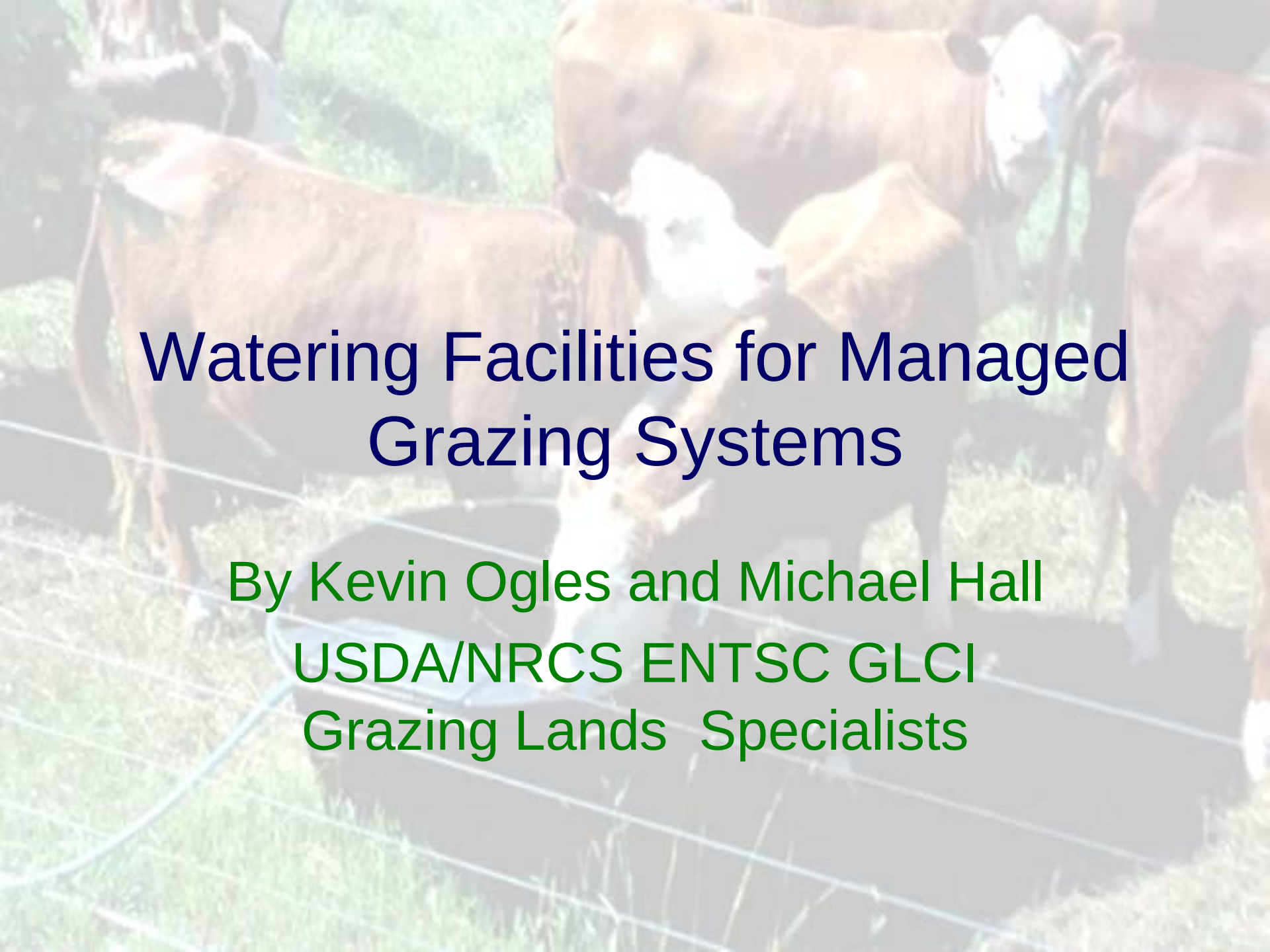


Watering Facilities for Managed Grazing Systems

By Kevin Ogles and Michael Hall

USDA/NRCS ENTSC GLCI
Grazing Lands Specialists

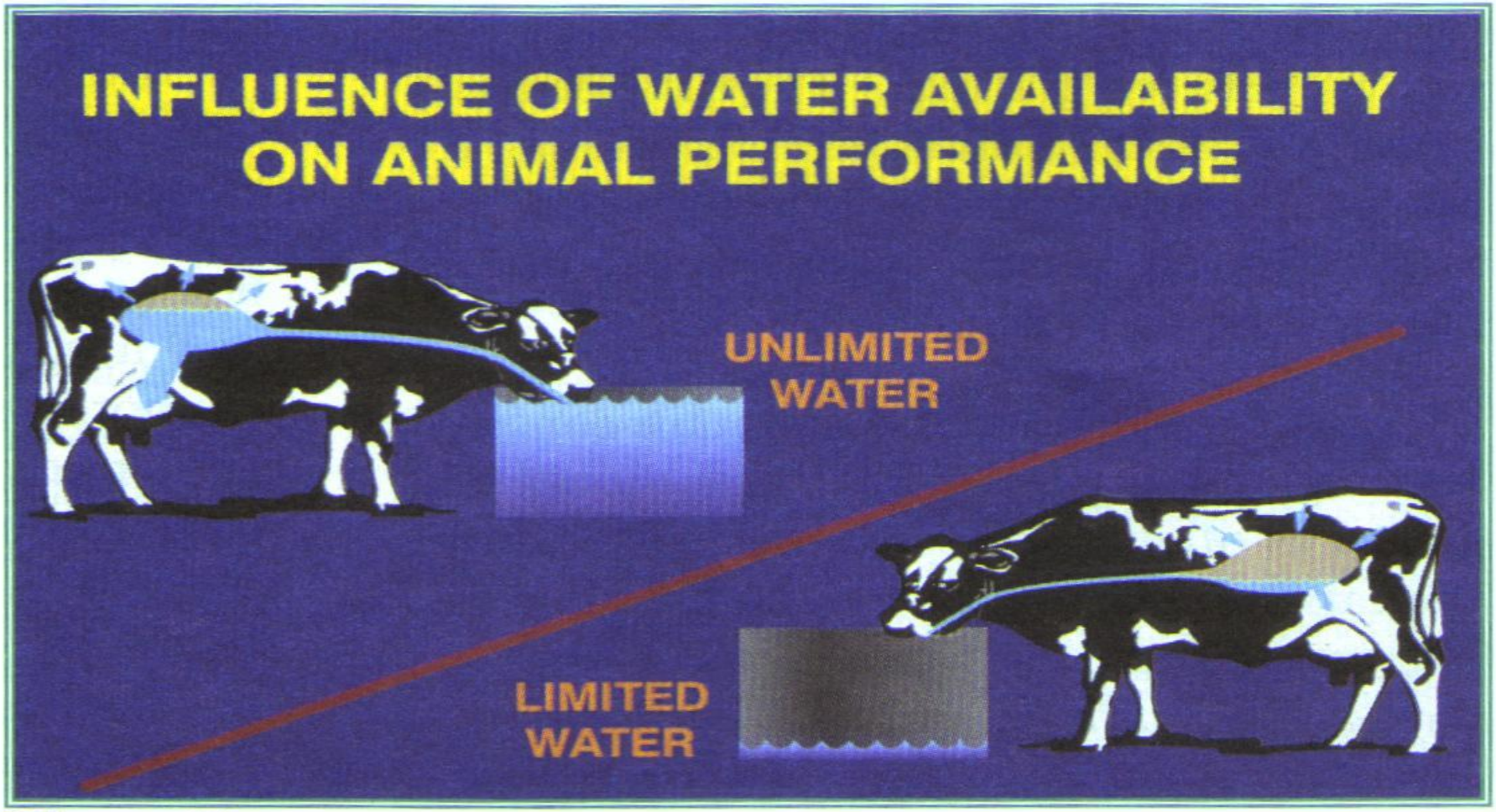


Figure 7 **When water is limited, milk production is also limited. When an animal consumes food, body fluids pass into the ruman to assist in the digestion process. If these fluids are not replaced, the net result is dehydration and a loss of milk production. When water is not limited, fluids pass out of the ruman to rehydrate the animal and for milk production.**

Watering Facilities for Managed Grazing Systems

- Determining Need
- Quality for the Animals
- Placement
- Tank Size and Shape Considerations
- Things to Avoid

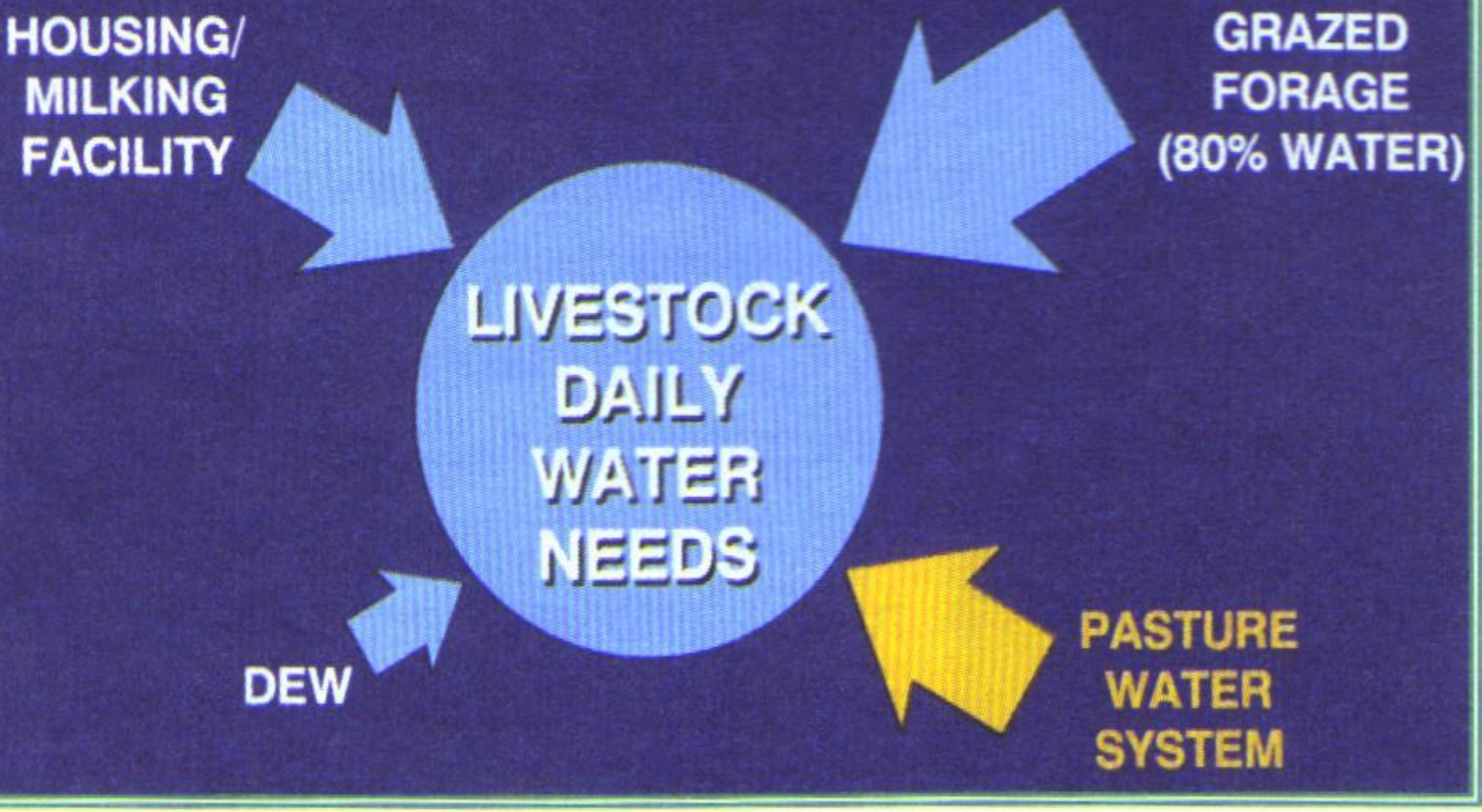
Livestock Watering Facts

- Very Few Scientific Trials with Results published on this
- Very Little Information on Any Livestock besides Cattle
- More Scientific Data on Dairy Than Beef
- Cattle - About 2/3 of their body is Water-Essential

Determining Need

1. How Much?
2. Under what climatic conditions?
3. How Fast?
4. Animal Behavior Impacts?

HOW MUCH WATER DO YOU NEED TO SUPPLY?



Determining Need

How Much?

Animal	Gallons water	Range
Dairy Cow	20	(15-25)
Beef Cow Pair	15	(12-20)
Yearling	10	(6-14)
Horse	10	(8-14)
Sheep	2	(2-3)

Water Intake from NRCS and Land Grant University Sources in U.S. Gallons Per Head Per 24 Hour Period

Livestock Type	NRCS Range and Pasture Handbook	NRCS MI and WI	NRCS OH, IN, IL	Virginia Tech	University of Vermont	Purdue University	University of Wisconsin	Ohio State University	1955 Yearbook of Agriculture (from studies in 40's and 50's)
Lactating Dairy	10-30	20	15	20-25	25	15-25	30	30	Jerseys 7.2-12.2 Holsteins7.8-21.8 80 lbs.+ 23
Growing Steers /Pregnant Heifers	6-18	15	12	8-12	20	12-20	8-10	8-10	Dry Dairy Cows - 10.8 4.2 - 8.4
Beef Cow/Calf Pair	6-18	15	12	8-12	20	12-20	8-10	8-10	4.2 -8.4
Horses - General	8-12	15	12	8-12	12	8-14	8	8	NA
Sheep - General	1-4	2	4	2-3	3	2-3	1	1	0.6 – 1.6, On good pasture almost none

Determining Need

- Under What Climatic Conditions?

Table 5.1 Daily water intake of dairy heifers under various temperature conditions.

Air temp. (degrees F)	lb water/ lb TDN	lb TDN/ day	gal water/ day
35	4.7	10.3	5.8
50	5.2	9.2	5.7
70	7.2	9.2	7.9
80	9.0	8.8	9.5
90	22.2	6.6	17.6
95	24.8	6.4	19.0

Thermoneutral Zone of Cattle

- TNZ is when cattle are comfortable when certain weather conditions are ideal for their bodies to function and grow with the least amount of inhibitors.

- Conflicting U.S. Information
- Beef Cattle data shows both
- 45°F to 74°F and 20°F to 70°F
- For Dairy Cattle
- 41°+F to 68°F
- Sheep ?
- Horses?

U.S. and Canada Studies on Temperature Effect on Water Intake In U.S. Gallons Note: Wt. of Cattle Unknown and Relative Humidity is Unknown

	At Daytime High to Next Temp. Break	40.2 °F	50.4 °F	58.3 °F	70.3 °F	80.2 °F	90.3 °F, CN dept of ag. got these at 81°F	≥ 88 °F or HOT hot" not defined on VT website"
Canada Dept. of Ag.	Beef Pregnant Heifers							
Canada Dept. of Ag.	Beef Cows at Peak Lactation		**10.0**	**10.1**	**11.6**	**12.4**	**15.6**	
Alberta (province) Dept. of Ag.	Beef Pregnant Heifers	**6.0**	**6.5**	**7.4**	**8.7**	**8.7**	**8.7**	
Alberta (province) Dept. of Ag.	Beef Cows at Peak Lactation	**11.3**	**12.6**	**14.5**	**16.9**	**17.9**	**16.2**	
Iowa State Virginia Tech	Beef Pregnant Heifers							**14.5 20-25**
Iowa State Virginia Tech	Beef Cows at Peak Lactation							**16.5 20-25**

New York NRCS/GLCI/Extension 2 Year Study

- 150 Dairy Cow herd with 17,070 pounds RHA production
- Orchardgrass, brome, alfalfa, ladino clover, other grasses
- 1999 was a drought year at this farm
- No water tank at the barn, only in the paddocks
- 100 gallon tank, 1.25” diameter pipe, full flow valves.
- 60% of water drank was done so in first 60 minutes entering the paddock
- Water Temp in tank was 43.2°F to 103.4°F in 1999, 43.9°F to 98.6°F in 2000.
- Paddocks - 1.2 to 2.7 acres
- Flow was 7.0-9.3 GPM and static pressure was 33-43 PSI at the tank.
- Air Temp. was max. 89.5 °F at 76% Relative Humidity. Low was 52.5°F at 93.8% RH.
- 1999 Maximum drank per head per day was 7.86 gallons. Least drank per head per day was 0.25 gallons. Average in 1999 growing season was 5.21 gallons per head per day. 2000 was 11.0, 1.5 and 6.0 gallons per head per day respectively.
- Measured water content of forage consumed was 79% water (in drought year!).

Thermal Heat Index

- Cattle shed heat
  - primarily through evaporation from the skin and through respiration (breathing)
  - The higher the humidity and the less amount of wind (speed) the harder for the animal to get rid of the heat.
- On high end of TNZ
- Heat Stress in Livestock is a combination of Temperature, Relative Humidity, and Wind Speed
- The Mesonet Cattle Stress Index is a tool that is used the measure the THI (but leaves out wind speed!)
- Anything at 71 THI or below is in the TNZ (until freezing conditions mentioned later)

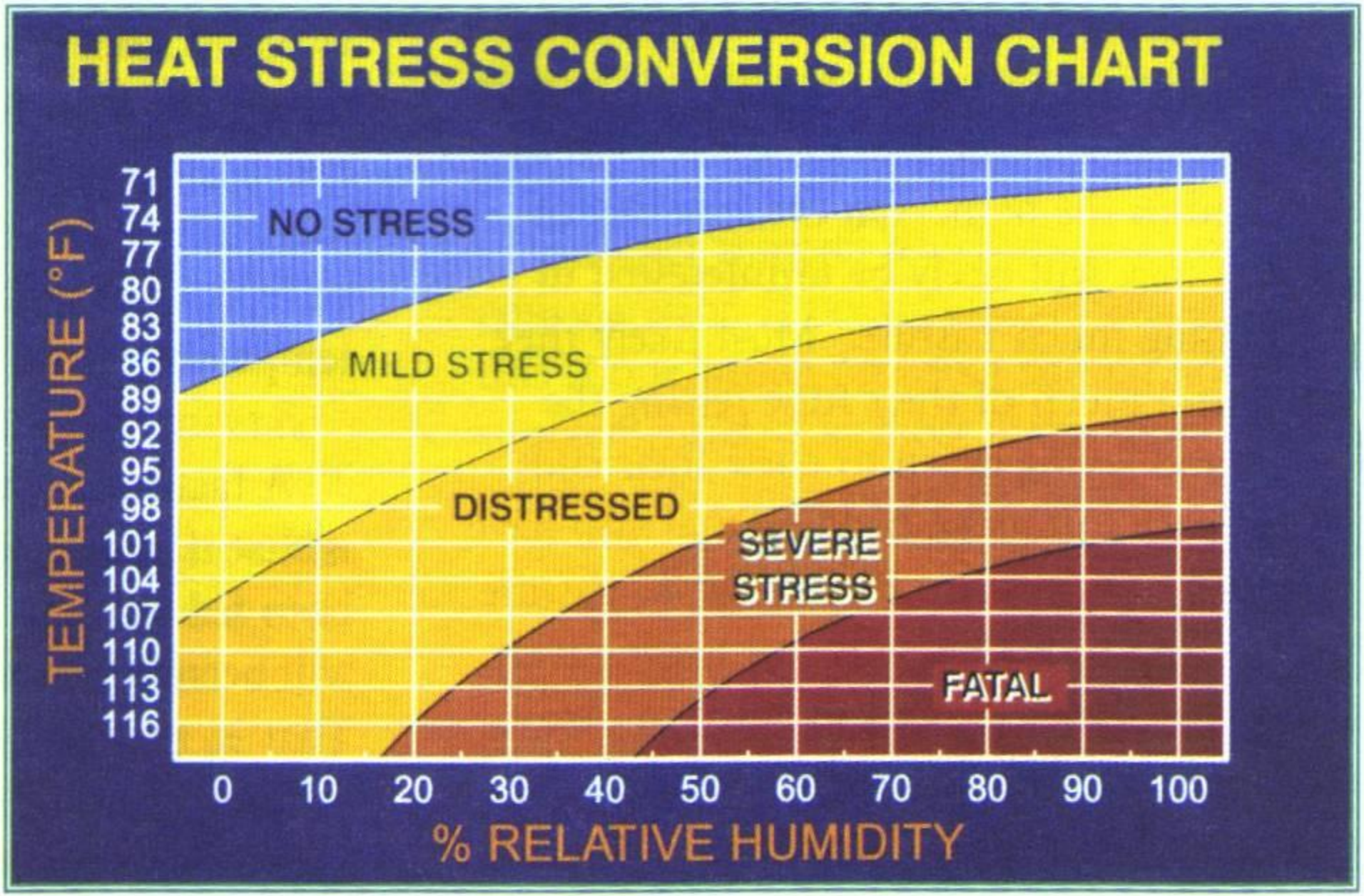


Figure 21 **The amount of heat stress a cow feels depends on the combination of temperature and humidity.**

Thermal Heat Index

- THI of 72 through 79 is Mild Stress – H2O intake slight+
- THI of 80 through 89 is Moderate Stress or the animals are “Distressed”. Management actions should be taken to help the livestock relieve the heat, such as shade and providing lots of water.
- A THI of 90 or More puts the livestock under Severe Stress and all measures should be taken to cool them. Besides providing water and shade, use misters, mister fans, or other measures. A few percentage points (increase) change in RH at this level and the heat could be fatal to them. I could not find records of this happening in the East Region.

Cattle Windchill Chart in ºF

Actual Temp	MPH ↓	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
Equiv. Temp	Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	5	48	37	27	16	6	5	-15	-26	-35	-47	-57	-68
	10	40	28	16	3	-9	-22	-34	-46	-58	-71	-83	-95
	15	36	22	9	-5	-18	-31	-45	-58	-72	-85	-99	112
	20	32	18	4	-10	-24	-39	-53	-67	-81	-95	110	129
	25	30	16	1	-15	-29	-44	-59	-74	-88	-103	118	133
	30	28	13	-2	-18	-33	-49	-64	-79	-93	-109	125	140
	35	27	11	-4	-20	-35	-52	-67	-82	-97	-113	129	145
	40	26	10	-5	-21	-37	-53	-69	-84	-100	-115	132	148
	45	25	9	-6	-22	-38	-54	-70	-85	-102	-117	135	150

Average Number of Days with an Average Maximum Temperature of 90°F or More (+ avg. THI score) and Average Wind Speed

Max. Temps mostly occur in July; Wind in July-Aug.	Central and Western UP	Eastern UP	Northern Lower	Central Lower	Southern Lower
Hot Days	4 THI=74	2 THI=72	4 THI=75	6 THI=77	9 THI=76
Wind	No data available	7.7 – 8.5	7.0 – 7.8	6.7 – 7.5	7.5 – 8.8

Recommendations Based on These Findings

- Water Intake for Livestock in a Managed Grazing System, when applied according to our 528 standard, should be credited by the water (as high as 80%) in the grazed forages.
- When Livestock drink water (have access) from a water source at the barn/parlor/yarding area, this should be included when calculating the water supplied to the animals when designing the tank size in the paddock.
- When Livestock are expected to be in 'Moderate Heat Stress' THI (or Higher) for a only a few days of the total grazing season, a contingency plan of action should be followed for those few days. We do not recommend sizing the tank for only 1% of the grazing season for example.
- When Livestock are in 'Moderate Heat Stress THI (or Higher) for several days (AL ex. - 25% or more of the Grazing Season), High Water Intake Rates should be used in the tank designs.

Determining Need

- How Fast?

Cattle Watering Facts

- They drink 1 to 2 gallons per minute
- They drink for 2 to 3 minutes per drinking event
- So they can drink 6 gallons per drinking event per animal

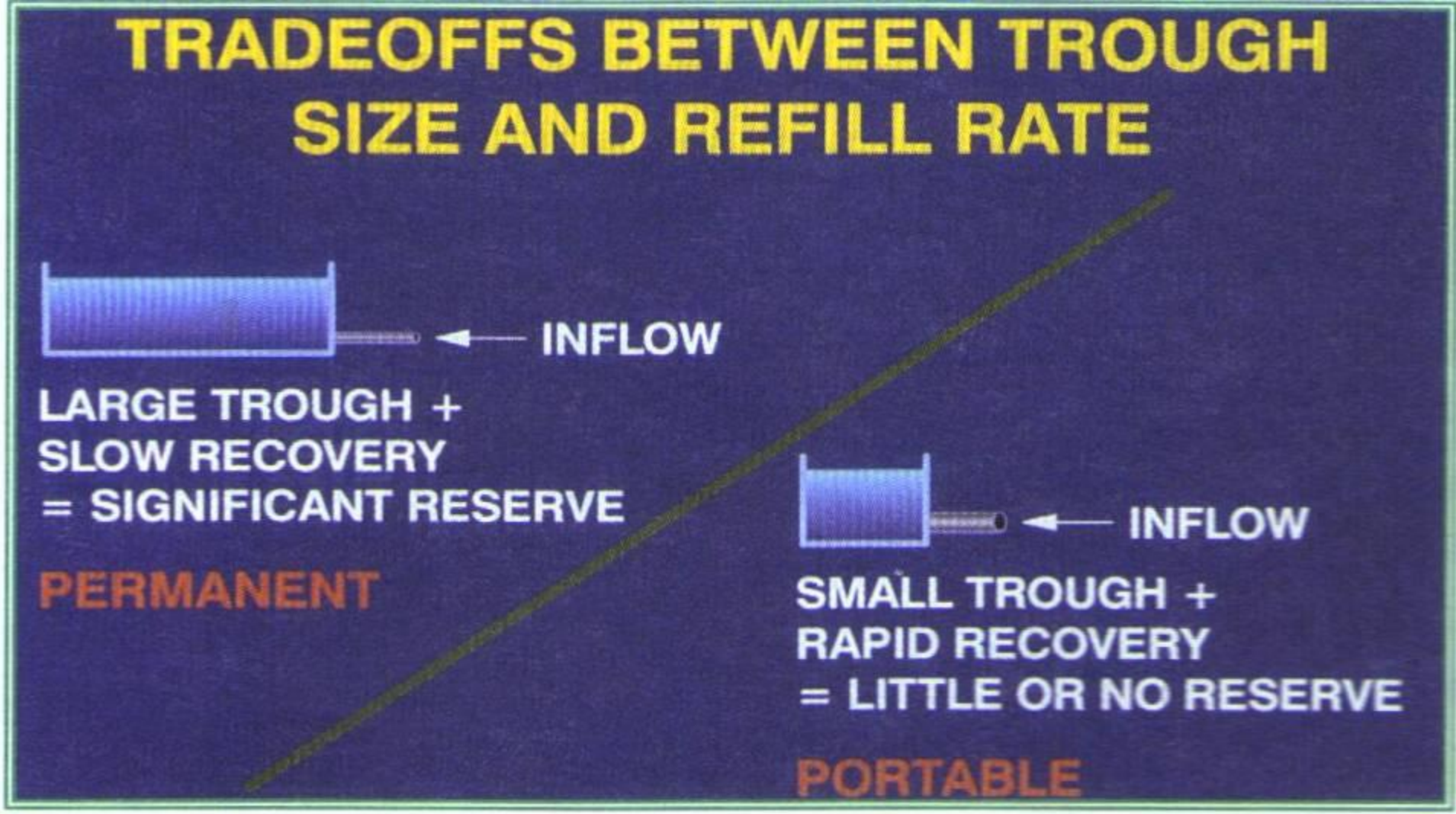
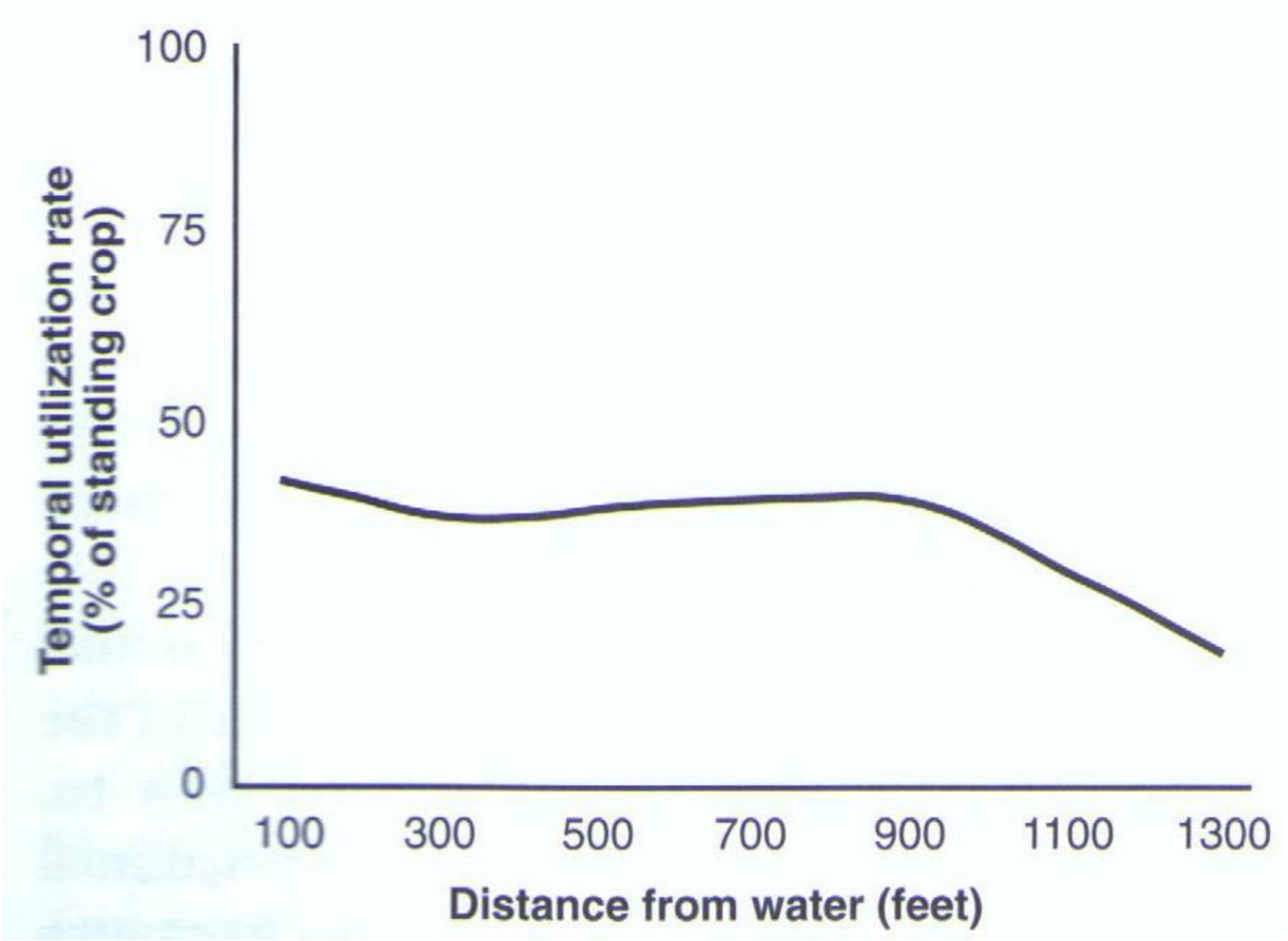


Figure 14 **There are two opposite approaches to dispensing water. One is providing a large trough with a low flow of water to replenish draw down by cows. A contrasting approach is a small tough with a quick recharge capability, which allows more management flexibility due to the trough's portability.**

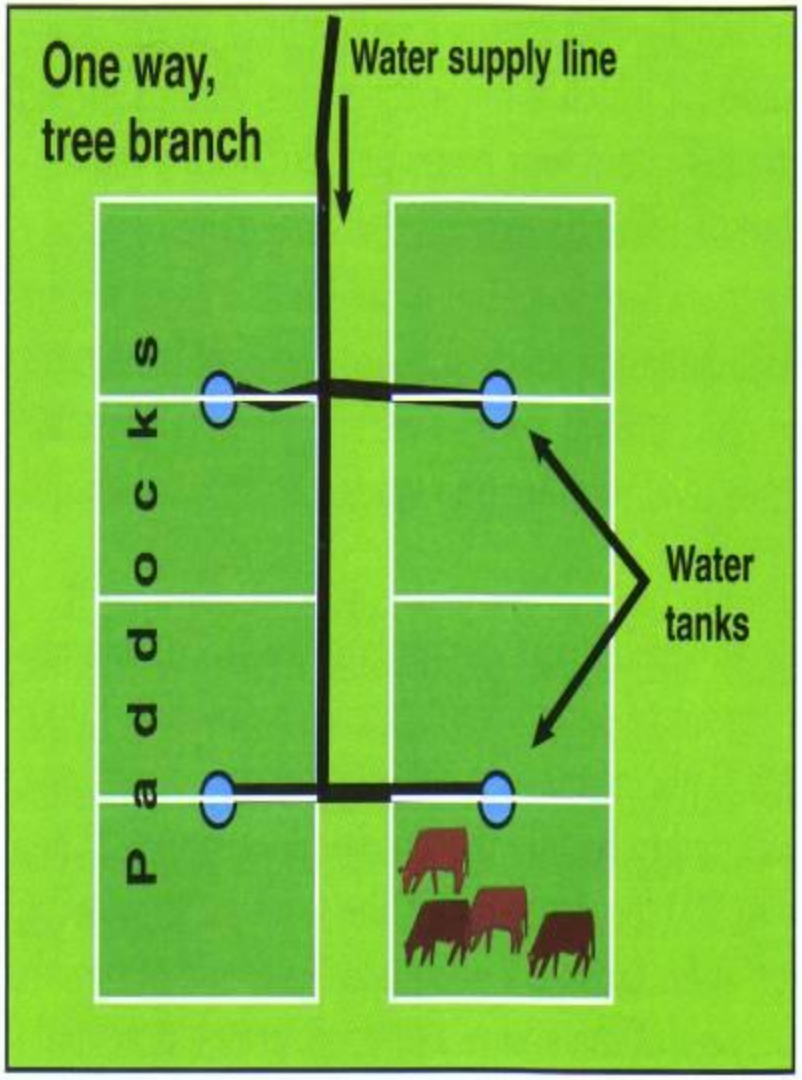
Determining Need

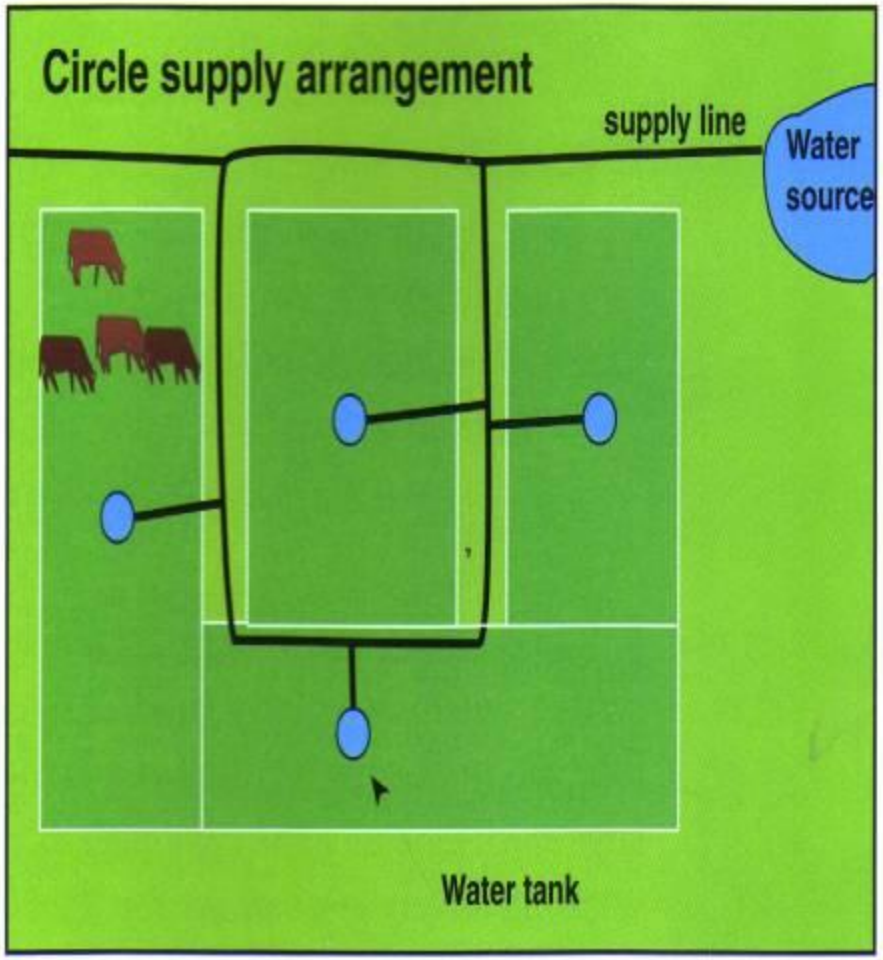
- Animal Behavior Impacts?


100
75
50
25
0
Temporal utilization rate
(% of standing crop)
100
300
500
700
900
1100
1300
Distance from water (feet)

Cattle Watering Facts

- 2% to 5% of the herd will come at a time to drink if the water source is within this distance – Note: shade, minerals, salt, topography factors.
- >10% of herd (25%or more) will come when the distance is greater than this
- This factor has a strong impact on properly sizing the tank.


One way,
tree branch
Water supply line
Paddocks
Water
tanks


Circle supply arrangement
supply line
Water
source
Water tank

Watering Facilities for Managed Grazing Systems

- Quality for the Animals

WATER SOURCES

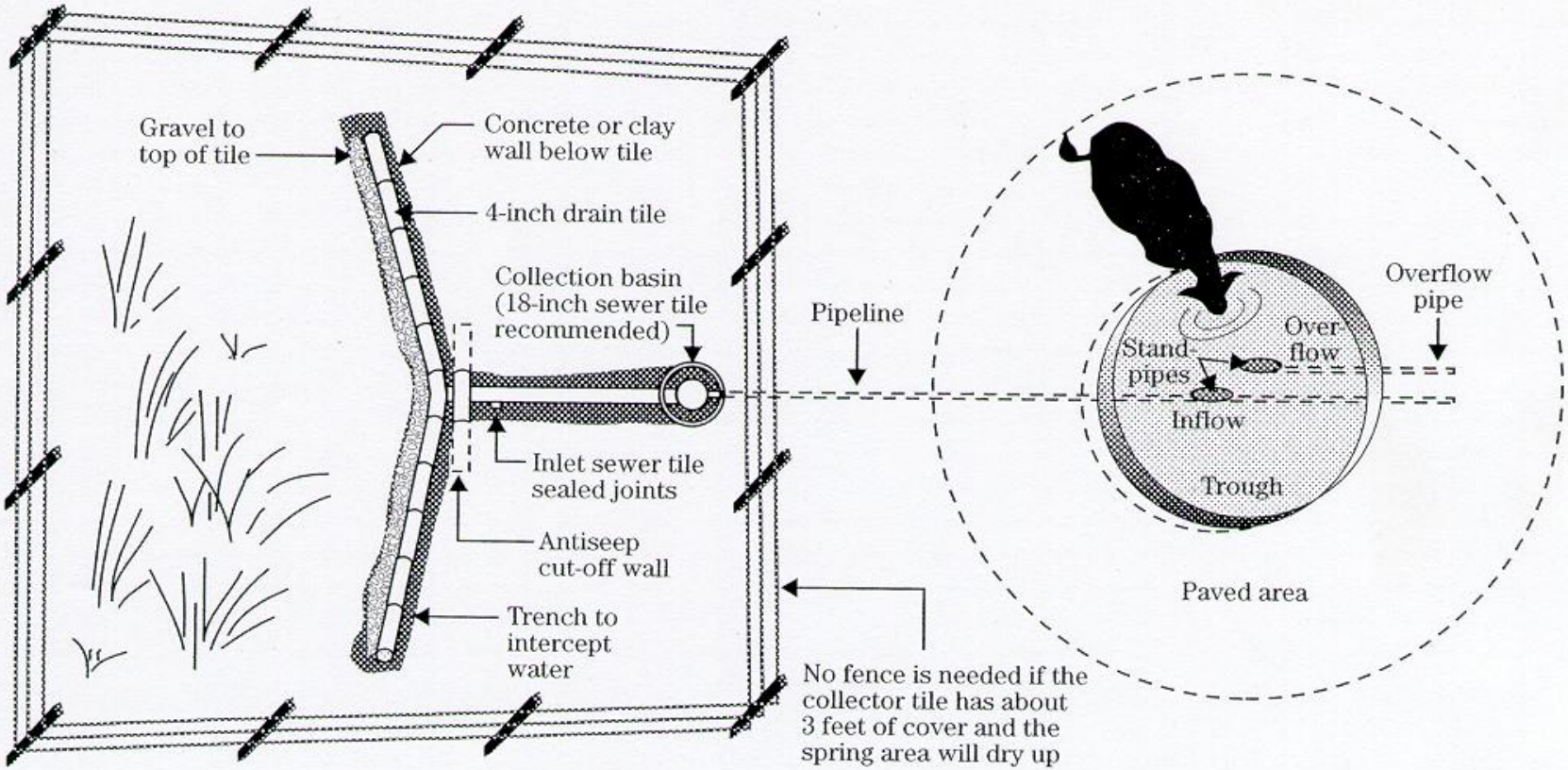
- WELLS
- STREAMS/CREEKS
- WETLANDS
- PONDS
- SPRINGS

Quality of Water Is Very Important to the Cattle

- Bulletin F-4275 from Oklahoma State Univ. is Very Good. It will be posted along with this presentation.
- Assess Water Quality for:

1. Odor and Taste
2. Physiochemical properties (TDS and TDO, hardness)
3. Toxic Compounds
4. Excess Minerals or Compounds
5. Presence of Bacteria (fecal coliform)

Figure 5–34 Spring development showing collection system, pipeline to and from trough, and trough



Watering Facilities for Managed Grazing Systems

Placement

Tank size and Shape considerations

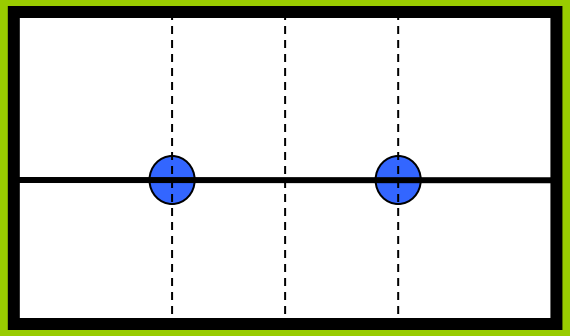
General Guide lines.

- Locate troughs on high ground with good drainage
- At permanent watering locations the surrounding ground should be protected.

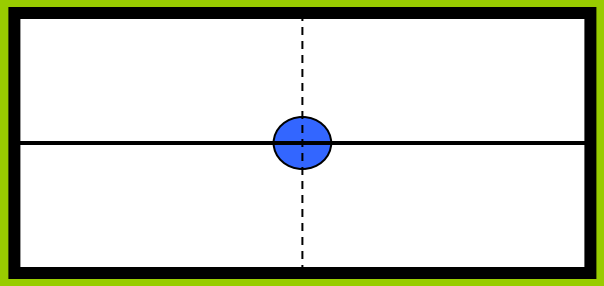
Cattle Watering Facts

- Cattle will need 24 – 30 inches of ‘head’ space on a linear tank based on 5% of the herd watering at once.
- They need 18 to 24 inches on a circular tank
- Prefer moderate temperatures of water (63 – 82 º F) instead of very cold or very hot
- Depth of at least 3 inches – prefer to put muzzle 1 to 2 inches in the water to drink
- Optimal height of tanks - 24 to 32 inches

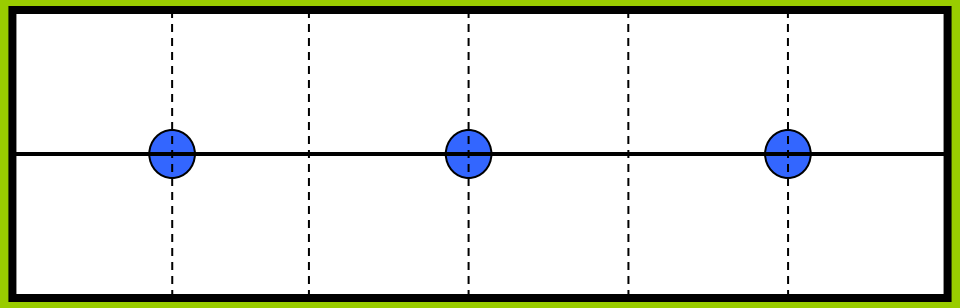

100 Gallon
378 Liter
Rubbermaid



8 Paddocks sharing Two tanks



4 Paddocks sharing One tank



12 paddocks sharing Three tanks

Watering Facilities for Managed Grazing Systems

- Things to Avoid.

"Hold up, Niles. It says here, 'These little fish have been known to skeletonize a cow in less than two minutes.' … Now *there's* a vivid thought."