

SCIENTIFIC CHALLENGES FOR DEMAND MANAGEMENT PROGRAMS



2018 UCRB Water Forum
Luke D. Gingerich, PE
J-U-B ENGINEERS, Inc.
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J-U-B ENGINEERS, INC.



Scientific Challenges for Demand Management Programs

There are a lot of scientific challenges with Demand Management:

- Soil health
- Economics
- Agronomics
- Hydraulics
- Plant physiology
- Sociology
- **Quantifying “conserved consumptive use”**



“Conserved Consumptive Use” is the foregone depletion from a demand management activity

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How do we quantify the value of this?



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OH... that's easy.

Use this table.

- 40.28" per year

Done and Done!

- Soil health
- Economics
- Agronomics
- Hydraulics
- Plant physiology
- Sociology
- ~~Quantifying "conserved consumptive use"~~

ESTIMATED SEASONAL AND MONTHLY CONSUMPTIVE USE OF CROPS

Table C0683.50(k)
Grand Junction, Colorado

TR-21 Blaney Criddle Method

CROPS	Growing Season		Average Consumptive Use (inches of water)												
	Average Dates	Days	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	TOTAL
Perennials															
Alfalfa zone 1	3/12 - 11/4	237	0	0	0.74	2.58	5.15	7.69	9.35	7.59	4.65	2.43	0.10	0	40.28
Alfalfa zone 2	3/2 - 9/25	207	0	0	1.36	2.32	4.34	6.20	8.68	7.28	3.81	0	0	0	33.99
Grass, Pasture	3/2 - 11/3	246	0	0	1.17	2.01	3.59	5.05	7.20	6.23	4.02	2.02	0.06	0	31.35
Annuals															
Beans, Dry	6/1 - 9/15	106	0	0	0	0	0	4.29	8.70	7.07	1.64	0	0	0	21.70
Corn, Grain	5/1 - 9/15	137	0	0	0	0	1.97	4.32	8.28	6.95	2.07	0	0	0	23.59
Corn, Silage															
Grain, Spring	4/5 - 8/1	118	0	0	0	0.97	4.13	6.62	3.47	0	0	0	0	0	15.19
Orchard zone 1 (w/ cover)	4/1 - 10/10	192	0	0	0	2.50	5.14	7.68	9.36	7.59	4.64	0.78	0	0	37.69
Orchard zone 2 (w/o cover)	5/9 - 9/29	143	0	0	0	0	3.07	6.19	8.69	7.28	4.41	0	0	0	29.64
Small															
Vegetables	4/15 - 10/15	183	0	0	0	0.43	2.40	4.91	6.81	5.73	3.13	0.59	0	0	24.00
Sugar Beets	4/15 - 10/15	183	0	0	0	0.60	2.72	5.75	9.25	8.85	5.59	1.42	0	0	34.18
Wheat, Winter	4/5 - 8/1	118	0	0	0	2.66	5.33	6.16	2.86	0	0	0	0	0	17.01
Average Precipitation			0.64	0.61	0.75	0.79	0.63	0.55	0.46	1.05	0.84	0.93	0.61	0.55	8.41
Effective Precipitation			0	0	0.29	0.54	0.49	0.49	0.45	0.97	0.65	0.64	0.04	0	4.59

Net irrigation requirement is the difference between crop consumptive use and effective precipitation.



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Not so fast! Blaney-Criddle is OK, but:

- “This is a **TEMPORARY** demand management program, not a change case, historical averages won’t work”
- “Producers need flexibility, it can’t all be complete fallow, people are going to engage on a **VOLUNTARY** basis”
- “Nobody should be **COMPENSATED** for water that doesn’t show up in lake Powell”



Scientific Challenges for Demand Management Programs

What about this? I am going to irrigate a perennial legume again after September 1st.



Or wheat on October 1st?



Scientific Challenges for Demand Management Programs



I'll stop irrigating after first cutting.



I'll tell these kids to stop doing whatever it is they are doing.



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- How do we arrive at a number that makes all parties comfortable with the necessary transaction?



- Negotiated Science Based Assumptions



Scientific Challenges for Demand Management Programs

Here is how we quantified CCU in our Conserved Consumptive Use Pilot Project:

- ASCE Standardized Penman Montieith

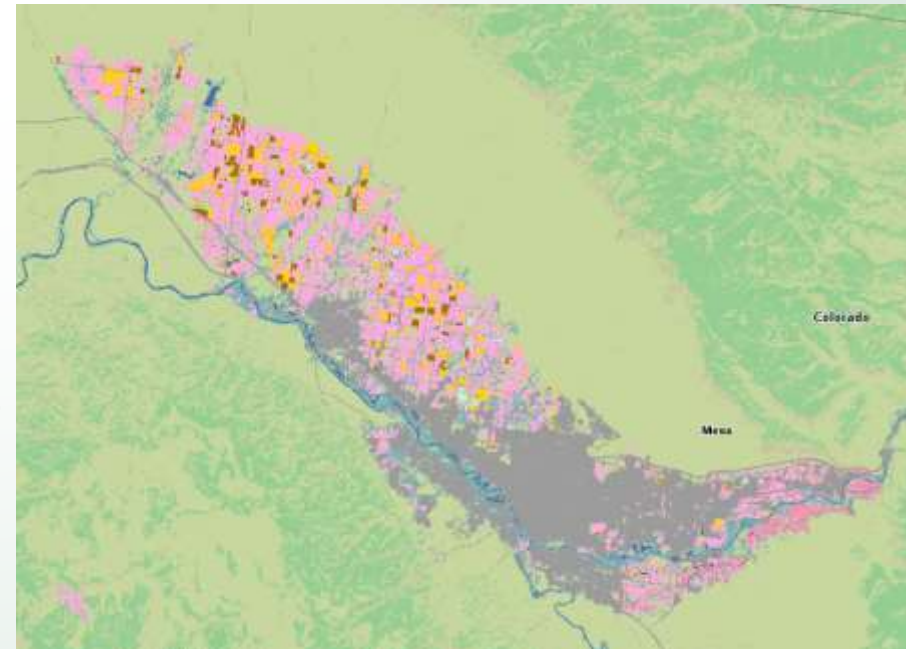
$$ET_{sz} = \frac{0.408\Delta(R_n - G) + \gamma \frac{C_n}{T+273} u_2 (e_s - e_a)}{\Delta + \gamma(1 + C_d u_2)}$$

- Historical data from FRT02 (thank you CoAgMet)

- 3 dominant row crop rotations (2014)

- Alfalfa – 73%
- Corn – 15%
- Wheat – 12%

- Weighted average of historic CU and crop type



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If a CCUPP cooperators does this for the entire irrigation season.

The assumed CCU = 33.3"/year



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Program Activity	Criteria	CCU (ac-ft/ac)
FF	No CU throughout Irrigation Season	2.8
WW	No CU until October 1	2.6
SS	No CU until September 1	2.3
AA	No CU until August 1	1.6

Same ET method. fall planting dates.

- Limiting the NSBAs
- Providing some flexibility
- Providing a measure of certainty in compliance
- Functioning crop rotation





Scientific Challenges for Demand Management Programs

Conserved consumptive use isn't the only parameter in the negotiation.

Program Activity Abbreviation	Fallow Period	Total Cost
FF	Entire irrigation Season	\$883
WW	April 1 through October 1	\$843
SS	April 1 through September 1	\$749
AA	April 1 through August 1	\$562
SF	May 15th through October 1st	\$699

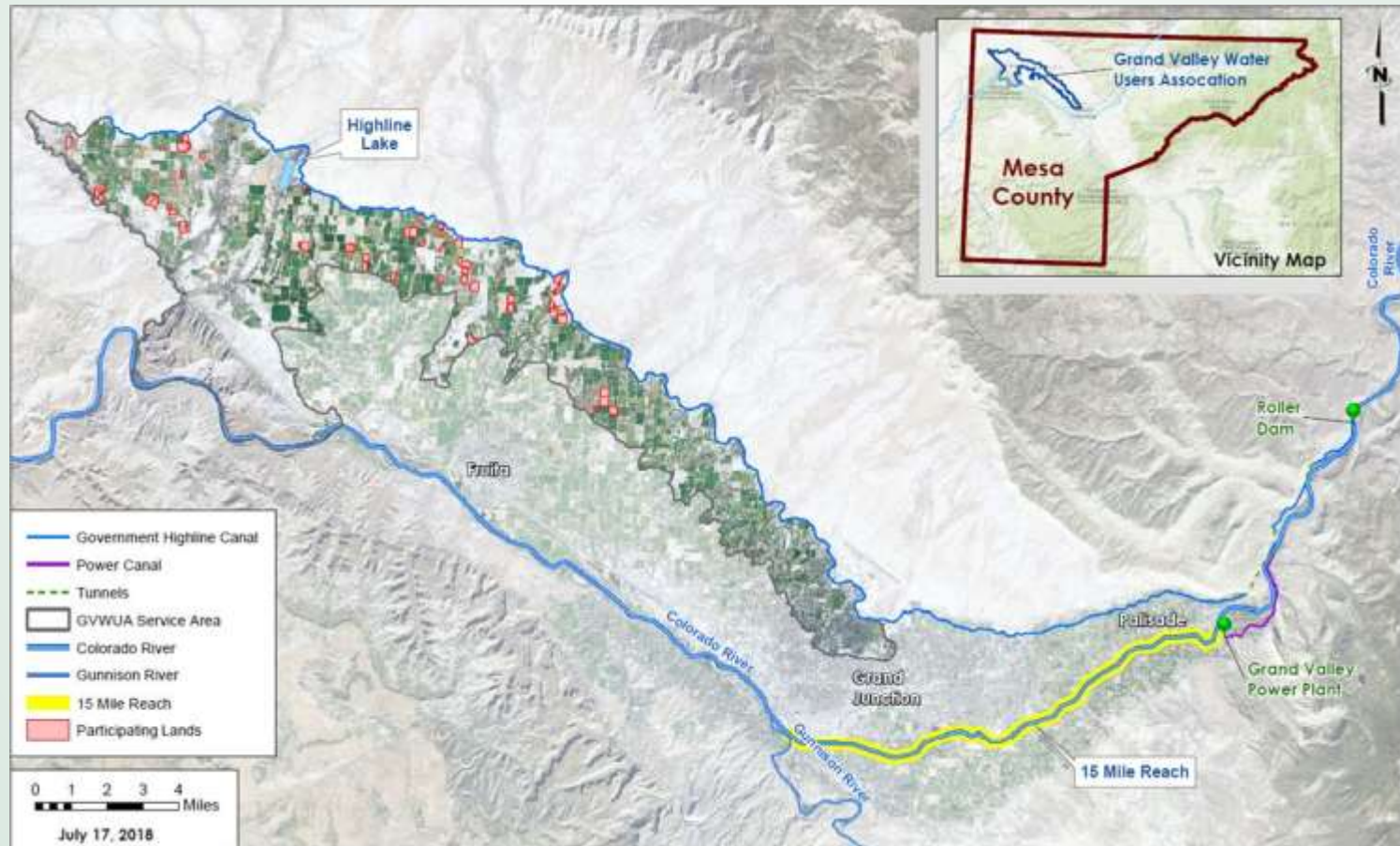
Voluntary, temporary, and compensated decisions must be made before we have all of the data necessary.

Municipal conservation has their own set of scientific and operational challenges. Let us not forget to focus on these challenges as well. They are of equal, if not more importance to a successful demand management program.



Scientific Challenges for Demand Management Programs

- Multiple parties must accept the assumptions appurtenant to the transaction
- Transaction costs will be prohibitive without accepted and agreed upon methodology



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THANK YOU

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