water Supply Reliability,* 2010
- *Dry-Year Water Supply Reliability Contracts: A Tool for Water Managers,* 2009

Bonnie Colby and various co-authors, University of Arizona, Department of Agricultural and Resource Economics.

Google: Colby water guidebooks

http://www.climas.arizona.edu/projects/innovative-water-transfer-tools-regional-adaptation-climate-change

crop yield & net revenue variability

$2,200/acre NET revenue difference,

head lettuce, Yuma County Arizona

yield: 700 cwt/acre

$11,900 net

yield: 800 cwt/acre

$14,100 net

adapted from Kurt Nolte, University of Arizona