<u>Alternative to GSA Groundwater Metering</u> ITRC-METRIC and Net Groundwater Use/Recharge

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Alternative to Well Metering

For On-Farm Irrigation Management

 Well flow and volume metering are important
 Irrigation scheduling and well efficiency trending

- For GW Basin Sustainability Monitoring
 - Well flow and volume metering are misleading
 - Meters provide the GROSS amount pumped
 - They do not report how much groundwater was consumed (used by plants)

Issues with existing groundwater policies

- Just having a policy does not mean it's a good one.
- Several states in the west limit gross GW pumping
 - Assume irrigation efficiency is 75-80%
 - Farmers improve efficiency.... and expand area or switch crops..... increasing consumption
 - Increased overdraft instead of solving the problem

Water Rights and Groundwater

- Poor understanding of groundwater <u>consumption</u>.....as opposed to <u>gross</u> pumping
- NEW Concept Consumptive Rights
- Consumptive Right = Surface Right + Net Sustainable Yield
- Ignore Irrigation Efficiency
 No one knows what it is anyway

With GW Metering Example

- GSA Assumes IE = 80%
- Surface Rights = 2.5 AF/A
- Sustainable Yield (net) = 0.5 AF/A
 - Pumping allotment = [(2.5+0.5)/0.8]-2.5 = 1.25 AF/A
- Farmer can apply 2.5+1.25 = 3.75 AF/A
- What if farmers actual IE = 85%?
 - Applying 3.75 AF/A,
 - 0.69 AF/A of groundwater would have been consumed,
 - 0.19 AF/A more than sustainable...

NEW Concept <u>Consumptive Rights</u>

 Consumptive Right = Surface Right + Net Sustainable Yield

Ignore Irrigation Efficiency
 No one knows what it is anyway

Alternative to Metering GW Pumping

• Net To/From Groundwater

- Spatial monthly model using

- Remote Sensing of actual consumption
- Surface deliveries
- Precipitation
- Can be used to evaluate different scales at the same time:
 - Sub-basin
 - GSA
 - Parcel/farm
 - Use in near real-time for tracking farm level GW consumption

NET to/from Groundwater



Monthly results **No groundwater pump volumes needed**

Remote Sensing of Actual ET_c

- Modified METRIC[™] algorithm with LandSAT images
- IS NOT NDVI based ET estimation!!
- Basic Principle Evaporative cooling
- Cooler fields have higher ET



Instantaneous ETc images





PRELIMINARY NTFGW Results

- Light to Dark Blue = Net TO GW
- Beige and Brown = Net FROM GW

PRELIMINARY NTFGW March 2011



PRELIMINARY NTFGW July 2011





Tracking NTFGW on a Farm Basis

ITRC-METRIC ETc

NTFGW



Pilot Projects



Pilot Project Results

Closure = GW + SW + P - ETc

Closure indicates deep percolation or carryover soil moisture Should be positive

		2014				2015				2016			
PARTICIPANT	CROP*	METRIC ET (IN)	RAINFALL (IN)	(GW+SW) APPLIED (IN)	CLOSURE (IN)	METRIC ET (IN)	RAINFALL (IN)	(GW+SW) APPLIED (IN)	CLOSURE (IN)	METRIC ET (IN)	RAINFALL (IN)	(GW+SW) APPLIED (IN)	CLOSURE (IN)
1	DAIRY					37.0	5.7	48.3	16.9	35.3	7.8	52.2	24.7
2	PISTACHIOS					17.1	5.7	27.8	16.4	19.7	7.5	46.6	34.4
3	DAIRY	33.5	6.2	45.2	17.8	37.3	6.2	41.2	10.2	30.1	8.4	40.5	18.8
4	ALMONDS	48.8	6.9	36.8	(5.0)	43.2	7.5	35.5	(0.2)	54.3	9.6	50.2	5.5
5	DAIRY	33.0	6.1	47.8	21.0	38.3	5.8	39.8	7.3	33.7	8.1	34.8	9.2
6	PISTACHIOS	43.5	6.3	37.5	0.3	34.5	6.1	26.6	(1.8)	39.5	8.3	41.0	9.8
7**	WALNUTS	34.8	6.9	37.3	9.4	30.3	7.4	34.7	11.7				
8	ALMONDS					37.1	6.2	36.0	5.0	46.0	8.3	42.1	4.4
9	ALMONDS	43.7	6.3	42.5	5.0	41.3	6.1	39.6	4.5	50.4	8.3	39.1	(3.0)
10	WALNUTS	47.6	7.1	43.0	2.6	40.5	7.6	34.8	1.9	48.3	9.9	46.7	8.4
11	GRAPES	41.0	5.8	37.4	2.2	34.8	5.7	34.6	5.5	44.6	7.8	38.9	2.1
12	TOMATOES					22.9	6.2	19.6	3.0	26.6	8.4	25.4	7.2
13	DAIRY					35.2	7.4	51.4	23.6	33.1	9.6	67.8	44.3
14	ALMONDS	33.8	5.9	32.1	4.2	34.5	5.9	35.5	6.9	44.4	8.0	33.9	(2.5)
15	DAIRY	27.3	6.5	53.1	32.4	28.7	6.6	44.6	22.6	24.8	8.9	47.7	31.9
16	WHT/CORN	45.3	5.8	37.9	(1.6)	48.3	5.6	36.6	(6.0)	37.9	7.7	32.9	2.7
17	PISTACHIOS					4.4	6.2	6.7	8.6	6.6	8.4	12.6	14.4
18	ALMONDS					36.1	6.3	36.5	6.7	43.9	8.5	40.2	4.7
19	PISTACHIOS					30.5	6.1	36.4	12.1	35.3	8.3	36.5	9.5

Why you need NET GW numbers ?

- Sustainable Yield is a NET value (no guessing at on-farm efficiency)
- GW sustainability has little to do with gross groundwater pumping
- GW use can be independently tracked and verified
- Historical evaluations of existing conditions
- Variable Spatial Scales
 - Parcel level
 - GSA/District level

Thank You



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