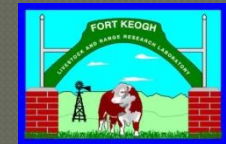
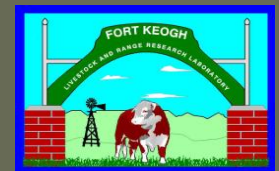


Fort Keogh Livestock & Range Research Laboratory



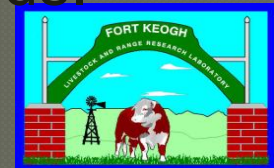
WINTER STOCK WATER

Fort Keogh Customer Focus Group Meeting
September 2011





“Our Mission is to research and develop ecologically and economically sustainable range animal management systems that ultimately meet consumers needs.”



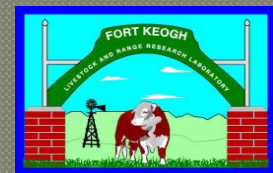
Item	Water analysis	Amt supplied in water
calcium	1.04 ppm	0.045 g/d
Chloride	14 ppm	0.604 g/d
Fluoride	3.3 ppm	142.4 mg/d
Iron	0.04 ppm	1.726 mg/d
Magnesium	0.29 ppm	0.013 g/d
Sodium	365.0 ppm	15.75 g/d
Sulfur	45.29 ppm	1.95 g/d

WATER QUALITY RESEARCH—Ft Keogh



Item	Minerals Diet	water & diet	Required
calcium	0.48 %	0.484 %	0.36 %
Chloride	14 ppm	0.06 %	?
Fluoride		142 ppm	?
Iron	1,378 ppm	1,379 ppm	50 ppm (hi)
Magnesium	0.17 %	0.171 %	0.20 % (lo)
Sodium	0.032 %	1.61 %	0.1 % (hi)
Sulfur	0.17 %	0.365 %	0.15 % (hi)
Copper	3.0 ppm	3.0 ppm	10 ppm (lo)
Manganese	83.0 ppm	83.0 ppm	40 ppm
Phosphorus	0.18%	0.18%	0.23 % (lo)
Potassium	1.30 %	1.31 %	0.70 %
Selenium	0.13 ppm	0.13 ppm	0.1 ppm
Zinc	21.0 ppm	21.0 ppm	30 ppm (lo)

Predicted mineral intake in
May 2009 (forage + water)



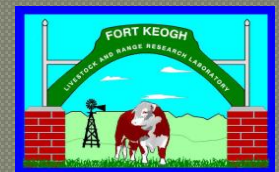
2011 Mineral Formula

(considering water)

Mineral	2010 Formula	2011 Formula	Comments
calcium	max 11.5%	max 11.5%	
phosphorus	min 6.0%	min 6.0%	short 10%
magnesium	min 4.0%	min 4.0%	short 5%
potassium	max 4.0%	max 4.0%	over spr/sum
copper	2000 ppm	2000 ppm	over 40%
manganese	2500 ppm	0 ppm	high diet
selenium	13 ppm	13 ppm	met require
zinc	4000 ppm	2000 ppm	met require



Winter stock water temperature



Another aspect of quality - Temperature



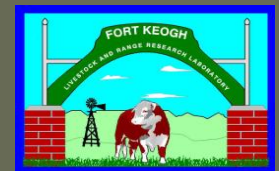
8 gallons of water at 35F to 98F



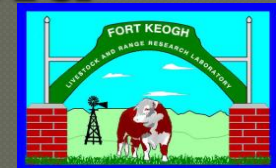
Requires 1,830,528 calories



Equal to 2.5 lbs corn or 5 lbs of
grass hay or 7 lbs native



- Why care about water temperature as long as it is not frozen?
 - Positive relationship water drank and feed consumed
 - Takes metabolic energy to warm cold water
 - Rumen microbes experience cold shock



Winter warm water study

Six paddocks

- 3 paddocks cold water 45°F
- 3 paddocks hot water 90°F
 - outdoor tankless water heater

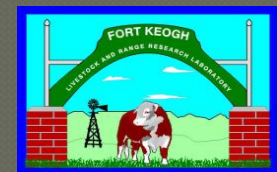
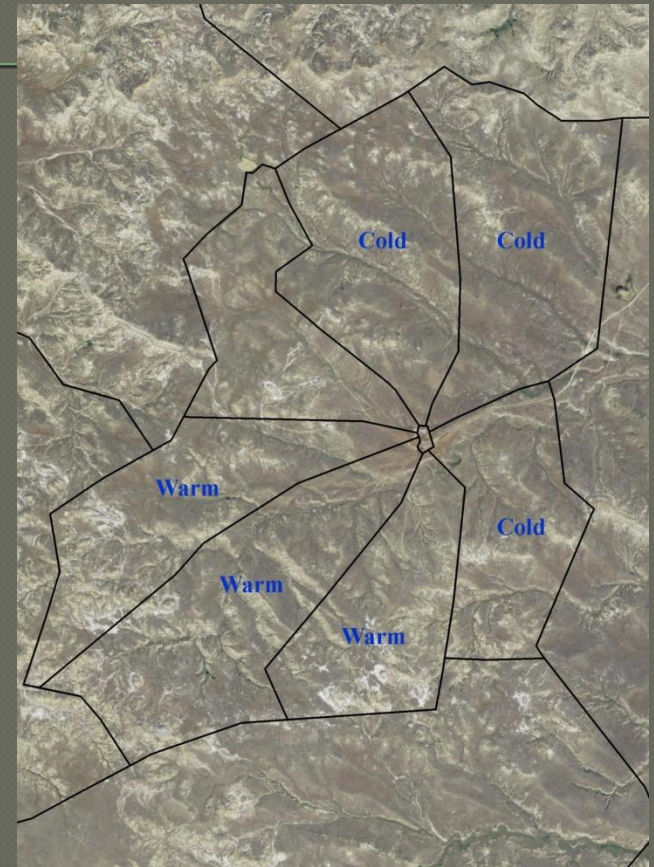
Water intake/paddock measured electronic meter

Days were categorized as:

- Cold - $< -9.5^{\circ}\text{C}$
- Cool - -9.5°C to -3°C
- Warm - $> -3^{\circ}\text{C}$

Cameras at water source

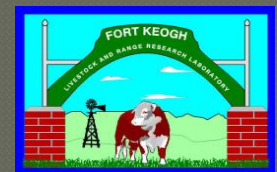
- Individual drinkers, Time of day consumed water
- Number of trips/day



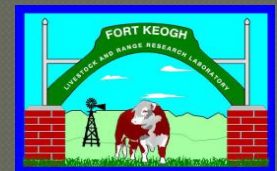
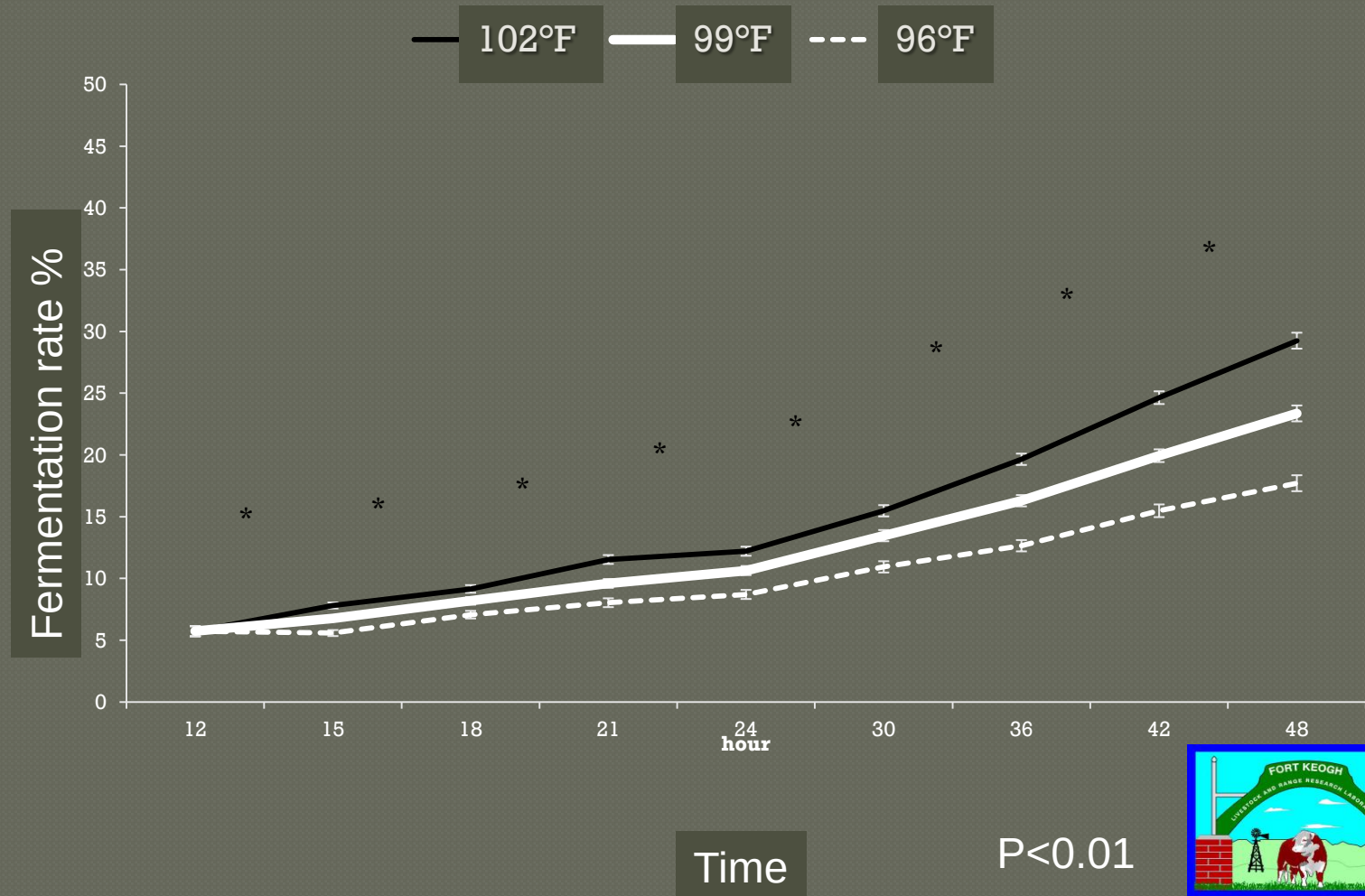
Laboratory Study

Artificial Rumen & Temperature

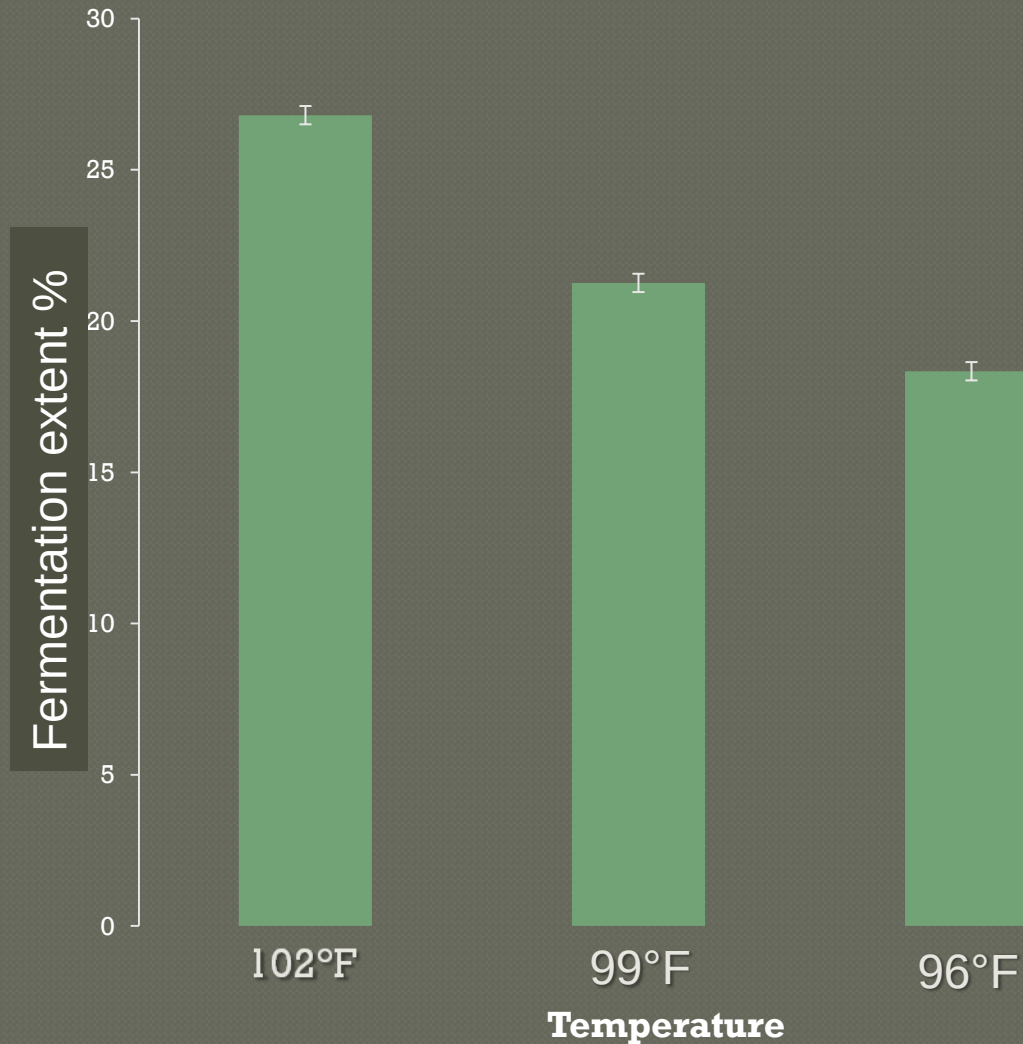
- Use cannulated cows
- Incubate winter diet samples
- 5 different temperatures
 - Body temperature 102°F
 - 99°F
 - 96°F
 - 93°F
 - 91°F
- Can rumen temperature impact digestibility?



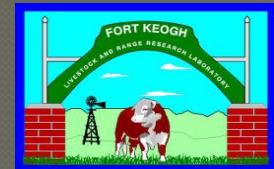
Fermentation rate below body temperature



Extent of digestibility below body temperature

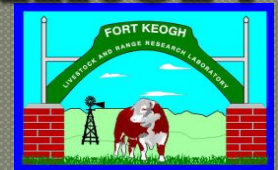


$P < 0.01$



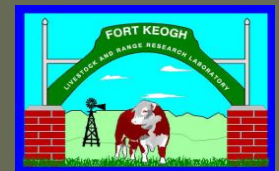
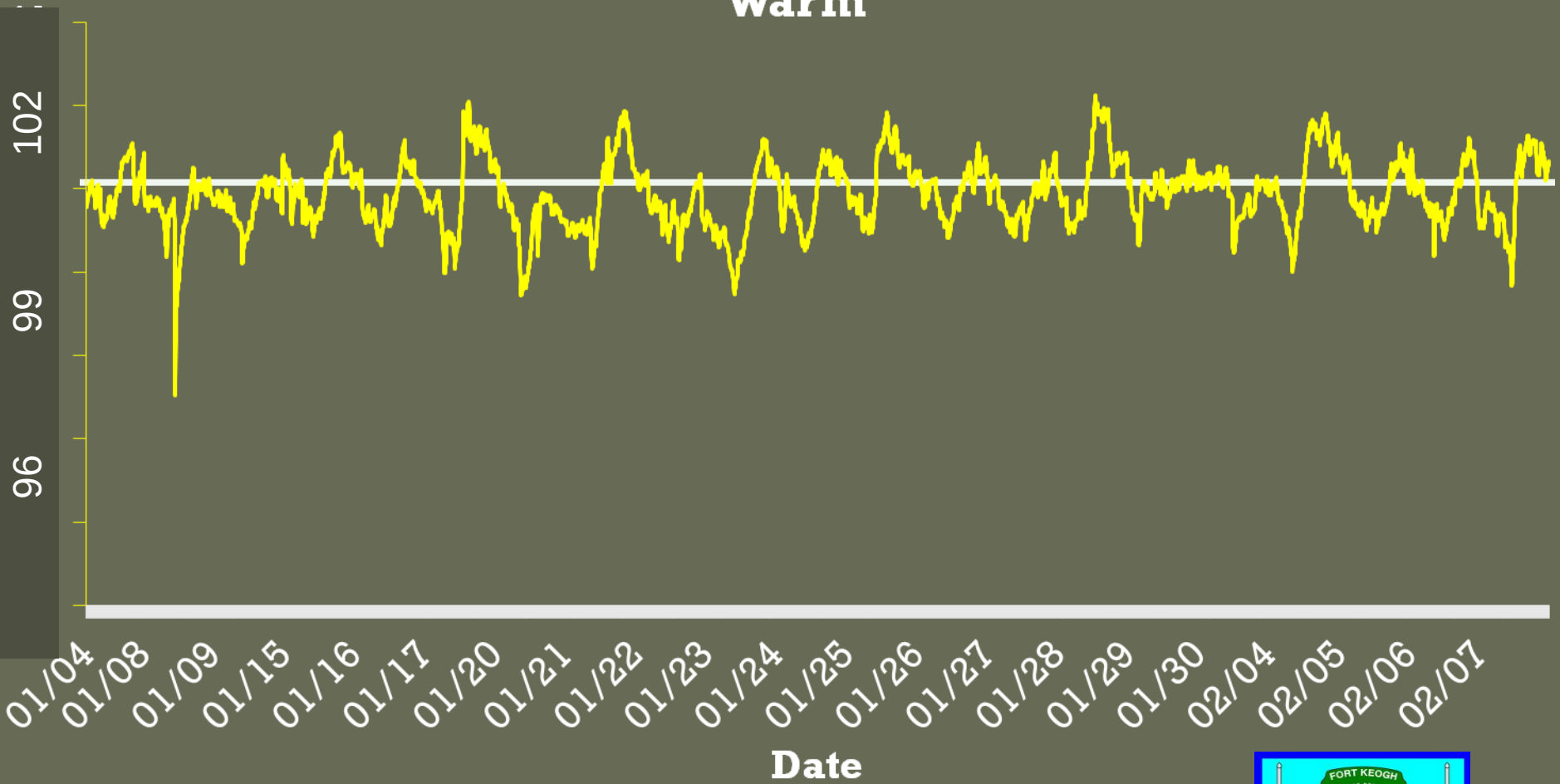


**How does rumen temperature
change in Winter?**



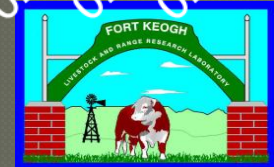
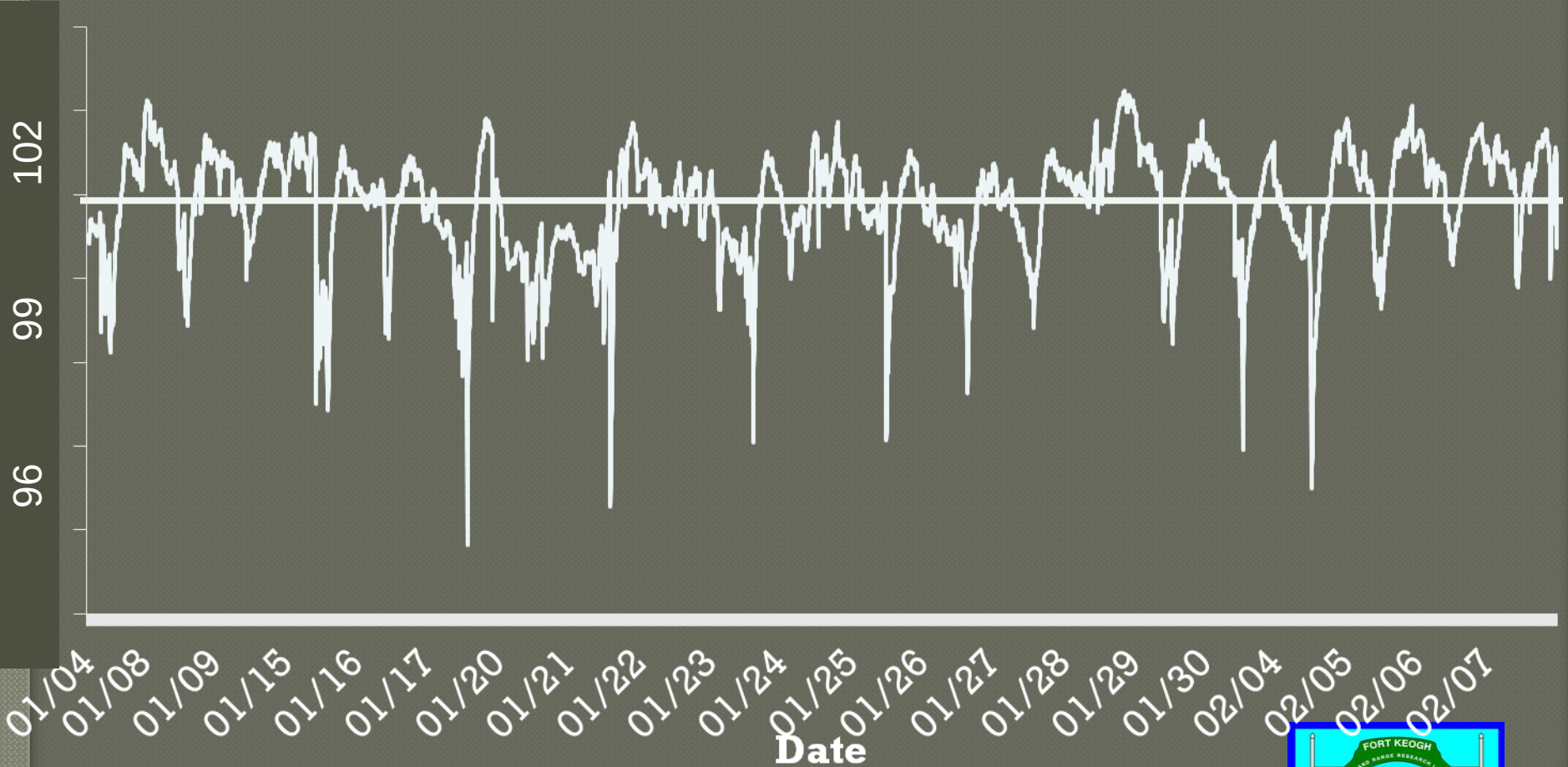
Range cow rumen temperature in winter

Warm

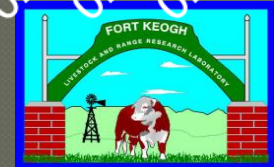
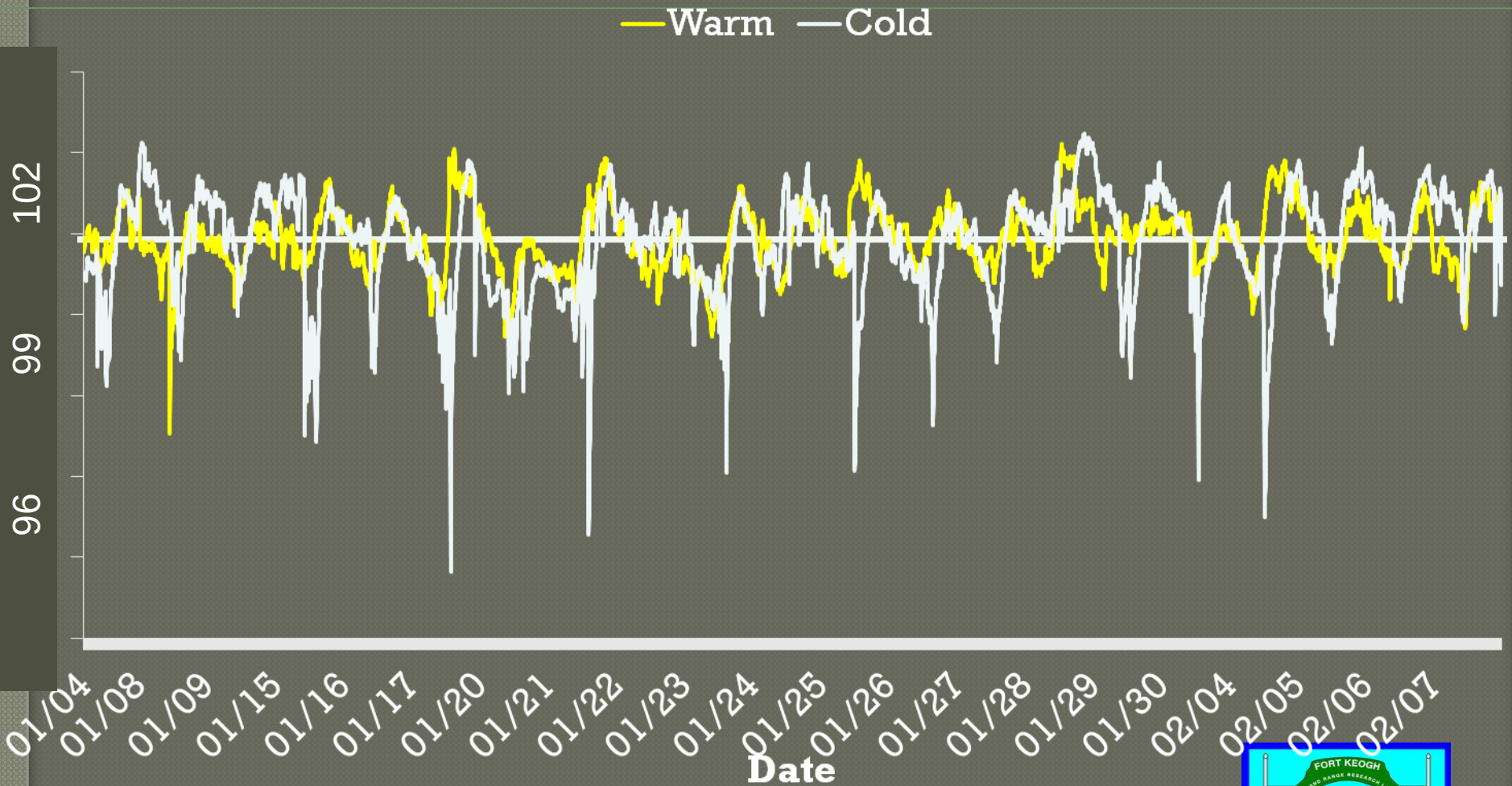


Range cow rumen temperature in winter

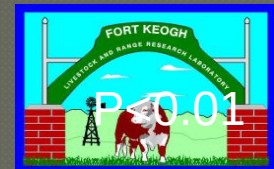
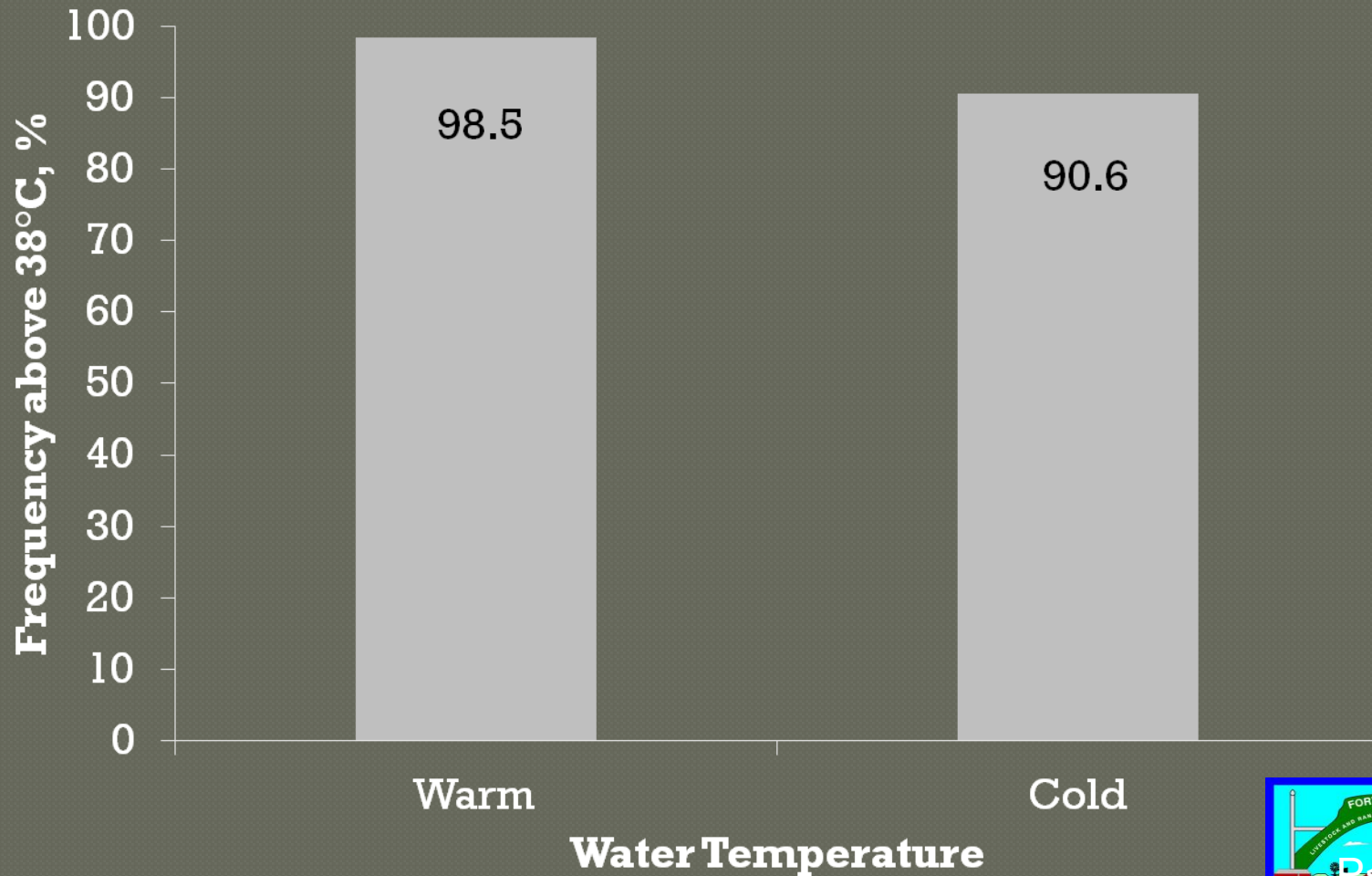
Cold



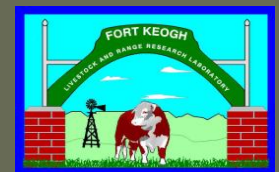
Range cow rumen temperature in winter



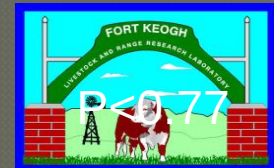
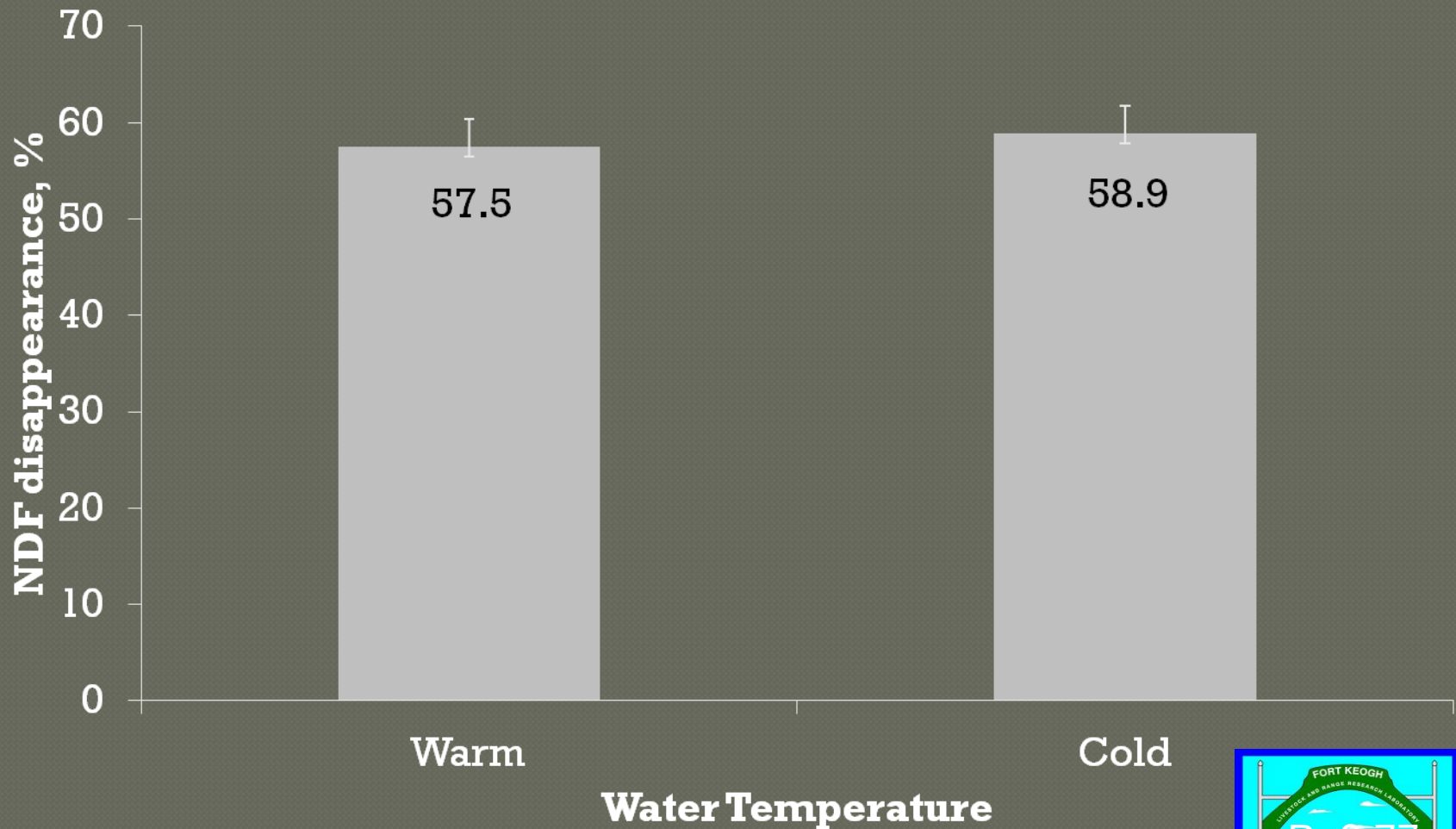
Effect of water temperature on frequency of rumen temperature above 98°F.



Did water temperature change range cow digestibility in 2010?

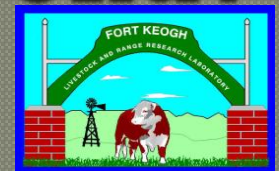


Water temperature did not influence fiber ruminal digestibility.

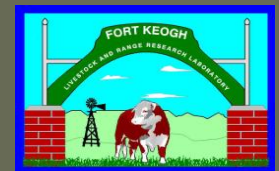
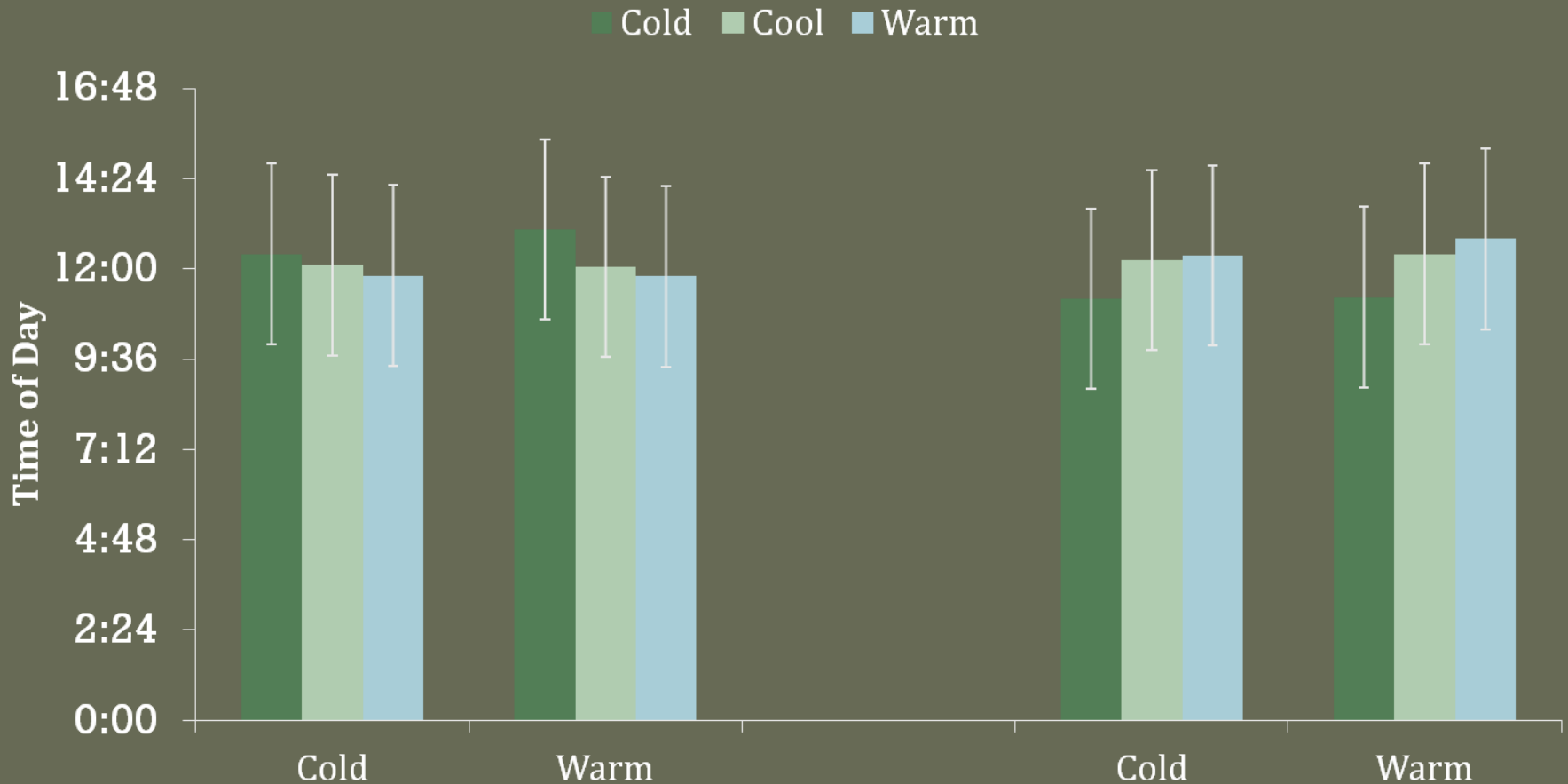




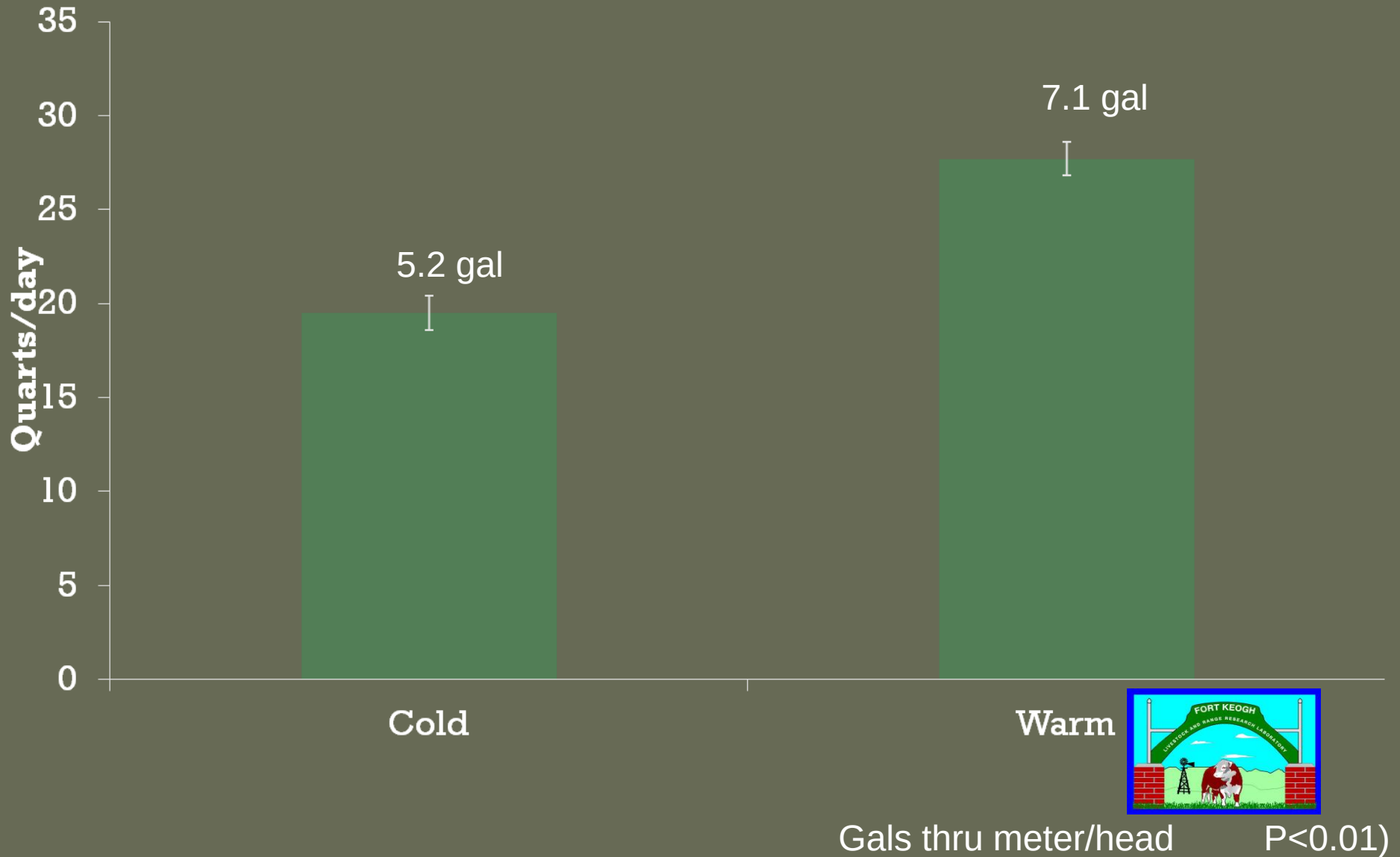
How did the cows
respond?



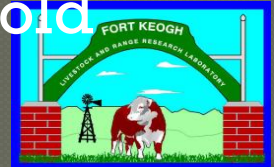
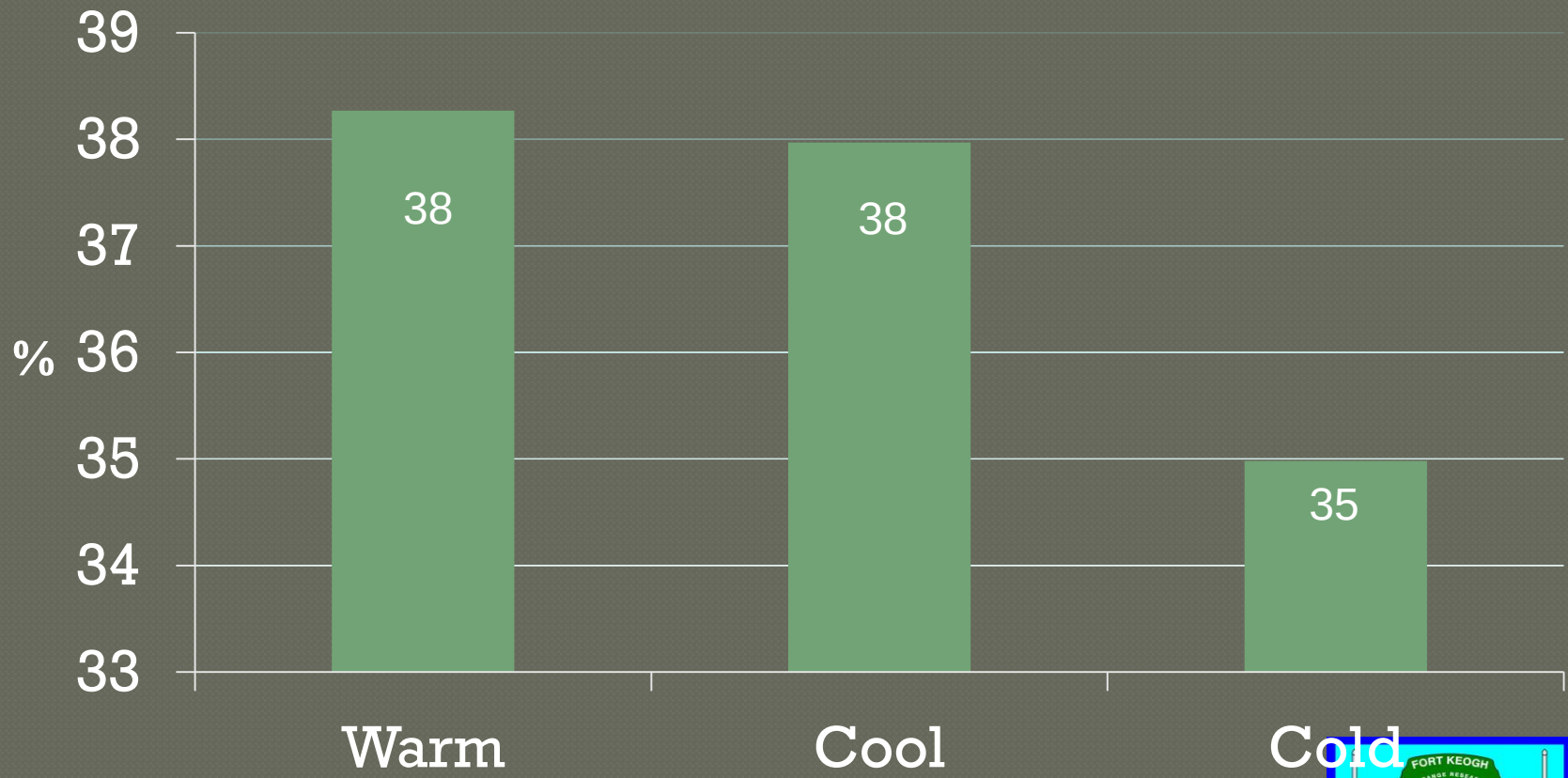
Depending on year daily high temperature influences time of day cows drink



Cows drink 25% more warm water

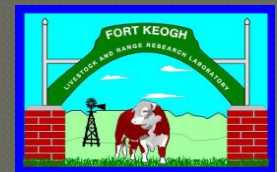


35 % of cows do not drink each day



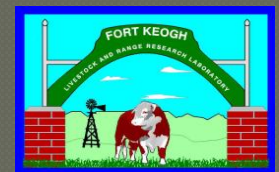
Water temperature & body weight change

- Cows with access to cold or warm water lost the same quantity of weight during winter (less than 10 lbs)



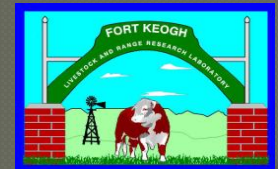
What's next?

- Continue 3rd year
- Appears greater water intake does not always cause important increases in feed consumption



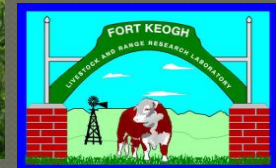
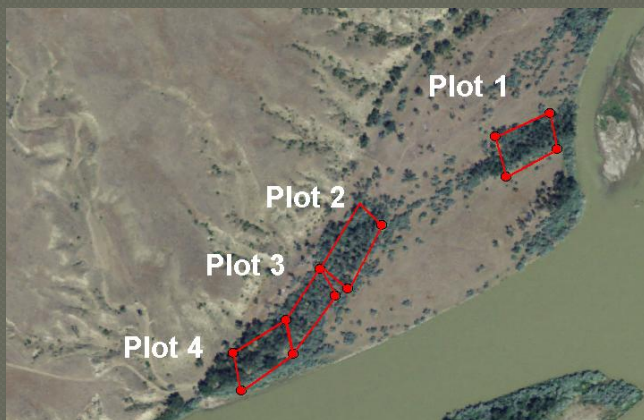
Variability Mineral Consumption

- Self-fed mineral
- Influenced by
 - Forage quality
 - Weather
 - Individual cow
- Test relationship of consumption to productivity
- Collaboration with MSU



● Russian olive

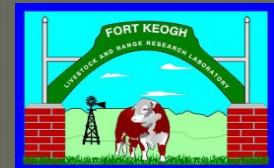
- Invasiveness
- Removal
- Vegetation Rehabilitation
- Collaboration NRCS & Sidney



**Completed 3 years
water quality**

● **Water quality**

- 98 watering sites
- Wells, springs, catchment ponds, surface flowing
- Location
- Season (wetter & drier)





Thanks
Questions comments

