Nebraska Agricultural Water Management Demonstration Network

INTEGRATING RESEARCH AND EXTENSION

By

Gary Zoubek

UNL Extension Educator

UPPER BIG BLUE NRD
Dedicated to Conservation
105 North Lincoln Avenue, York Nebraska 68467 (402) 362-6601

NRCS Natural Resources Conservation Service

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People Involved

- Suat Irmak –Irrigation Specialist
- Rodney DeBuhr – Upper Big Blue NRD
- Dan P. Leininger –Upper Big Blue NRD
- Jennifer Rees – UNL Extension Educator
- Jim Schneider – UNL Extension Educator
- Brandy VanDeWalle – UNL Extension Educator
- Gary Zoubek – UNL Extension Educator
- 40+ Producers & Crop Consultants

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SITUATION

- Nebraska has over 8.2 million acres of irrigated land that's vital to the state's economy.
- Growers are challenged to conserve water and increase crop water use efficiency while still meeting the crops' water requirements for maximum return.

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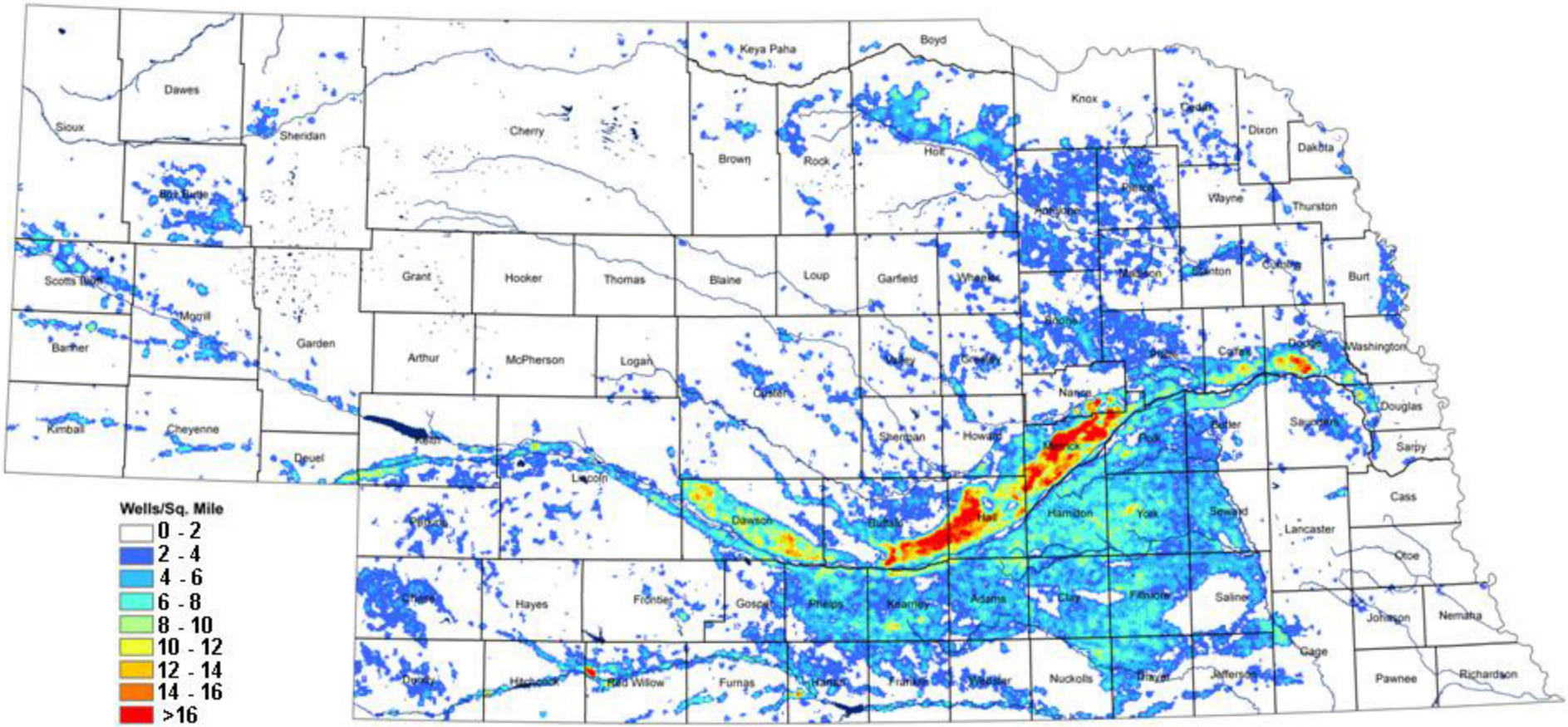
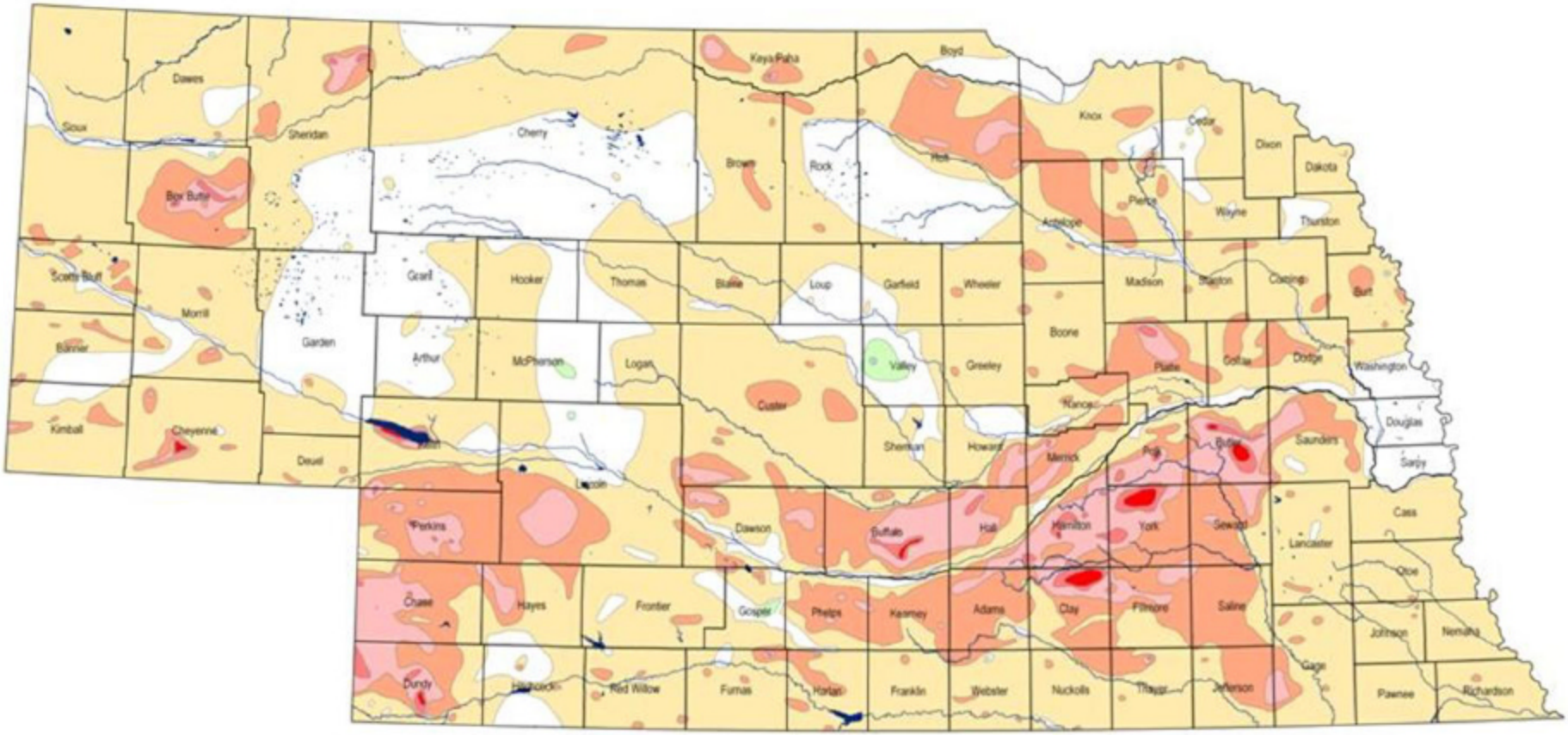
Density of Registered Irrigation Wells in Nebraska
August 2005



Source: Nebraska Department of Natural Resources

Groundwater-Level Changes in Nebraska – Spring 2000 to Spring 2005



Rise in Feet

- 1.00 to 4.99
- > 5.00

Decline in Feet

- -1.00 to -4.99
- -5.00 to -9.99
- -10.00 to -14.99
- -15.00 to 19.99
- >-20.00

- <+/- 1.00 foot change or no data
- Surface Water

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Water the lifeblood of agriculture!

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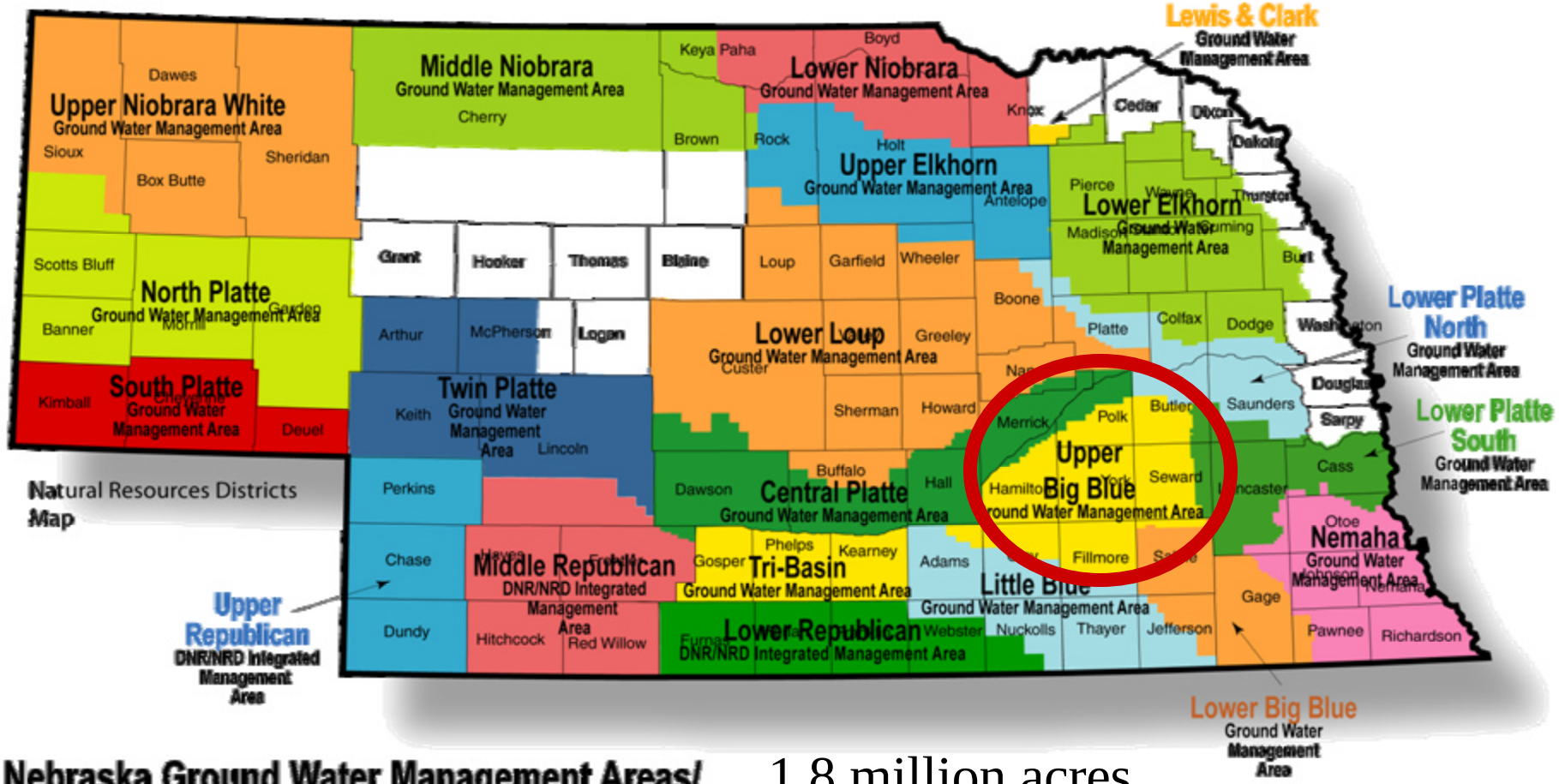
The NAWMDN was formed by UNL Extension in partnership with the Upper Big Blue NRD in early 2005.



1.8 million acres

1.1 million irrigated acres

OBJECTIVES

- With over 13,000 irrigation wells in the Upper Big Blue NRD, saving 1” of irrigation water per acre would result in 27.1 billion gallons of water and $6 million savings in energy costs.

- Our interdisciplinary work group hopes to improve the understanding and implementation of several different new technologies for the measurement of soil water status and crop water use in Nebraska.

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NAWMDN Goals

- Work closely with clientele to transfer high quality research information on soil water status and crop water use measurements to Nebraskans through a series of demonstration projects established in growers' fields.

- Foster adoption of newer irrigation water management technologies to help growers increase water use efficiency, save water, reduce energy consumption, and protect the environment.

- Provide *on-site* reference and crop evapotranspiration information for more accurate *in-season* water management.

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Initial Efforts

- In early 2005, we collaborated with 18 growers and established demonstrations in each of their fields in South Central Nebraska.

- Each demonstration site consisted of a set of Watermark Sensors and an ETgage.

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2006 Efforts

Efforts were made to get more producers & consultants involved.

- A cost share up to 50% or $300 towards the purchase of ETgages ($180.00), Watermark sensors ($24.00), and hand-held meters ($219.00) was provided by the NRD.
- Cooperating producers and consultants read & maintained the devices/sensors on a weekly basis, recorded rainfall and irrigation events, & report the data to the UBBNRD/Extension.
- Educational meetings, Field Days & Demonstrations were held.
- Over >50 people were involved in 2006.

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Why is Irrigation Management Important?

- Energy savings
- Environmental impacts
- Limited water supply-water allocations
- Higher crop water use efficiency
- $$$$

Would you run equipment without working gauges?

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Irrigation scheduling is applying the right amount of water at the right time.

Growers irrigate using one of several criteria:

- Intuition
- The Neighbor
- Calendar/days since last rainfall or irrigation
- Crop Evapotranspiration
- Soil Water
- Other

Measurements of crop ET and or soil water can provide objective criteria for irrigation management.

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New Technologies?

25-50%

50-100%

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Two Tools Used!

- Atmometer (ETgage)
- Watermark Sensors

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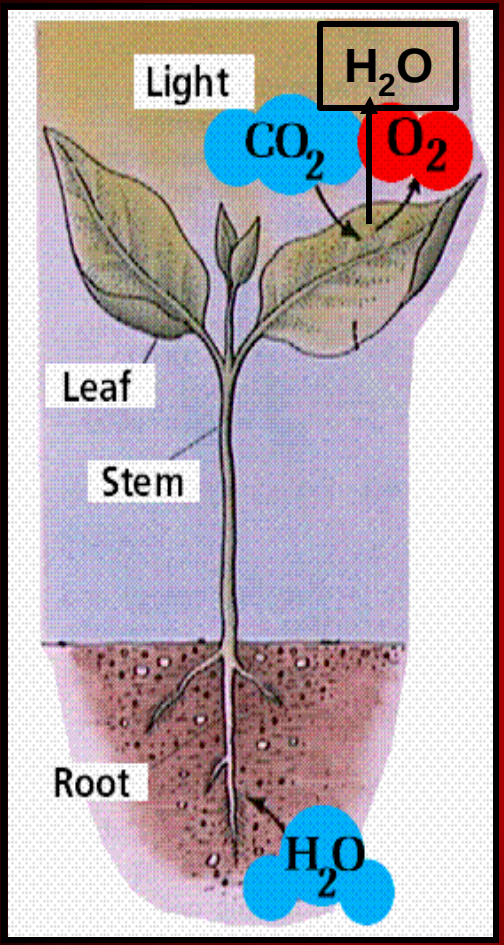
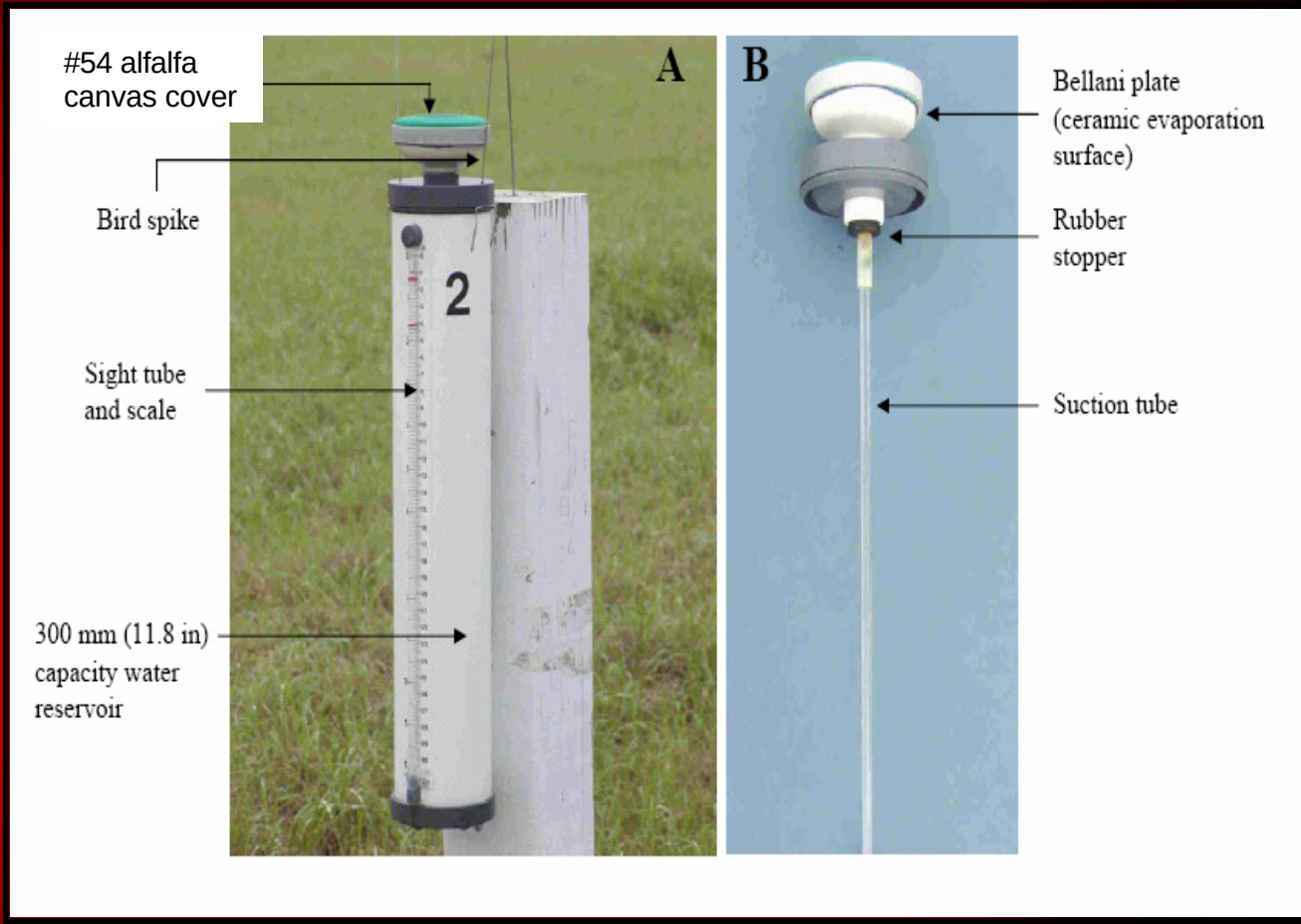
Atmometer (ETgage)





Source: http://www.emc.maricopa.edu/faculty/farabee/biobk/BioBookPLANTANAT.html

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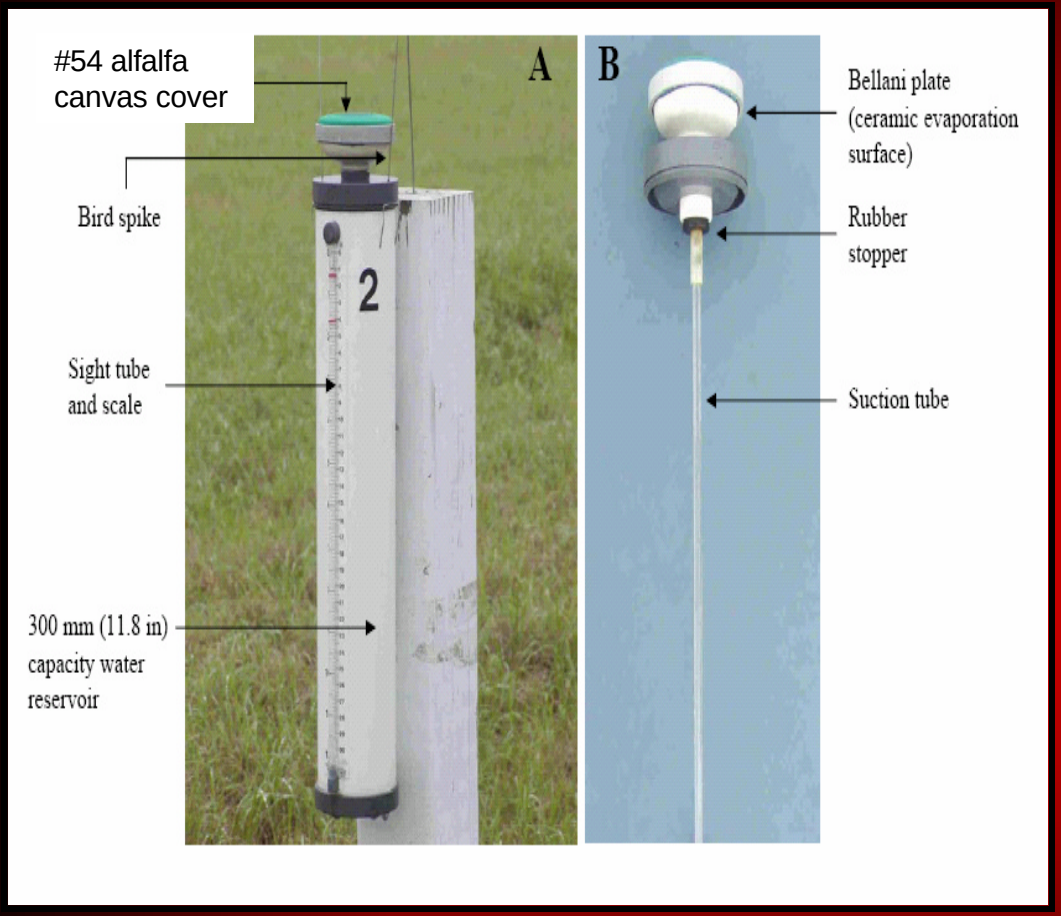

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Crop Water Use = ETr x Kc

From ETgage

From ETgage NebGuide

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Crop coefficient (Kc)

Table I. Alfalfa-based crop coefficients (Kc) at the beginning of each growth stage for corn, soybean, and wheat (High Plains Regional Climate Center, 2005).

Corn		*Soybean*		*Wheat*	
Growth Stage	*Kc*	*Growth Stage*	*Kc*	*Growth Stage*	*Kc*
2 leaves	0.10	Cotyledon	0.10	Emergence	0.10
4 leaves	0.18	First Node	0.20	Visible Crown	0.50
6 leaves	0.35	Second Node	0.40	Leaf Elongation	0.90
8 leaves	0.51	Third Node	0.60	Jointing	1.03
10 leaves	0.69	Beginning Bloom	0.90	Boot	1.10
12 leaves	0.88	Full Bloom	1.00	Heading	1.10
14 leaves	1.01	Beginning Pod	1.10	Flowering	1.10
16 leaves	1.10	Full Pod	1.10	Grain Fill	1.10
Silking	1.10	Beginning Seed	1.10	Stiff Doug	1.00
Blister	1.10	Full Seed	1.10	Ripening	0.50
Dough	1.10	Beginning Maturity	0.90	Mature	0.10
Beginning dent	1.10	Full Maturity	0.20		
Full dent	0.98	Mature	0.10		
Black layer	0.60				
Full maturity	0.10				

From NebGuide

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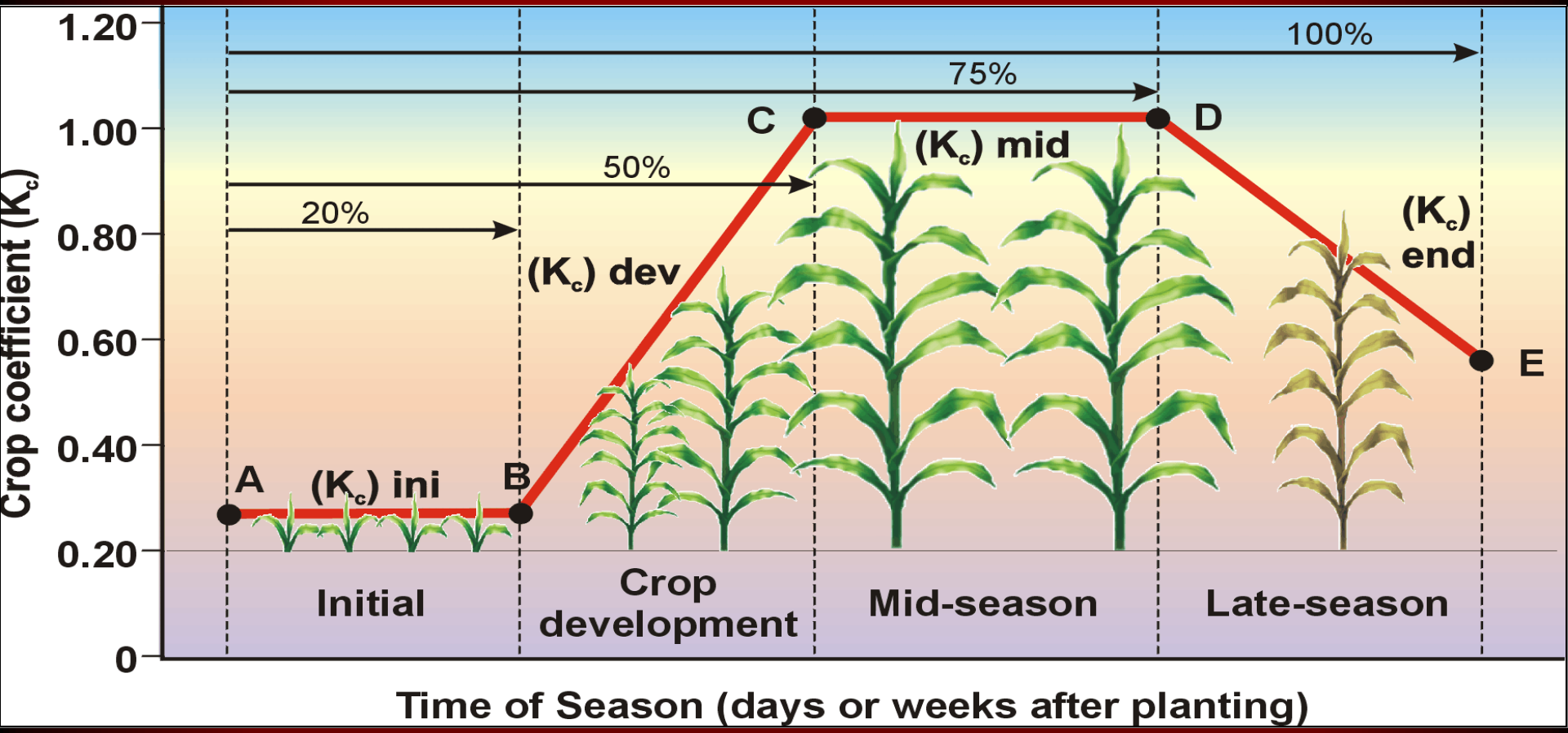
Crop coefficient Kc



Irmak, S. (2006)

Example

Corn at the 12-leaf growth stage
the water level in the ETG (with a No. 54 canvas cover) sight tube decreased 1.30 inches during the 7-day period since the last irrigation.

ETr = 1.30 inches (evaporation from the ETG)

Kc = 0.88 (from *Table I* for the 12-leaf stage)

ETc = ETr x Kc ETc = 1.30 inches x 0.88 = **1.1** inches

Solution Days Site ET readings

Date	Weekly ET	Crop Stage	Factor	Crop ET
6/12/06	2.3	V6	.35	.81
6/19/06	1.75	V8	.51	.89
6/26/06	1.75	V10	.69	1.21
7/3/06	2.00	V12	.88	1.76
7/10/06	1.50	V14	1.01	1.51
7/17/06	1.63	V16	1.10	1.79
7/24/06	1.65	R1	1.10	1.82
7/31/06	1.90	R1	1.10	2.09
8/7/06	1.70	Blister	1.10	1.87
8/14/06	0.95	Milk	1.10	1.05
8/21/06	1.10		1.10	1.21
8/28/06	1.15	B. Dent	1.10	1.27
9/4/06	1.10		1.10	1.21
Total	**20.48**		**Total**	**18.49**

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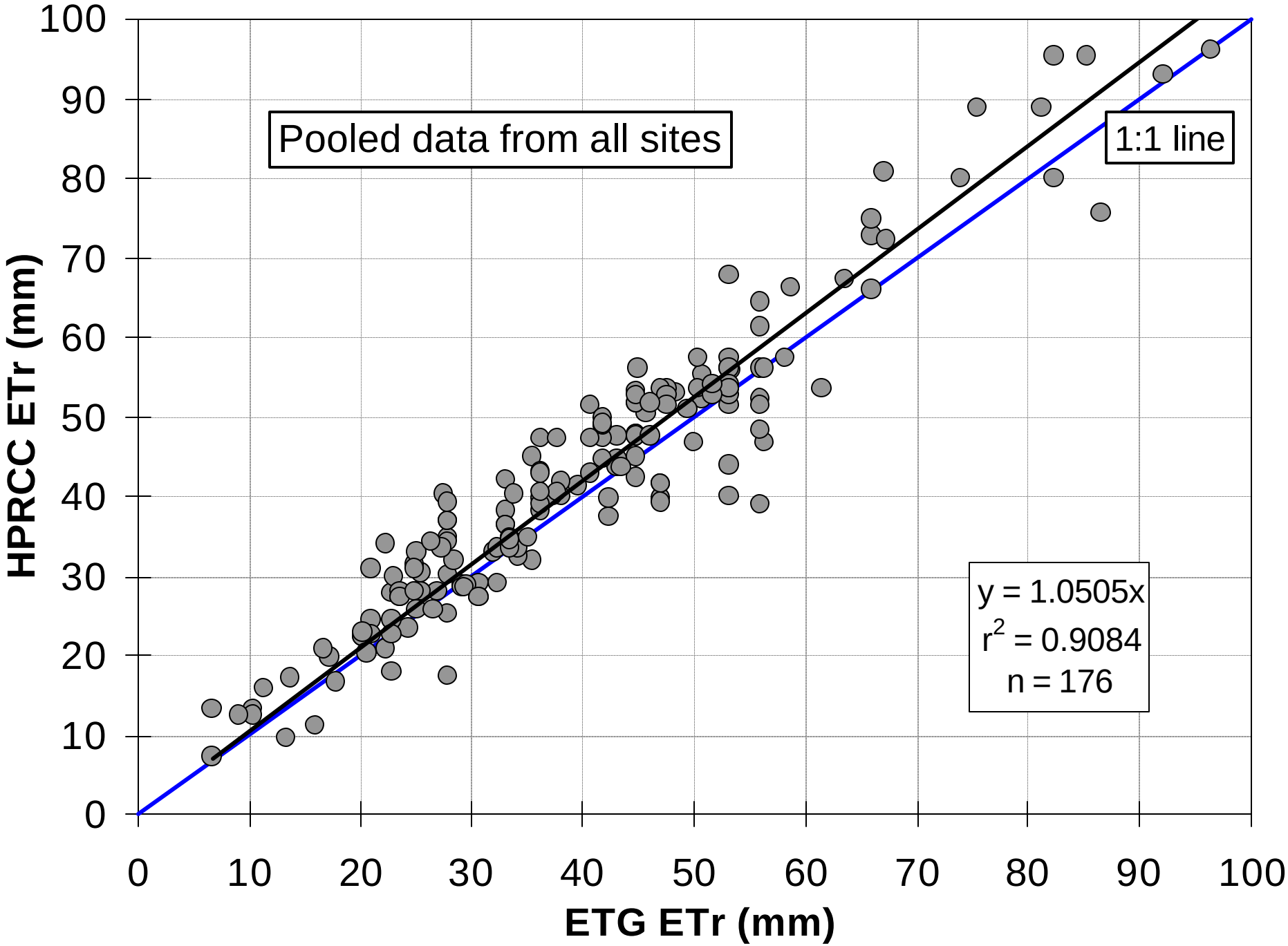
Pooled data from all sites
1:1 line
y = 1.0505x
r2 = 0.9084
n = 176
HPRCC ETr (mm)
ETG ETr (mm)
0
10
20
30
40
50
60
70
80
90
100

Upper Big Blue Natural Resources District Web Site - Microsoft Internet Explorer

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DOWNLOAD 2006 ZONE 5 AND 6 REPORT FORM that can be submitted to the NRD via email. You must have Microsoft Excel or Word. To print out a 2006 Zone 5 and 6 report form use the Printable AdobePDF Forms to the right.

CLICK HERE FOR LATEST INFO ON TREES. Order trees early this year. Click here for a printable Tree Order Form. For more information about the NRDs tree planting programs go to Forestry and Wildlife. View tree photos and info at NRD Trees

CROP-TIP demo field shows big savings. Results from the first year of the NRD / Cornerstone Bank demonstration field shows how farmers can save water, nitrogen and MONEY with good management.. For details click on CROP-TIP INFO.

The Upper Big Blue Natural Resources District Programs Book contains information about the current NRD programs and activities.

WANTED: Several weather watchers in Nebraska. Are you willing to record precipitation using a free rain gauge, provided by your local NRD. For more information click the icon to the left.

FLOW METER COST-SHARE PROGRAM. The Nebraska Environmental Trust has awarded the District $350,000 for 2006-07 for a new water conservation improvement program. Most of this money is available for cost-share to irrigators. For details and an

2006 GROUND WATER LEVEL CHANGE - The Spring 2006 ground water level measurements showed a 0.87 ft. decline from the spring of 2005. You may click here **(2006 Ground Water Level Change)** for more information.

Click here for daily crop water use (updated weekly). A summary of 2002, 2003, 2004 and 2005 Crop Water Use Data is also provided to help producers with their NC-17 annual irrigation reports.

WILD NEBRASKA - is the new wildlife habitat incentive program. If you own land you could get paid to improve your land for wildlife.

The Upper Big Blue Natural Resources District offers a $500 scholarship, the Raymond A. Burke Scholarship. Click the ICON for more information and a printable application.

The Upper Big Blue River Archers is a club that uses the archery range to the West of Recharge Lake. The 14+ acre outdoor range is open to the public with over 25 covered bail targets, elevated platforms, and a variety of realistic shooting situations. Contact the club by clicking on the bow & arrow icon to the left.

Printable AdobePDF Forms

Tree Order Form
Well Permit Application
Well Abandonment Cost-Share Application

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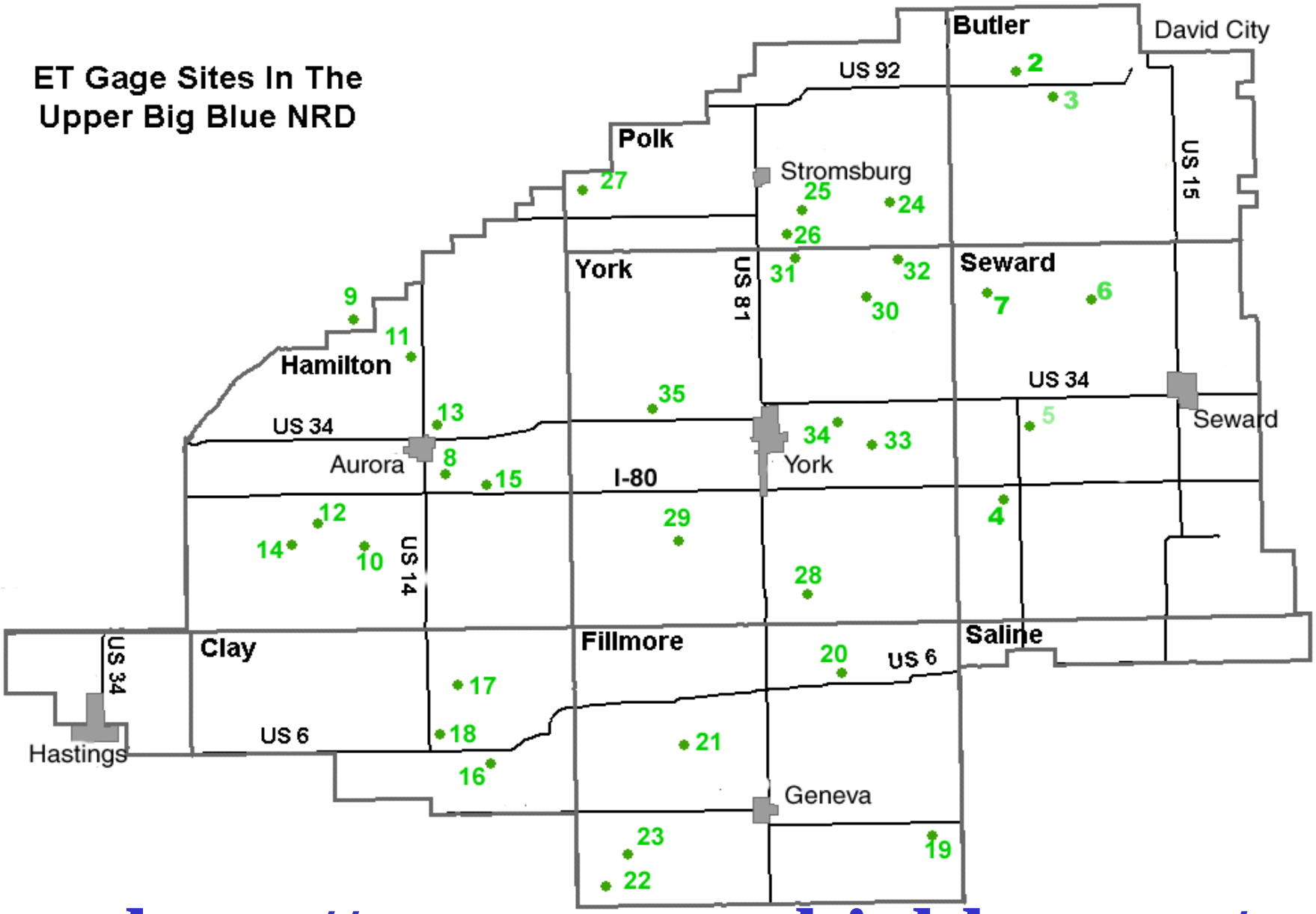
Nebraska Water Management Demonstration Network



http://www.upperbigblue.org/

Upper Big Blue Natural Resources District Web Site - Microsoft Internet Explorer
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Site #34
2006 Nebraska Water Management Demonstration Network ET Gage Data
Jerry Stahr - Section 35-T11N-R2W, York County

Date Read	5/16/06	5/23/06	5/29/06	6/5/06	6/12/06	6/19/06	6/26/06	7/3/06	7/10/06	7/17/06	7/24/06	8/7/06
ET Gage Change for period	date	1.90	2.00	2.00	2.10	1.75	**2.00**	**1.75**	1.12	2.00	1.75	1.25
Average Daily Water Use for Period	started	0.27	0.33	0.29	0.30	0.25	0.29	0.25	0.16	0.29	0.25	0.09
Corn Emerged 4/20												
Growth Stage		V6	V8	V10	V12	V16	V16	R1	R1	BLISTER	BLISTER	DENT
Crop ET Factor		0.35	0.51	0.69	0.88	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Water use for period		0.67	1.02	1.38	1.85	1.93	2.20	1.93	1.23	2.20	1.93	1.38
Corn Emerged 5/1												
Growth Stage		V4	V6	V8	V12	V14	V16	V16	R1	BLISTER	BLISTER	DOUGH
Crop ET Factor		0.18	0.35	0.51	0.88	1.01	1.10	1.10	1.10	1.10	1.10	1.10
Water use for period		0.34	0.70	1.02	1.85	1.77	2.20	1.93	1.23	2.20	1.93	1.38
Corn Emerged 5/10												
Growth Stage		V2	V4	V8	V10	V12	V14	V16	R1	R1	BLISTER	DOUGH
Crop ET Factor		0.10	0.18	0.51	0.69	0.88	1.01	1.10	1.10	1.10	1.10	1.10
Water use for period		0.19	0.36	1.02	1.45	1.54	2.02	1.93	1.23	2.20	1.93	1.38
Corn Emerged 5/20												
Growth Stage		V2	V2	V6	V8	V10	V12	V16	V16	R1	R1	DOUGH
Crop ET Factor		0.10	0.10	0.35	0.51	0.69	0.88	1.10	1.10	1.10	1.10	1.10

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Watermark Sensors

Hand-held meter

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Relationship between plant available water and Watermark readings for various soils from EC783.

Soil matric potential (kPa)	Soil type, depletion in inches per foot associated with a given soil matric potential value measured by the Watermark sensors, and available water holding capacity for different soil types							
	Silty clay loam topsoil, Silty clay subsoil (Sharpsburg)	Silt-loam topsoil, Clay loam subsoil (Keith)	Upland silt loam topsoil, Silty clay loam subsoil (Hastings, Crete, Holdrege)	Bottom land silt-loam (Wabash, Hall)	Fine sandy loam	Sandy loam	Loamy sand (O'Neill)	Fine sand (Valentine)
0	0	0	0	0	0	0	0	0
20	0	0	0	0	0.20	0.30	0.30	0.30
33	0.20	0.14	0	0	0.55	0.50	0.45	0.55
50	0.45	0.36	0.32	0.30	0.80	0.70	0.60	0.70
60	0.50	0.40	0.47	0.44	1.0	0.80	0.70	0.70
70	0.60	0.50	0.59	0.50	1.10	0.80	0.80	0.80
80	0.65	0.55	0.70	0.60	1.20	1.00	0.93	1.00
90	0.70	0.60	0.78	0.70	1.40	1.20	1.04	-
100	0.80	0.68	0.85	0.80	1.60	1.40	1.10	-
150	0.90	0.86	1.08	1.20	-	-	-	-
200	1.00	0.95	1.20	1.20	-	-	-	-
Available water capacity (in/ft)	1.8-2.0	1.8-2.0	2.2	2.0	1.8	1.4	1.1	1.0

Table I. Depletion (in/ft) in available soil water versus soil matric potential for different soil textures.

Water Calculator

Microsoft Excel

B4 =(102+108)/2

WaterCalculator

Sensor Depth (ft)	Watermark reading (kPa)	Plant available water (in)	Hastings silt-loam % Depletion per 3ft (1.1 in/ft plant available water)
1	105	0.22	
2	84	0.37	
3	98	0.27	
	SUM	0.9	74.1
4	59	0.64	

http://york.unl.edu/watercalculator.htm

Example Watermark Readings

Date	1”	2’	3’	4’	Available Remaining	% Depleted
6/19/06	53	105	26	41	2.1	18 %
6/26/06	70	115	31	22	1.8	23 %
7/3/06	94	131	47	56	1.2	32 %
7/10/06	103	126	57	74	1.0	35 %
7/17/06	91	78	68	81	1.3	30 %
7/24/06	81	34	55	77	2.2	17 %
7/31/06	104	124	78	91	.8	38 %
8/7/06	14	16	6	12	3.3	0 %
8/14/06	44	88	73	93	1.7	24 %
8/28/06	64	44	35	105	2.5	12 %
9/4/06	89	75	45	101	1.6	26 %

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Initial Evaluation
(75% of surveys returned)

- Nearly 60,000 irrigated acres
  - 20,815 producers & 39,500 consultants!
- Producers averaged 867 irrigated acres.
- Average estimated irrigation amounts
  - 8.8”/acre corn (1.7” savings)
  - 7.2”/acre soybeans (1.7” savings)

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What did you like best about the program?

- Using the technology to check myself.
- The introduction and cost share of these new technologies. I also liked the follow up support available.
- ET gauge provided local info to schedule irrigation.
- I liked the training and also that the NRD and Extension were involved together.
- Informational meetings provided to help understand correct use of equipment.

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What overall impact has the NAWMDN had on you?

- I've learned from it! Confident that this technology is helpful.
- More focused on reducing water use to grow crops.
- Makes you more aware of the need to schedule irrigation based upon facts vs. a gut feel to irrigate.
- It has made me feel confident in the decisions I make regarding when to irrigate.

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Impact

- Growers are gaining confidence in these tools.

- They've reported 0 - 3.5 inches of irrigation water savings.

- More growers & crop consultants will join the network in this year!

- The network is expanding into other parts of the state.

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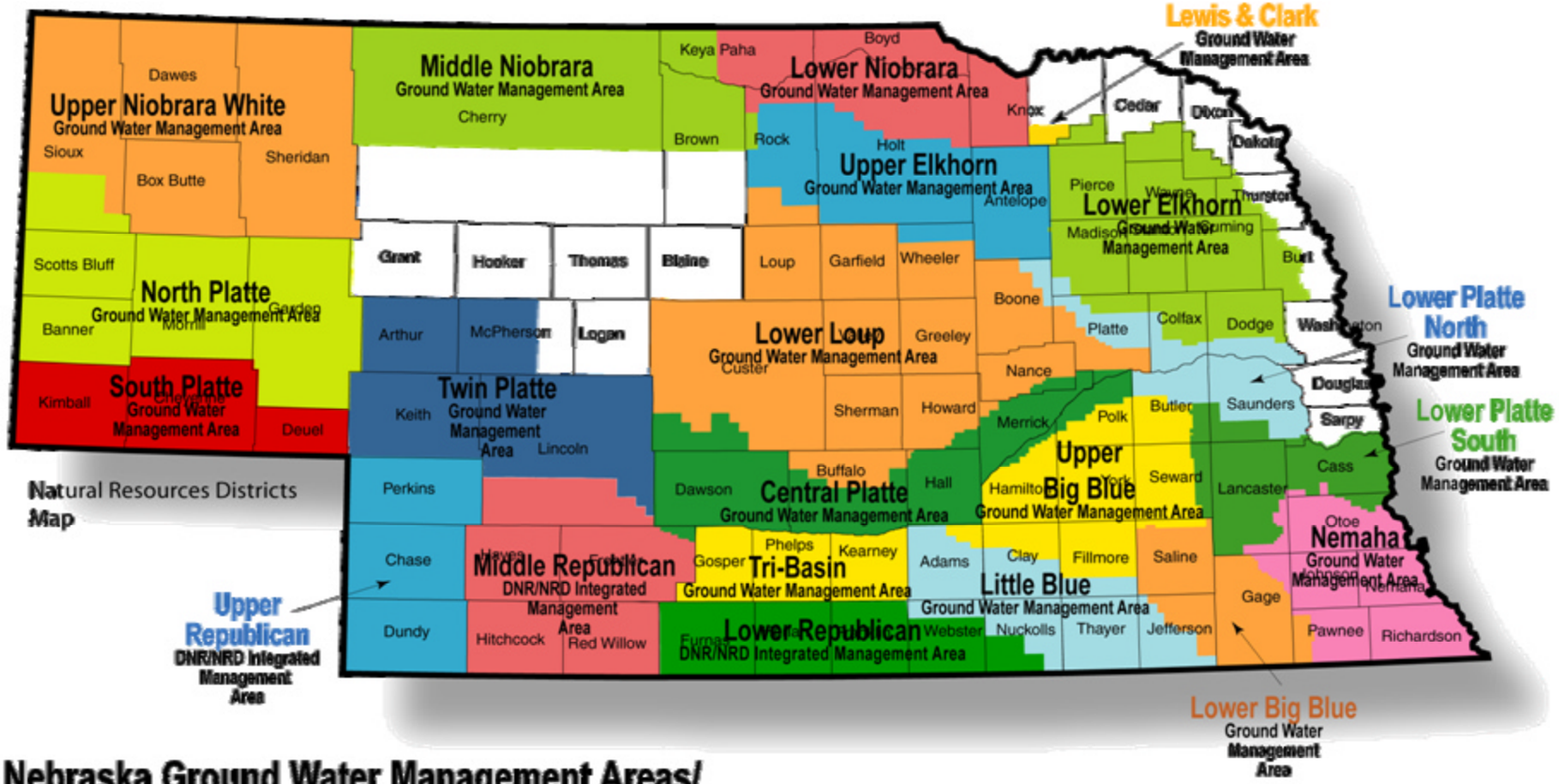
Plans are to expand the NAWMDN in 2007



Nebraska Ground Water Management Areas/ DNR/NRD Integrated Management Areas

Graphic by
Nebraska Department of Natural Resources-October 2006

Questions?

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