

Engineering of Pressurized Irrigation Systems: Accurately **Applying Water** When and Where It Is Needed

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Applying Water
When and Where It Is Needed

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Plan To

- Discuss development from surface to pressurized irrigation
- Describe irrigation development using pressurized irrigation and center pivots in Nebraska
- Discuss emerging technology for controlling center pivots
- Philosophize a bit and summarize



Surface/Gravity Irrigation

- Difficult to place water accurately, when, and where it is needed
- In typical sloping field, water is over applied at the upper end, and/or under applied at the lower end





Improved Surface Irrigation

- Better methods and management have improved efficiency of surface irrigation
 - Siphon tubes
 - Gated pipe
 - Level basin

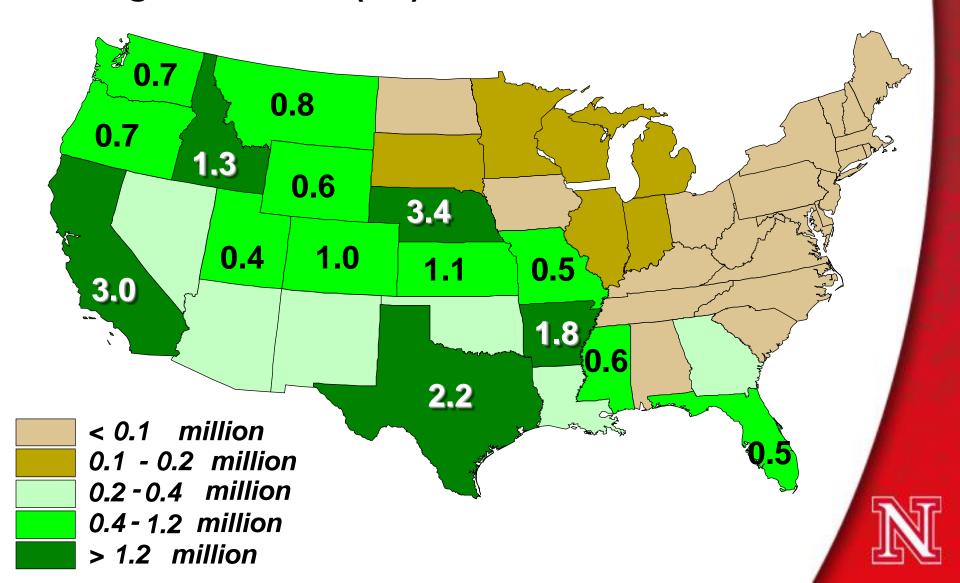






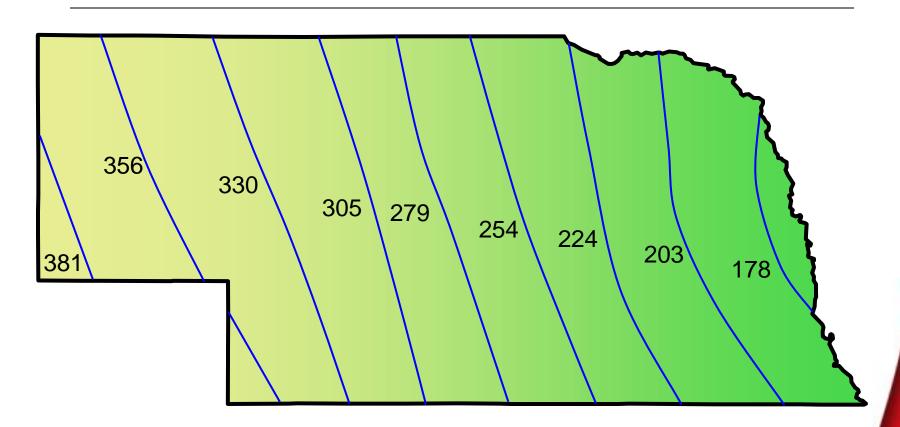


Irrigated Area (ha)

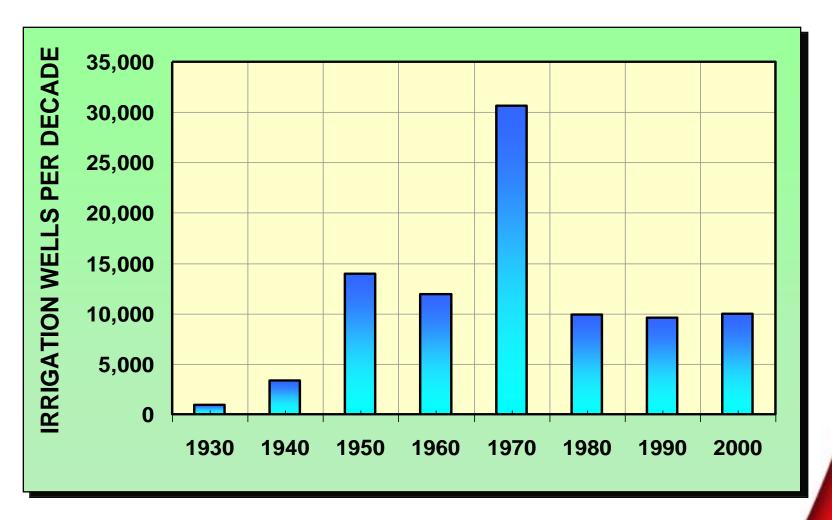


Net Irrigation Requirement (mm) for Corn on Silt Loam Soil

Based on simulation for 1951 - 2004



Irrigation Development in Nebraska





Use of Pressurized Irrigation

- Sprinkler irrigation in Nebraska
 - − 1970: ~20%
 - -2012:>70%

"Pressurized irrigation allowed us to take control of the application rate." Elias Fereres



Use of Pressurized Irrigation

- Sprinkler irrigation in Nebraska
 - − 1970: ~20%
 - -2012:>70%
- Two primary reasons
 - Development of the center pivot
 - High Plains/Ogallala Aquifer



1950s

• First center pivot was built – in Nebraska





1970s

 Reduced labor and better distribution of water – if managed correctly– led to widespread adoption





Center Pivot Manufacturers

• Four major U.S. manufacturers are in Nebraska



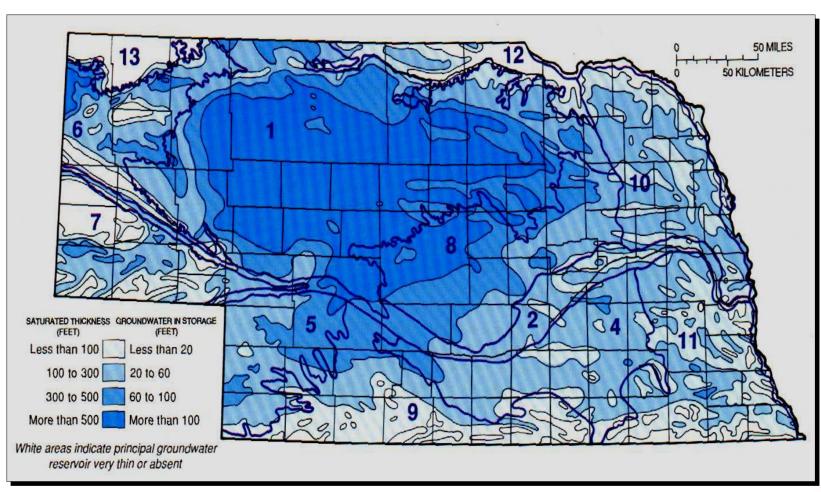






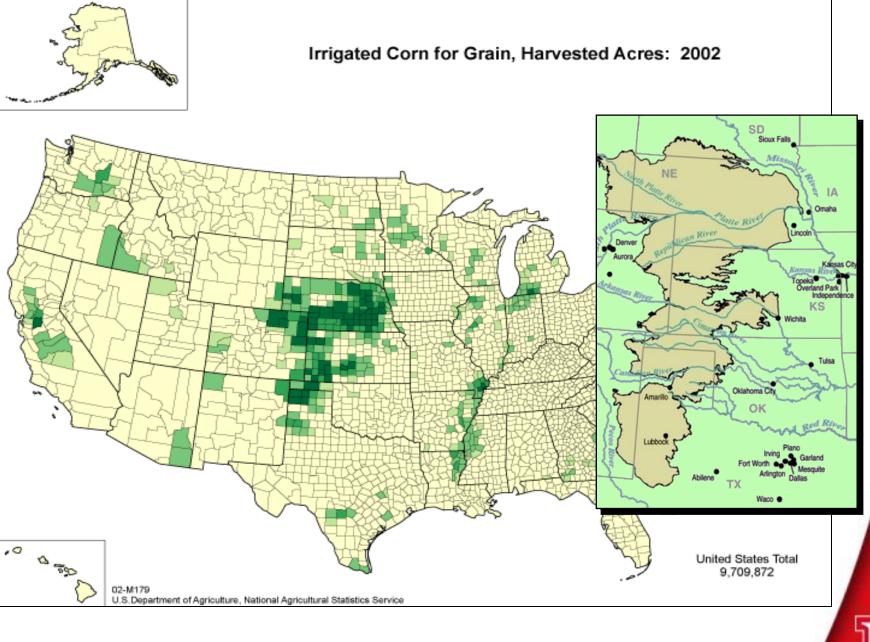


High Plains Aquifer

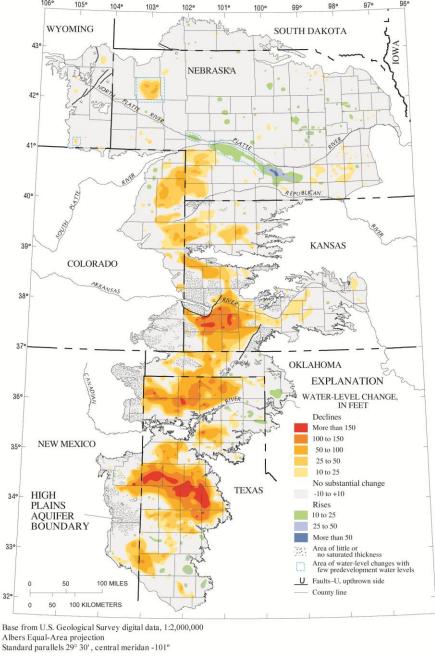


Nebraska Conservation and Survey Division







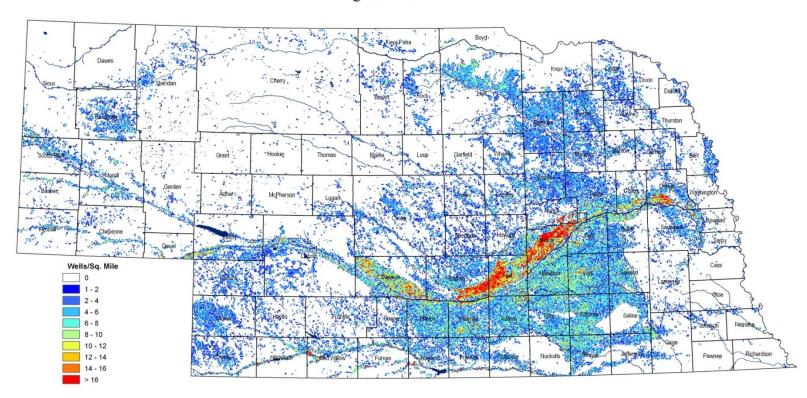


Standard parallels 29° 30', central meridan -101°

Figure 1. Water-level changes in the High Plains aquifer, predevelopment to 2007 (modified from Gutentag and others, 1984; Lowry and others, 1967; Luckey and others, 1981; and Burbach, 2007).



Density of Registered Irrigation Wells in Nebraska August 2007





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CONSERVATION AND SURVEY DIVISION (http://csd.unl.edu) School of Natural Resources (http://snr.unl.edu) Institute of Agriculture and Natural Resources/College of Arts and Sciences University of Nebraska-Lincoln

Mark Burbach, Water Levels Coordinator, CSD



Technology for Managing Center Pivots



Information Courtesy of:







Control Panels







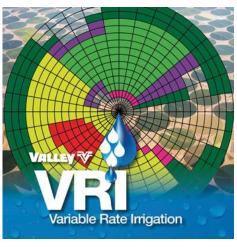
Controlling the Irrigation System



Manage More Acres



Instant Notifications



Variable Rate Irrigation



Decreased Down Time



Improved End Gun Control

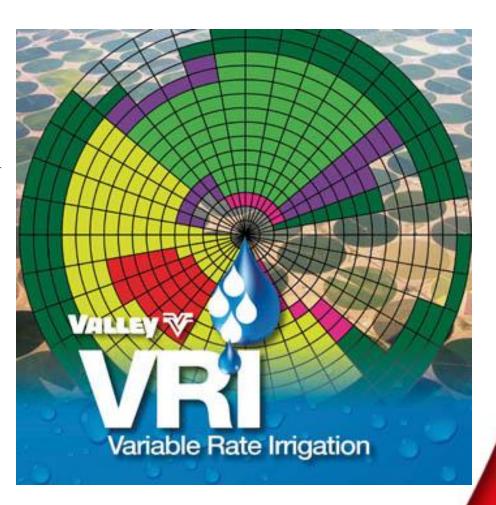


Variable Rate Applications

- Different crops or growth stage
- Soil variability

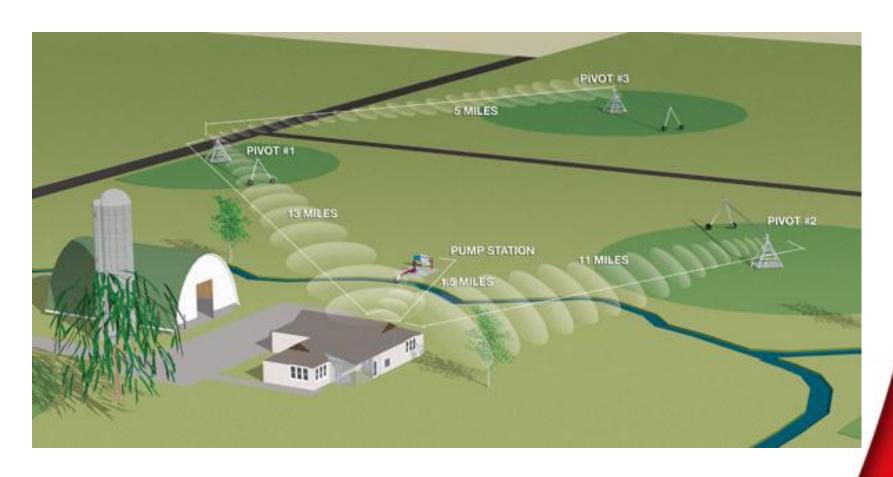
"... just because you can doesn't mean you should."

Steven Raine





Controls





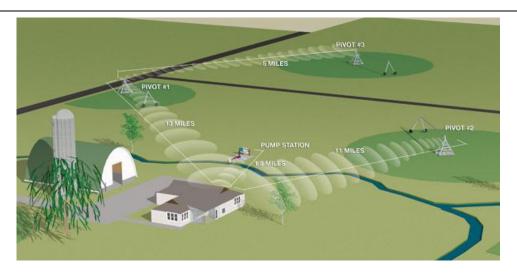
Controls

- Turn Pivot On/Off
- Check Voltage
- Monitor/Change Direction
- Pivot Diagnostics
- Precise End Gun Control
- Turn Water On/Off
- Program Run Ability
- Field Position Sensor
- Percent Timer Status
- Start/Stop Pivot





Controls



- Reliable, private radio telemetry offers real time data
- Soil moisture data received from Watermark® soil moisture sensors
- Receive alarm messages by cell phone, text message, or email
- Control pivots, check status, monitor and control pumps, valves and other devices
- Generate reports to support your farm management
- Turn your pivots off or on.
- Control your end guns.
- Switch direction of your pivot.
- Change pivot speed.
- Change water depth.







FARMCO

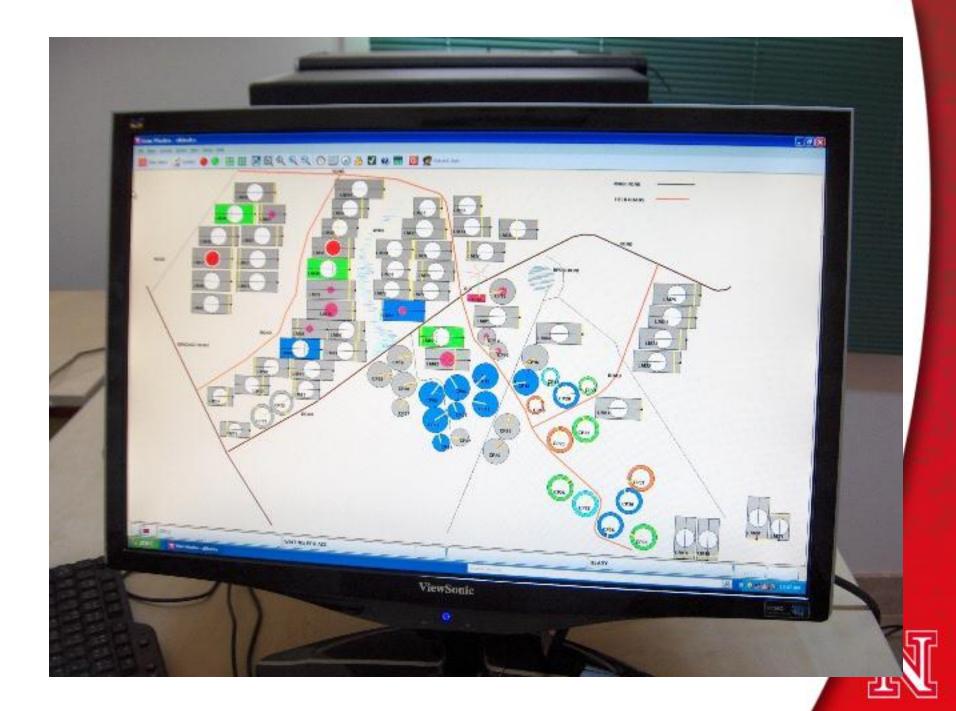
- 9000 ha, irrigated wheat, maize, alfalfa
- 51 linear move systems
- 33 center pivots
- Partnership
 - Valmont Industries
 - CNH
 - Great Man Made River Authority

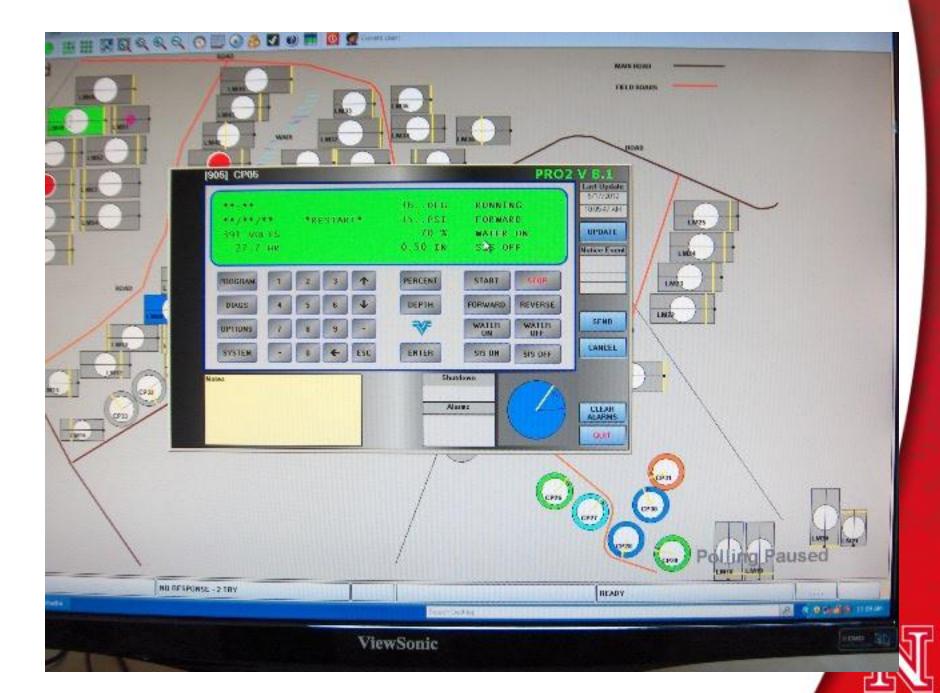














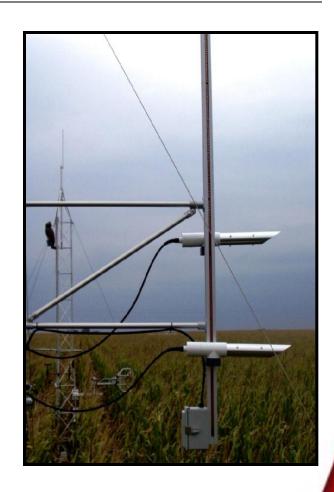
Latest Development





Utilizing the Technology

- Accuracy and timing are only part of the management
- Knowing amount to apply is equally important
 - Therefore being able to measure, estimate, and predict crop water use is critical





Summary

- Pressurized irrigation allows us to control the application rate (and placement) more accurately
- Technological advances (sensors and controls) allow us to automate much of the system, and to communicate better with it
- But to use water efficiently in irrigation requires
 - Good data
 - Good decision making









Obrigado!

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