

Shade Research and Equine Responses to Hot Weather



Kathryn Holcomb, PhD

Carolyn Stull, PhD

School of Veterinary Medicine

University of California, Davis

keholcomb@ucdavis.edu



How Horses Respond to Hot Weather

Physiology

- Increase respiration rate, blood flow to skin, sweat

Behavior

- Turn rump to sun, move to shade or into breeze, stand rather than lie down, stand near or in water
- Drink more water, eat less feed



Heat Dissipation

Conduction

Between surfaces

Convection

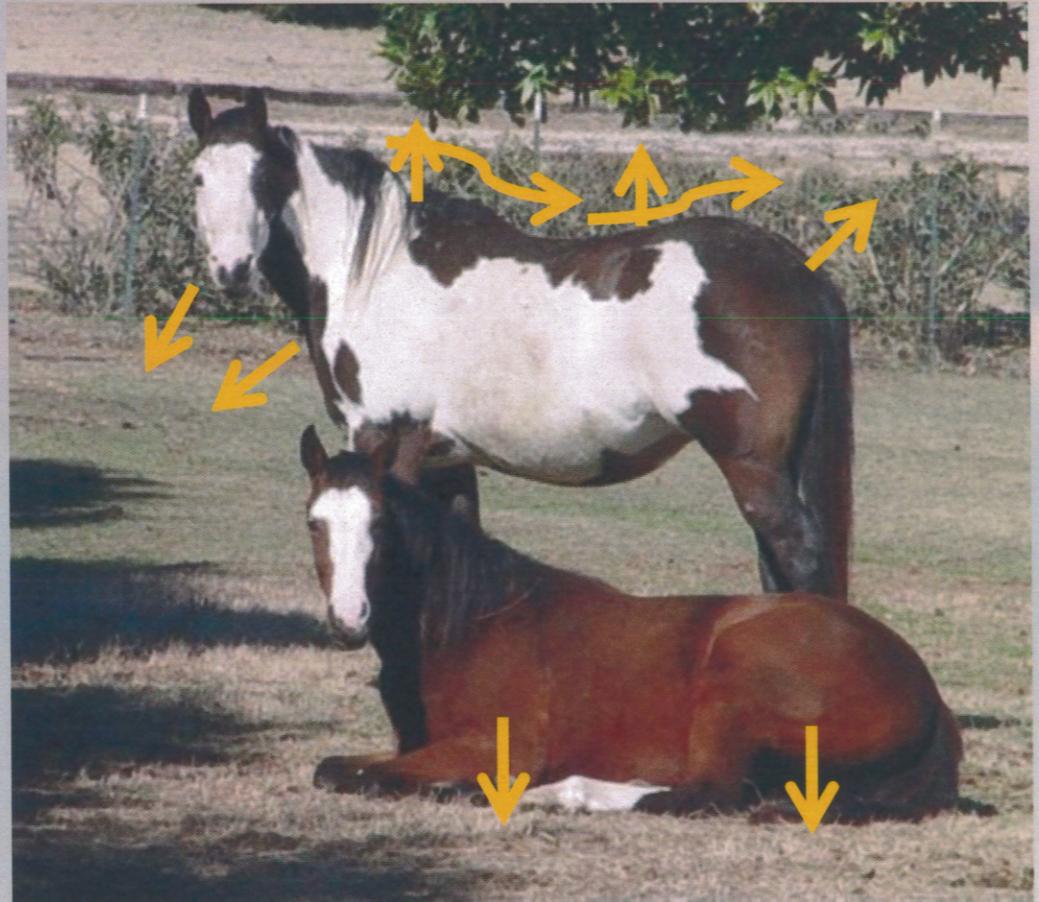
Air, wind

Radiation

Electromagnetic waves

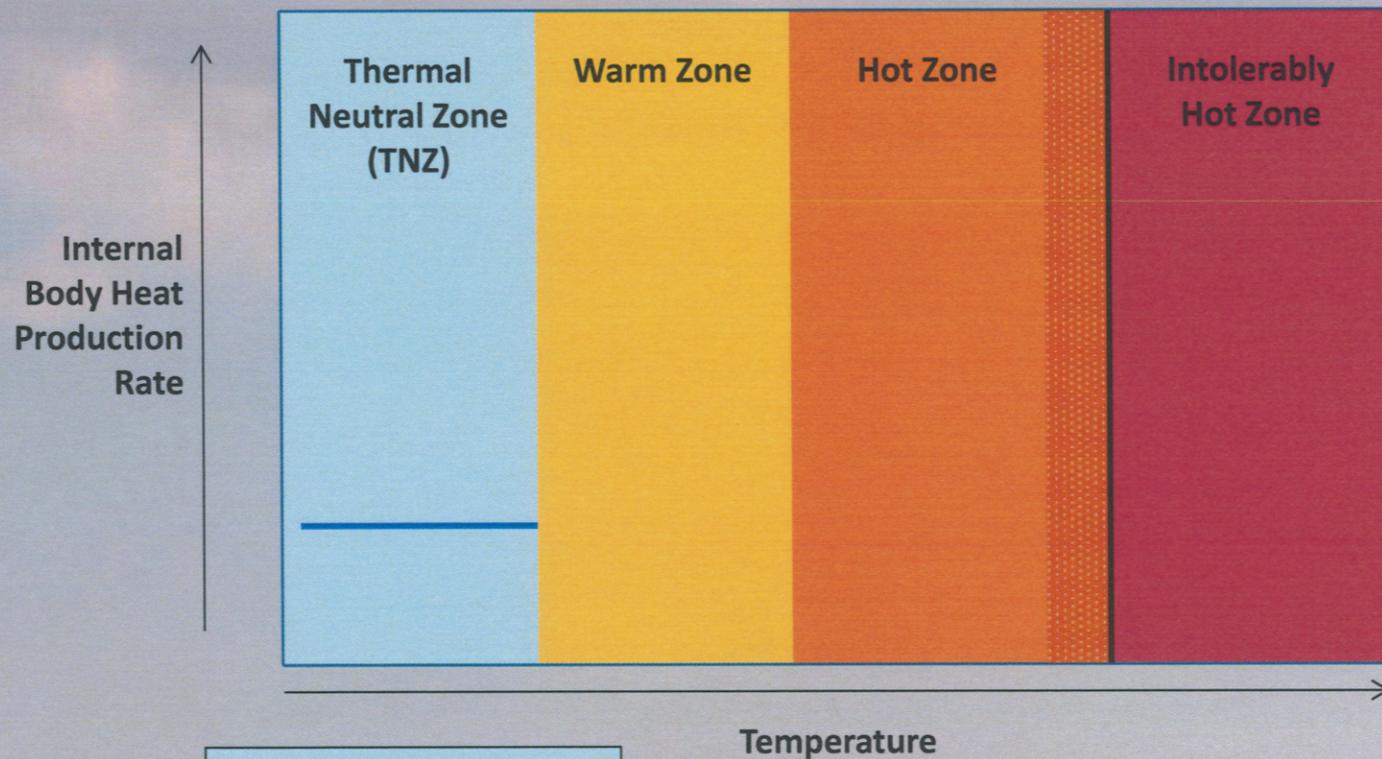
Evaporation

Respiration & sweat



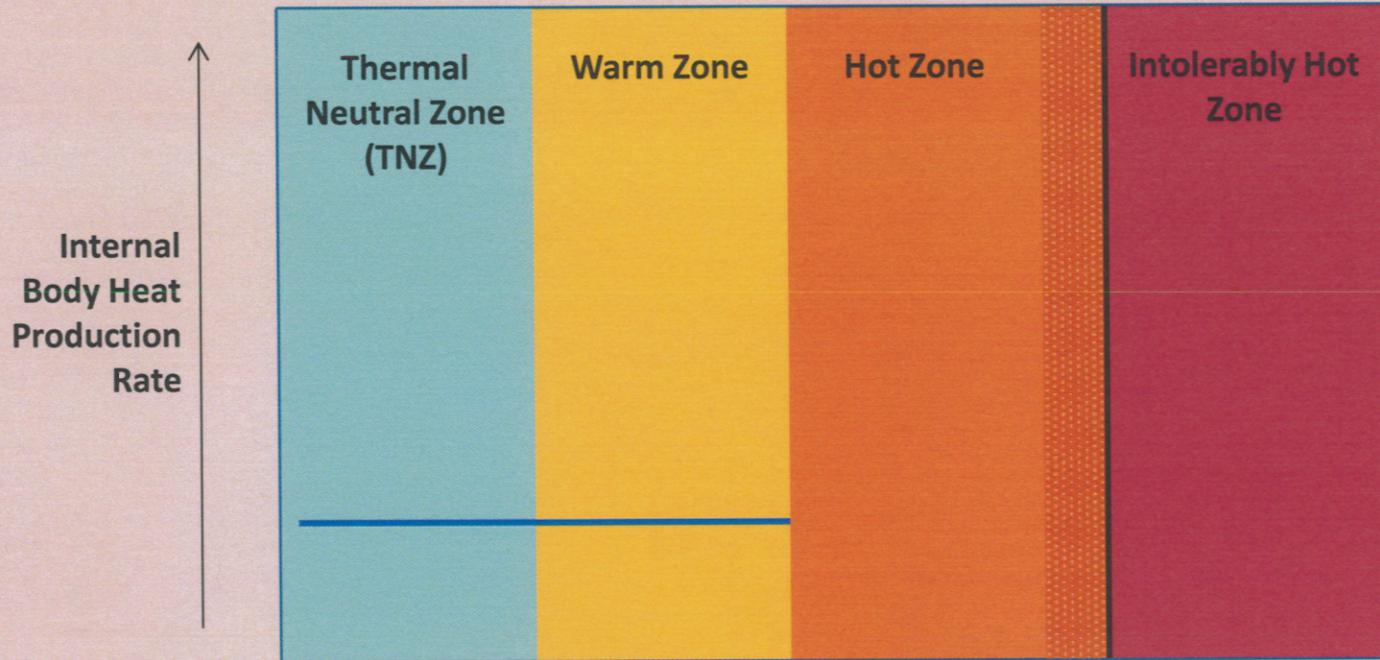
Heat always moves from higher to lower temperature

How do Horses Respond to Increasing Environmental Temperature?



No extra energy spent to maintain body temperature

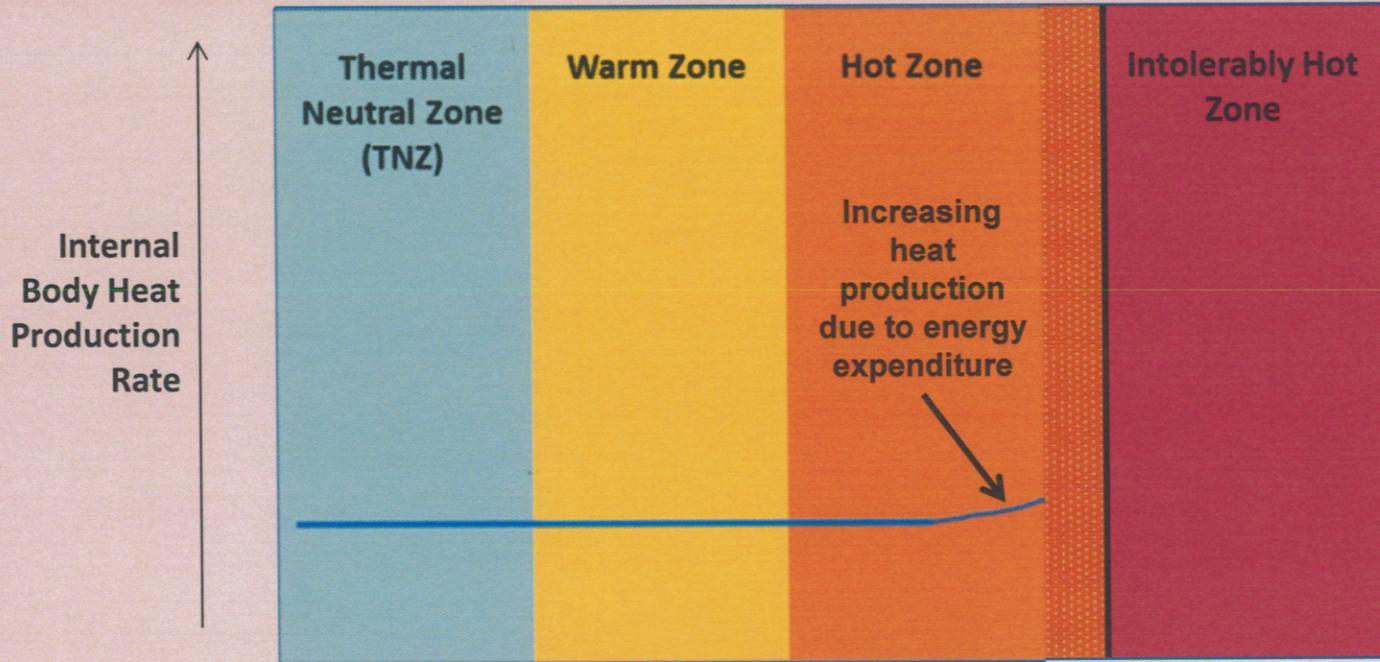
Horse's Responses to Increasing Environmental Temperature



Adapted from Curtis, 1983

- Passive**
- ↑ blood flow to skin
 - ↑ drinking
 - ↓ eating
 - Stand rather than lie down
 - Turn rump to sun
 - Move into shade or breeze
 - Stand in or near water

Horse's Responses to Increasing Environmental Temperature

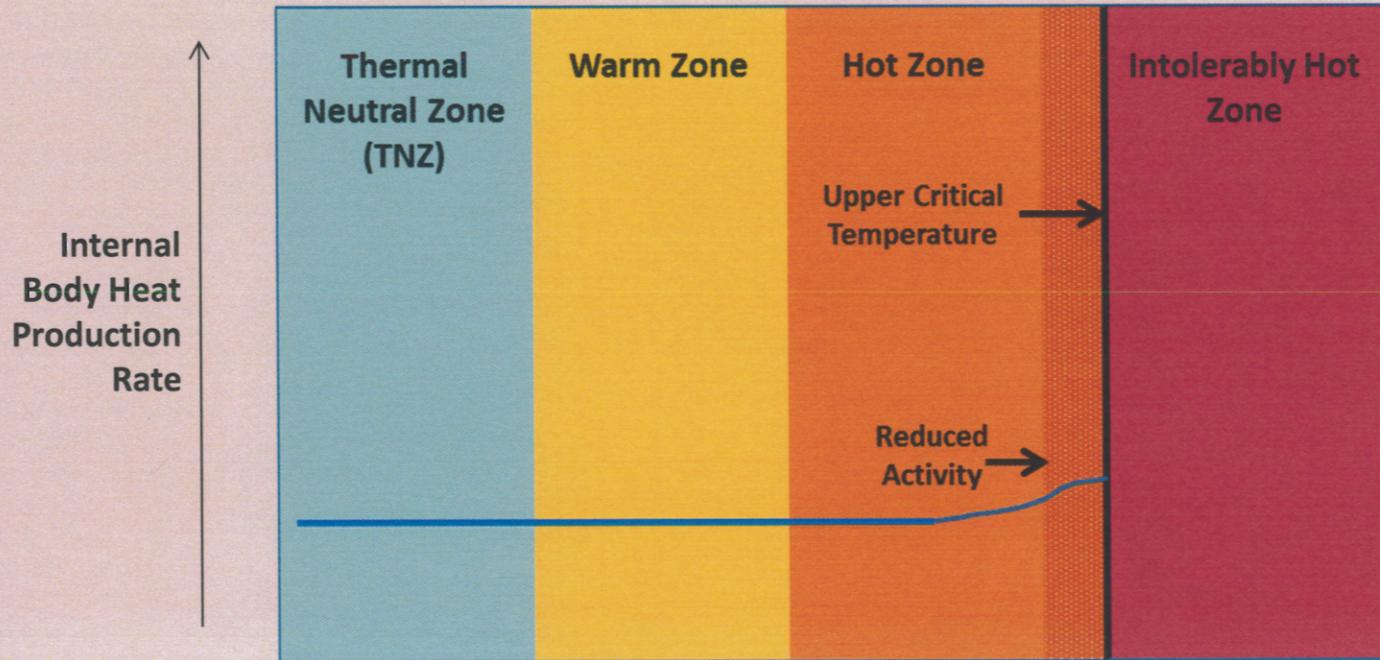


Adapted from Curtis, 1983

Active

↑ Respiration rate
↑ Heart rate
↑ Sweat
↑ Rectal temperature

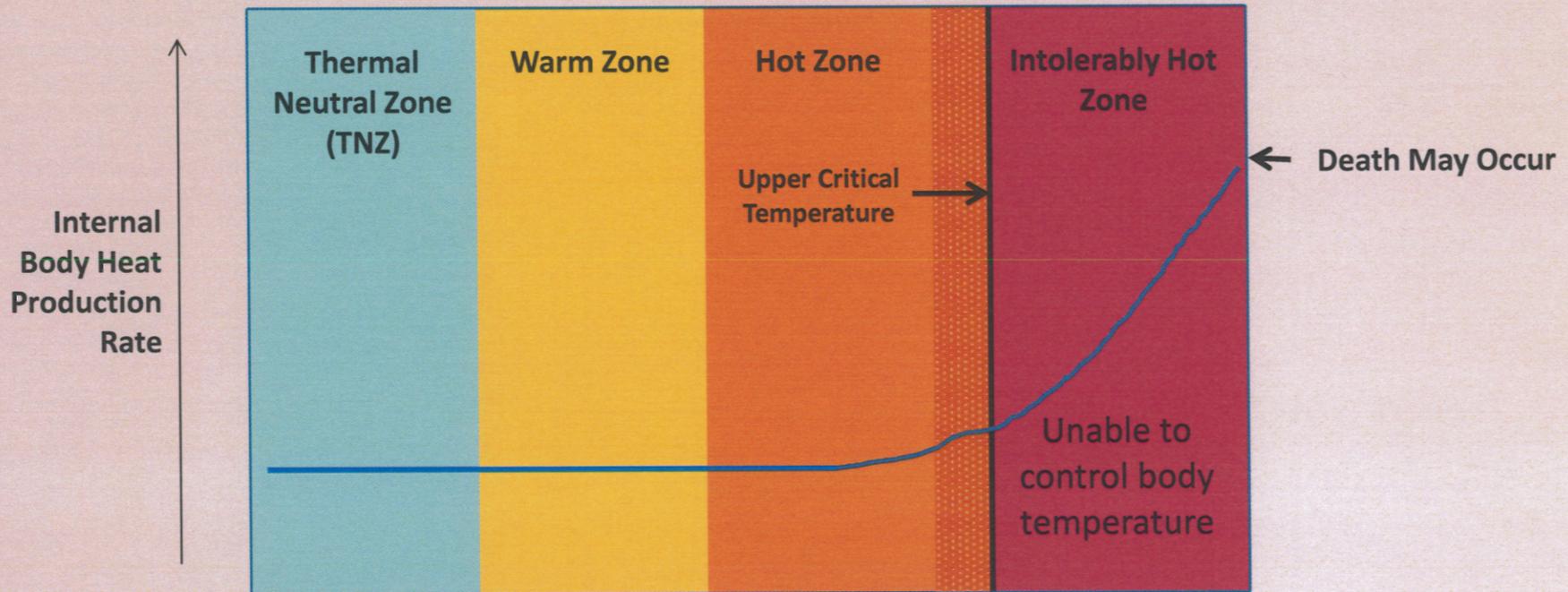
Horse's Responses to Increasing Environmental Temperature



Adapted from Curtis, 1983

Upper Critical Temperature: All thermoregulatory mechanisms employed!

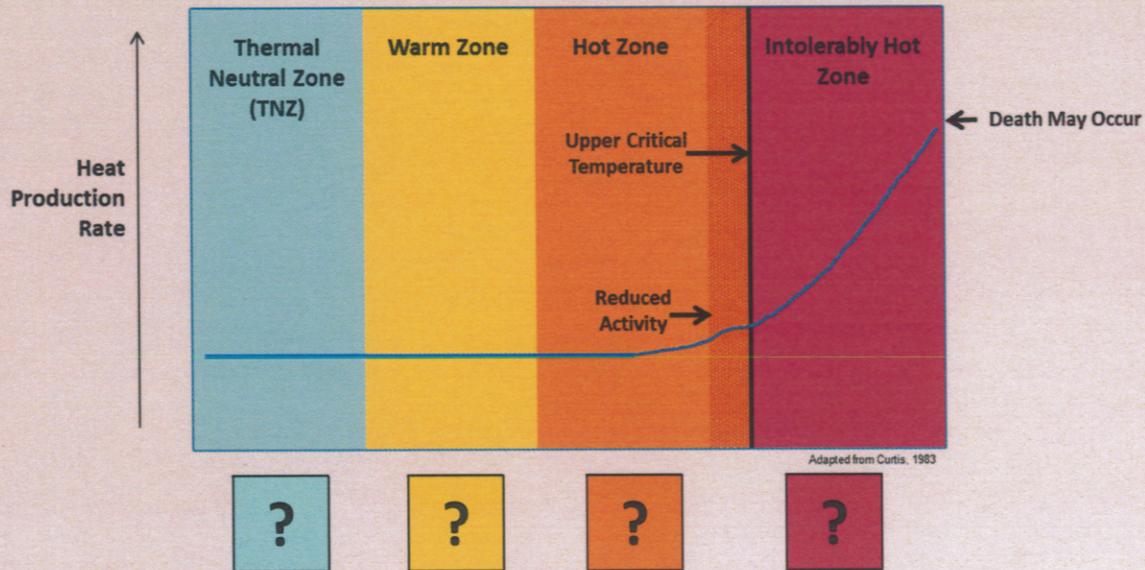
Horse's Responses to Increasing Environmental Temperature



Adapted from Curtis, 1983

Thermoregulatory mechanisms overwhelmed

What Are These Environmental Temperatures?



“It Depends!”

- What’s the humidity?
- wind?
- solar radiation?
- duration of heat? (hours/day, number of days)
- night time cooling?

“It Depends!”

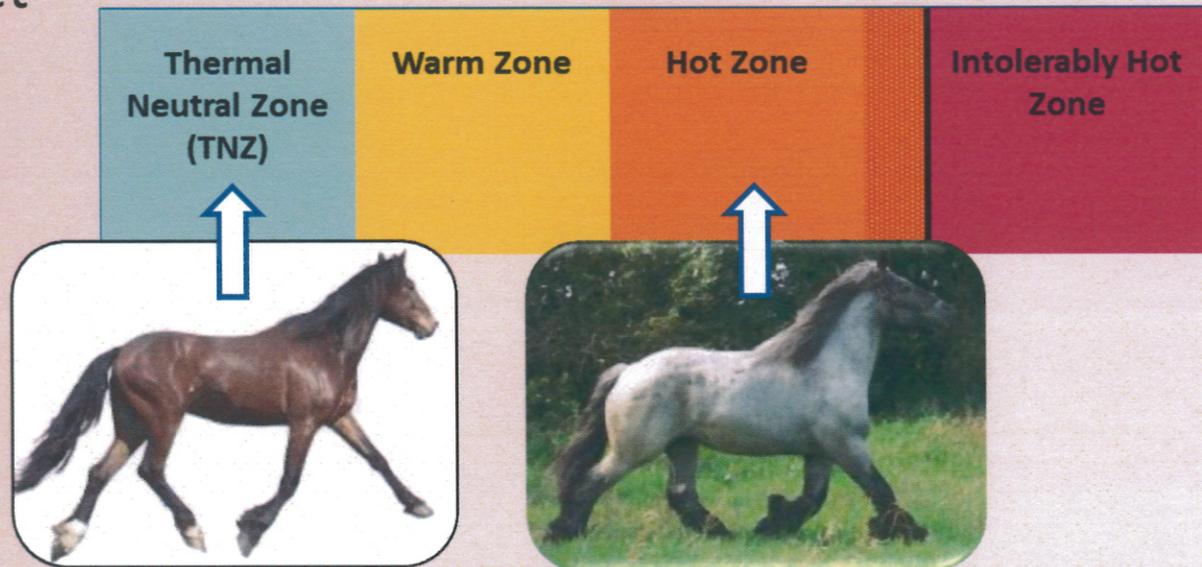
What is the horse's

- body type
- size
- age
- health/disease
- fitness
- body condition
- coat color
- skin color
- hair length
- diet

Is the horse

- accustomed to the climate
- at rest or exercising
- on bare dirt, sand, grass, pavement
- stabled or turned out
- housed alone or in group
- pregnant

Does the horse have access to clean water?



Research

- Extensive research on effects of heat, management practices for domestic horses undergoing strenuous exercise
 - especially in hot, humid weather
 - show high tolerance for heat
- Limited research on horses at rest



Shade Research

Perceived Temperature



Ambient temperature

Relative humidity

Wind speed

Precipitation

+ Solar radiation

= **Lower perceived temperature**

Shade Research

Do domestic horses benefit from shade?

Measured physiology & behavior of domestic horses in

100% Shade



OR

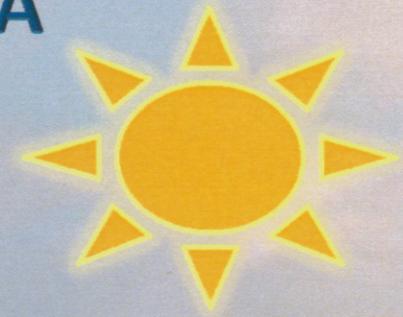
100% Sun



Average Weather Conditions, Davis, CA

July 2011

12:00-6:00 pm

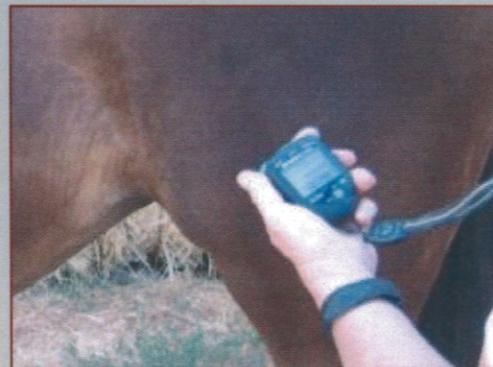


	Shade	Sun
Solar Radiation, Watts/m ²	18	733
Avg. Ambient Temperature, °F	88°	88°
Maximum, °F	102°	103°
Soil Temperature, °F	88°	132°

Shade Research Results



	Shade	Sun
Rectal temperature, °F	99.5	100
Respiration, breaths/min	21	26
Skin temperature, °F	94	96
Sweat, % observations	1%	52%

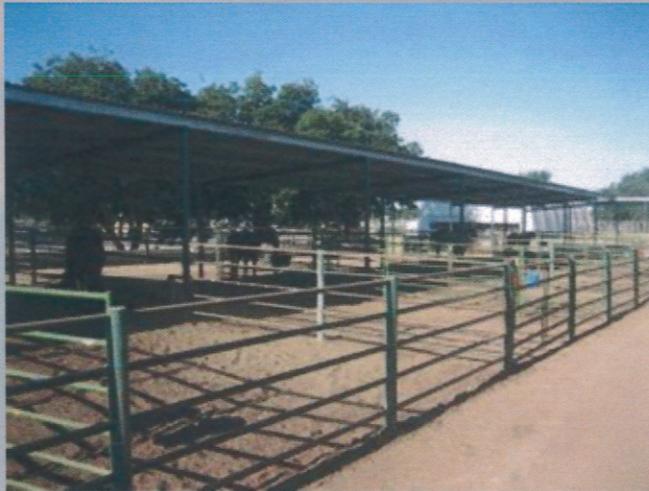


- All are significantly different
- Horses in sun used active mechanisms

Shade Research

If shade is available to domestic horses, will they use it?

Pens half-covered by shade structure
1 horse/pen



Results:

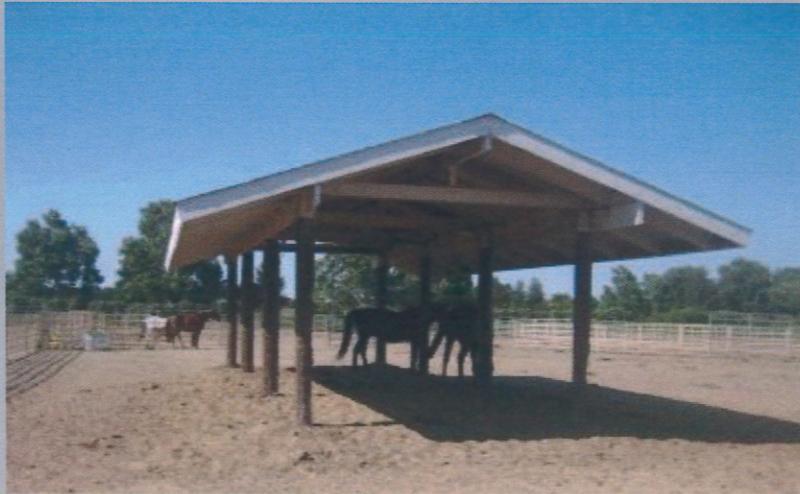
- Average shade use was 57.1 %
- 7.1% > chance (chance = 50%)

Shade Research

Will small groups of domestic horses use shade?

Group of 3 horses/pen

Shade structure in large pen



Results

Average shade use 7.1%

Social factor?

Herd dynamics

Shade Research Conclusions

1. Do horses benefit from shade? **Yes**

Horses in sun: **active** responses

2. If shade is available, will horses use it? **Yes**

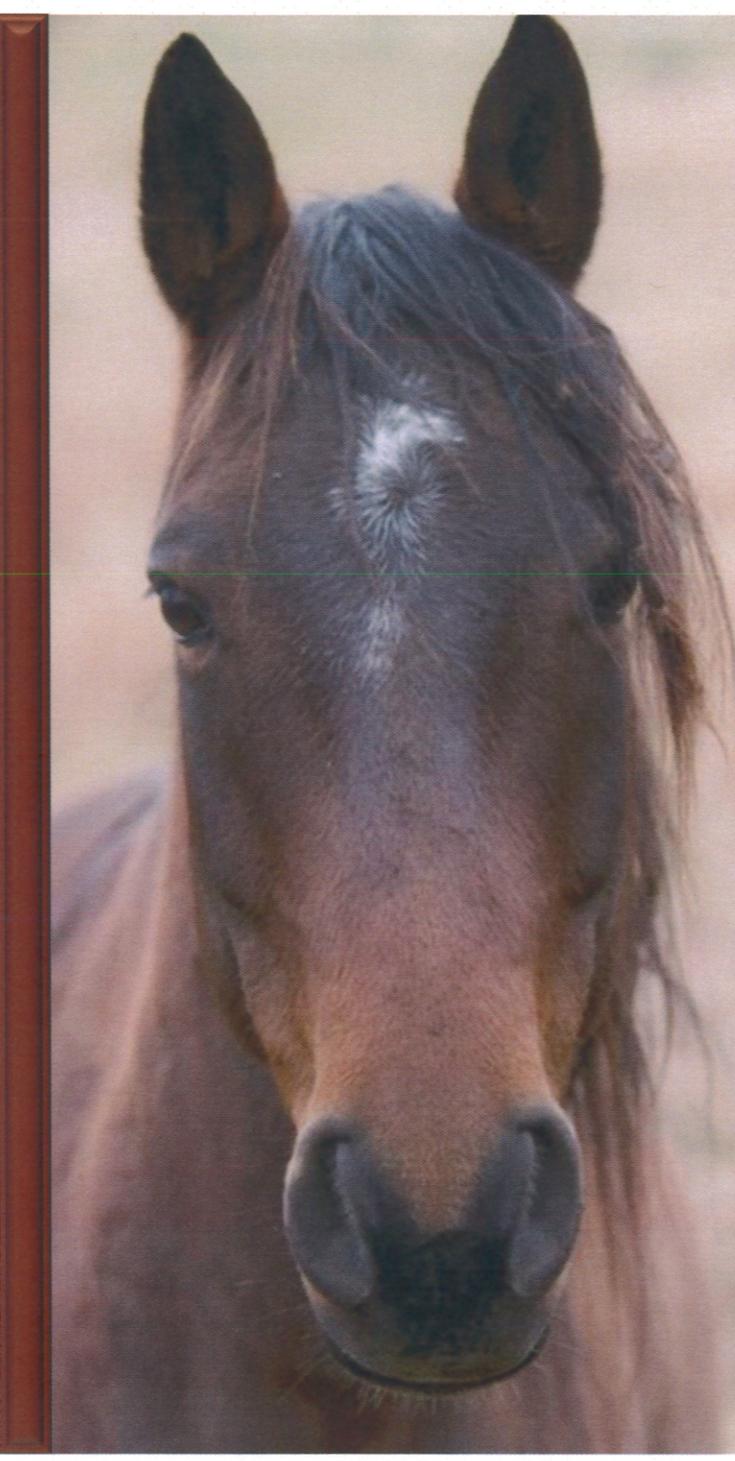
May depend on herd dynamics



Considerations

Horses with compromised health are likely to receive greater benefit from shade than mature, healthy horses





Questions?

Kathryn Holcomb, PhD
keholcomb@ucdavis.edu

Carolyn Stull, PhD
clstull@ucdavis.edu

www.vetmed.ucdavis.edu/vetext/programs/animal_welfare

School of Veterinary Medicine
University of California, Davis

