

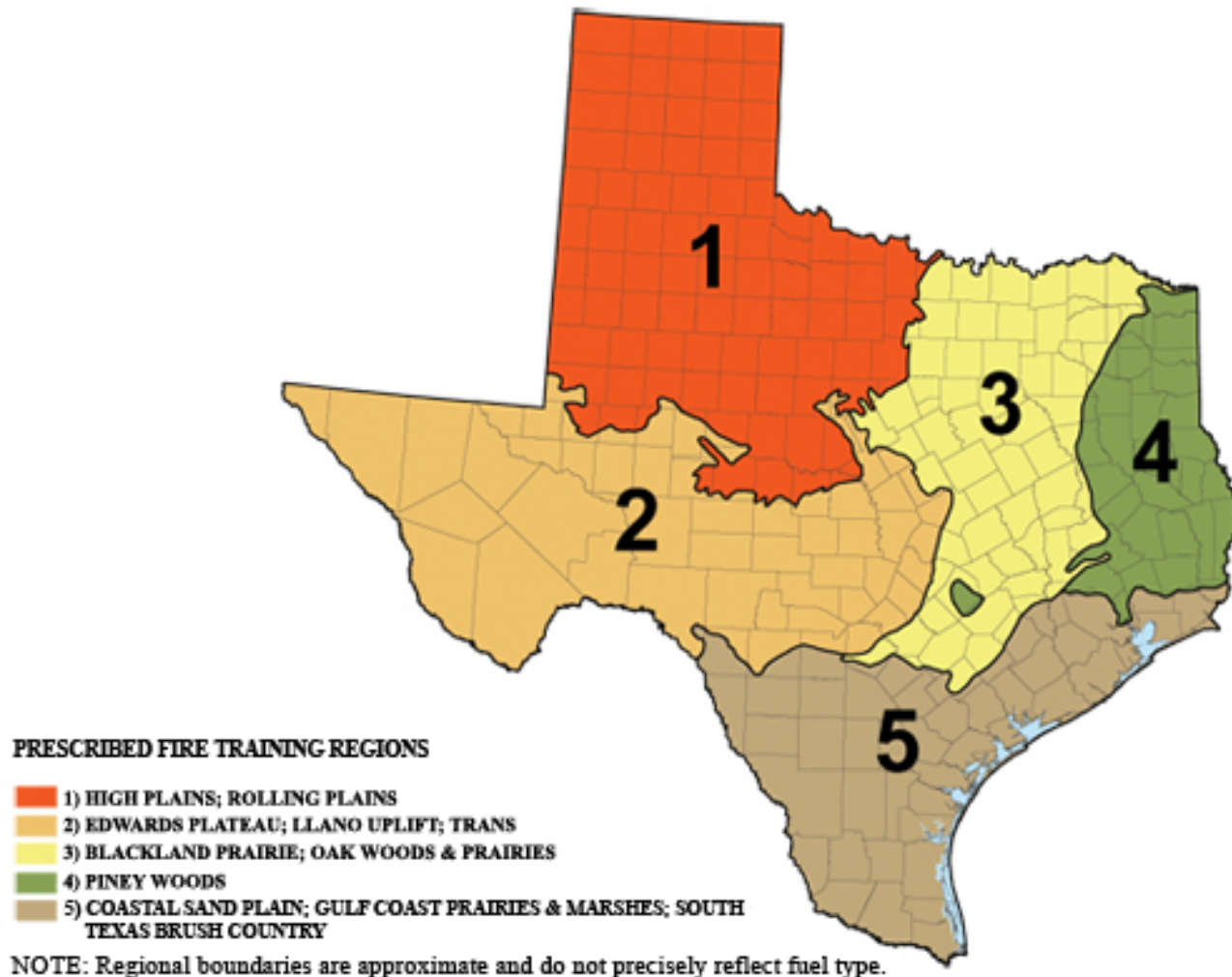
Vegetation Response to Fire



Ecosystems in Texas

- Most Ecosystems in Texas are fire dependent.
- In absence of fire, the vegetation complex changes, habitats are modified, and carrying capacities are typically reduced.
- The Prescribed Burning Board settled on 5 regions to describe the fire effects on vegetation.

Ecosystem Regions as Related to Prescribed Fire



Fire Effects on the Ecosystem

- **Direct effects on:**
 - Plants
 - Effect of heat
 - Sprouters/non-sprouters
 - Grasses/shrubs/trees
 - Animals
 - Very little effect

Heat Effects

- Heat of a fire can determine the success of a prescribed fire.
- Heat of a fire has other properties relating to the vegetation complex.

How Hot Does It Get?

- Surface temperature directly corresponds to fuel loading.
- 1500 pounds of grass = 215 degrees.
- 7000 pounds of grass = 730 degrees.

How Hot Does It Get? - *continue*

- Wind can slightly affect soil surface temperatures.
 - Slight wind = 172 degrees.
 - Moderate wind = 312 degrees.

How Hot Does It Get? - *continue*

Below soil surface

- Temperature increases only in upper .4 inches of soil.
- No direct effect on soil organic matter, microbial populations or buried seed.

How Hot Does It Get? - *continue*

Above soil surface

- 2 - 6 inches temperatures twice as high as soil surface.
- 3500 lbs. grass = ~ 400 degrees.

How Hot Does It Get? - *continue*

- **Heavy slash**
 - surface temperatures = 1150 - 1841 degrees.
 - 1" below soil surface = 360 degrees.
 - 5" below soil surface = 143 degrees.



How Hot Does It Get? - *continue*

- On windward side of mesquite tree.
 - 640 degrees
- On leeward side of mesquite tree.
 - 1220 degrees

Heat of Combustion

- Water vapor must boil off.
- Steam distillation occurs.
- Volatile gases given off.
- Ignitions occurs about 655 degrees.
- Moisture content delays combustion.





Heat Effect on Seeds

- Seeds very tolerant to heat.
- Grass seeds can tolerate 180 - 240 degrees for 5 minutes.
- Little effect on seeds at soil surface.
- Sometimes heat can increase germination.

Heat Effect on Plant Tissue

- Vascular plants easily killed by heat.
- Generally 140 degrees for 2 minutes is lethal to growing plants.



A photograph of a forest fire. In the foreground, there is a layer of dry, brown pine needles and leaves. In the middle ground, a line of fire is burning along the base of several trees. The trees have dark trunks and green foliage. Smoke is rising from the fire. The background shows more trees and a hazy sky.

Fire Adaptations

Bark insulation

- Very little heat damage if bark is .4 inches thick (pine)



Fire Adaptations - *continue*

Growth Form

- Bunchgrass with old growth susceptible.
- Growing point close to surface are susceptible.
- Rhizomatous grasses fire-tolerant.
- Growing annuals usually killed outright.

Soil and Water Properties

A Function of:

- Intensity of burn
- Fuel type
- Soil
- Climate
- Topography



Soil and Water Properties - ***continue***

Organic matter (very short term)

- Evaporation will increase.
- Erosion will increase slightly.
- Less rainfall will be retained.

Soil and Water Properties - *continue*

- Optimum range for bacterial growth is 86 - 100 degrees F.
- Bacterial activity stops at 140 degrees.
- Main ecological effect of fire on organic matter is compressing the decay process into a very short time.



Grassland - *continue*



- Excess litter inhibits grass production.
- Most perennial grasses thrive with burning.
- Excess litter slows nutrient cycling.
- Litter removal increases drought stress.



Forests



- Litter and duff reduced 3 - 70 percent.
- Rarely detrimental unless the fire is too hot.



Water-repellant Layers

- Fuels that burn quickly or that burn very hot usually do not form water-repellant layers.
- Most common in shrub/forest where fires last 5 - 25 minutes.
- Happens to coarse textured soils more than fine textured soils.



Soil Chemistry

- Nitrogen and sulfur volatilize following burn.
- Cations more difficult, losses minor and due to erosion.
- Nutrients move from ashed litter into soil.

Mineral Changes

- Minerals in forest burns may increase severalfold.
- Ash in grasslands has a negligible effect on plant growth.

Soil Losses

- Without cover, erosion happens.
- Four years can be required before steep slopes stabilize.
- Soil losses on grasslands are usually very small after burning.
- Sandy soils more susceptible to wind erosion.

Runoff

- In Texas research, runoff increased only 3 - 5 years post-burn, even then very small amount.



Water Quality

- Sediment and turbidity are main concerns.
- Returned to pre-burn conditions within two years on 15 - 20 percent slopes.
- Soil losses were .2 tons/acre/year when vegetation returned to 65 percent cover.

Vegetation Mortality

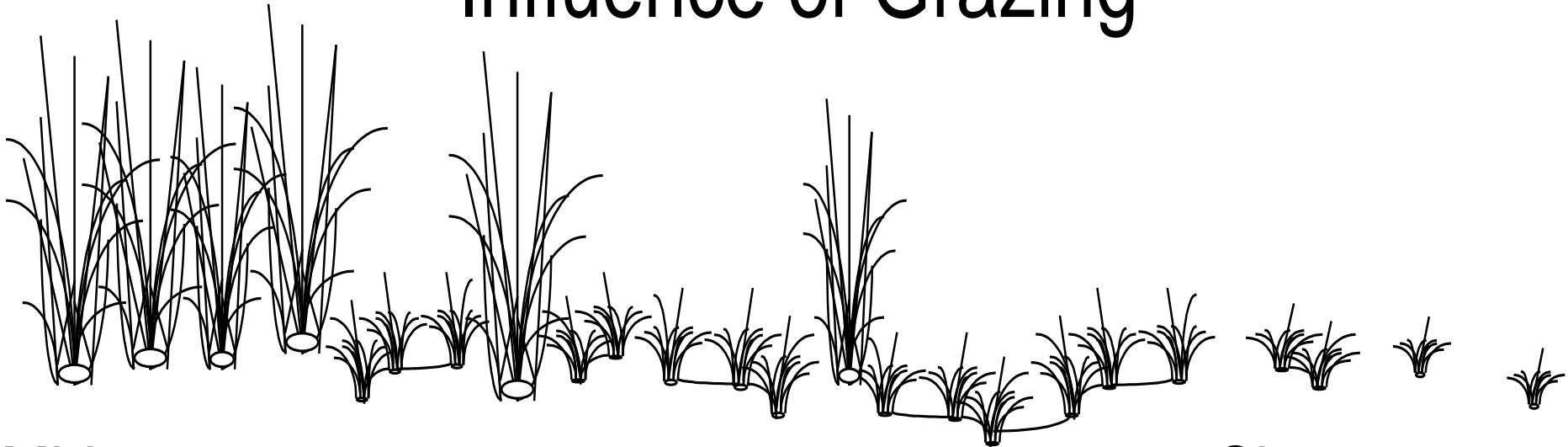
- Most rangeland and forest plants are present because of previous fires.
- Sprouters
 - Most browse and some trees can be top killed but will come back at the base.



Vegetation Mortality - *continue*

- Non-sprouters
 - Very few plants do not re-sprout if top killed by fire.
 - Ash Juniper, Eastern Red Cedar, Tasajillo are examples of plants that can be killed by fire.

Influence of Grazing



Mid-grasses

Short-grasses

Low ← Stocking Rate → High

High ← Fire Intensity → Low

High ← Fire Intensity (Fuel) → Low

Prescribed Fire has the Potential for Restoration



07/18/2006

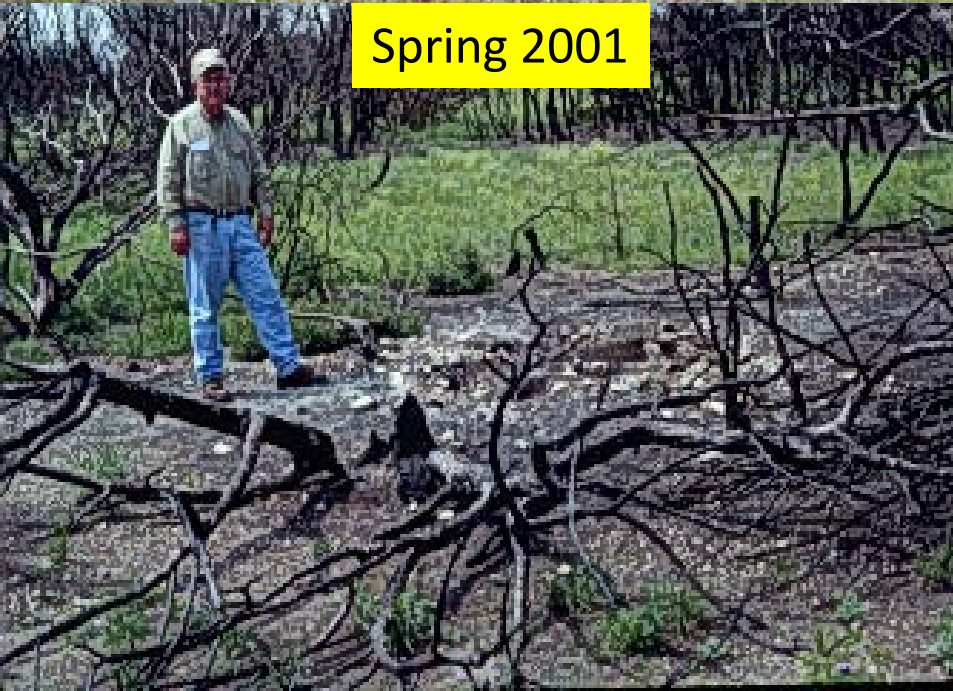
Preburn May 2000



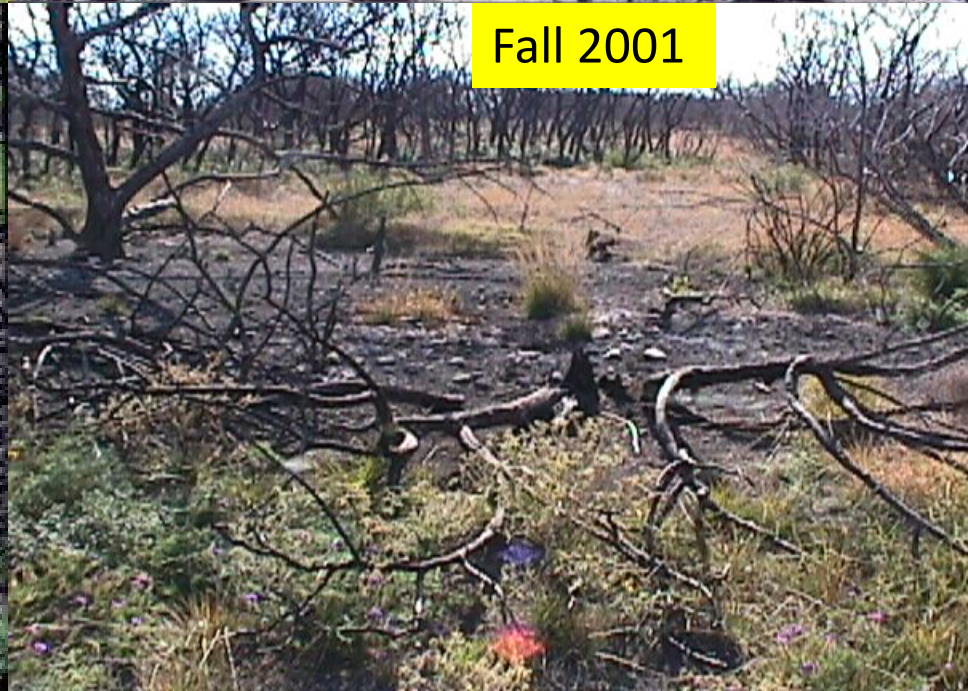
Post burn Aug 2000



Spring 2001



Fall 2001





Summer 2003

Response is Affected by Precipitation



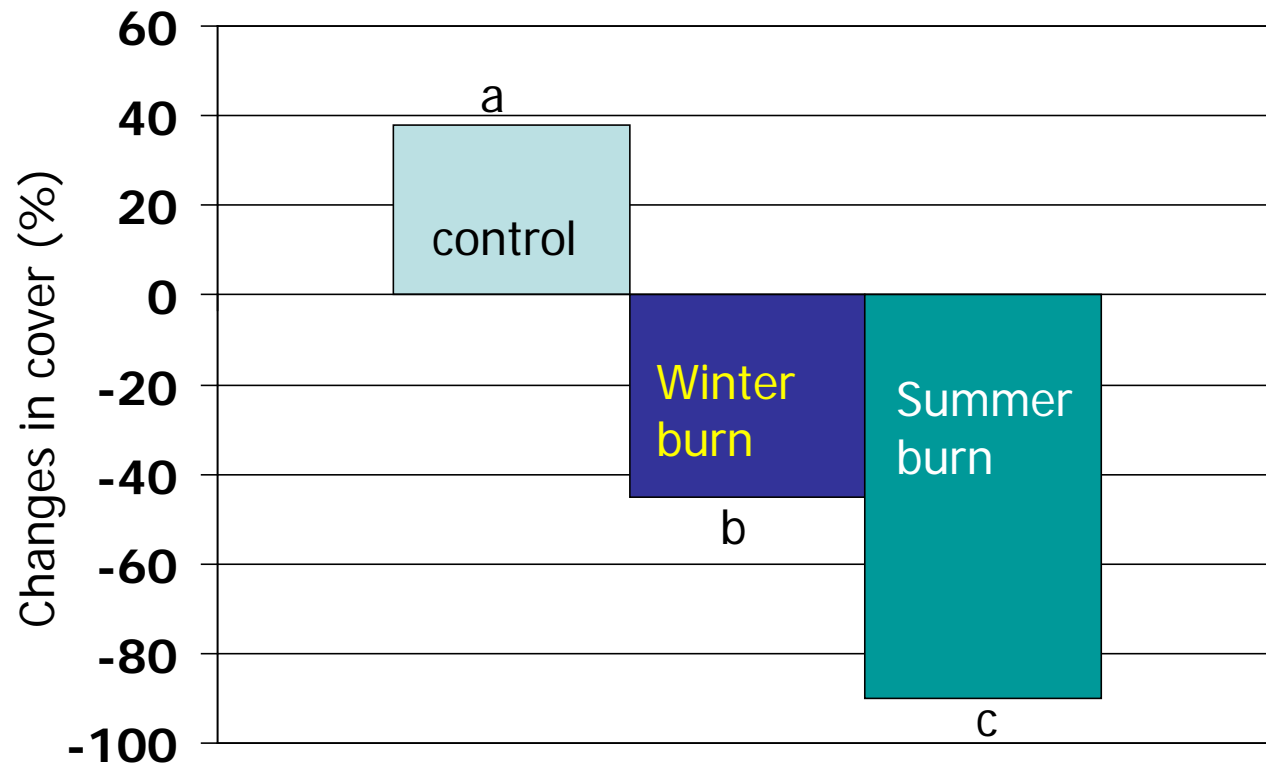
One year following a prescribed fire



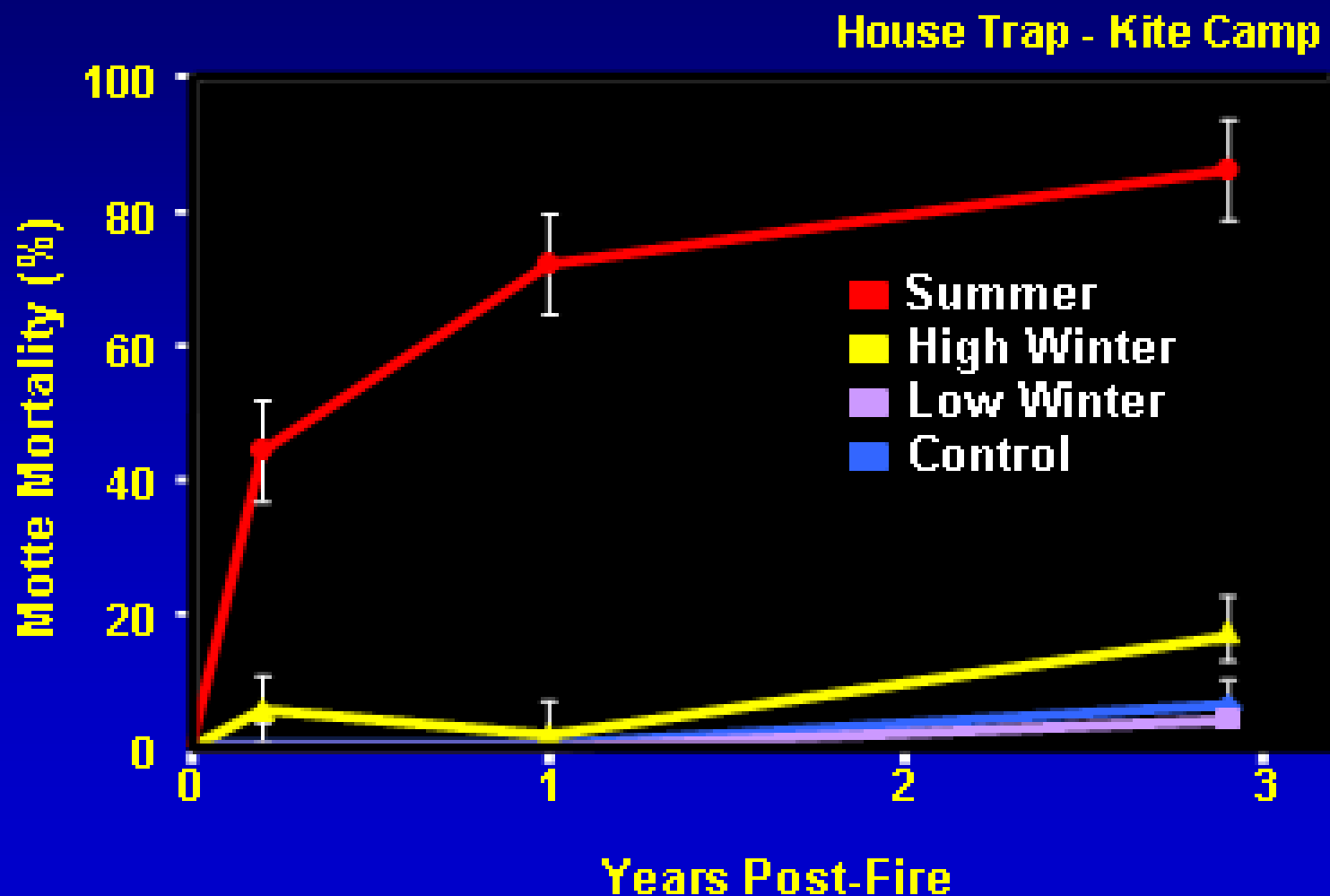
Data from Studies on Prescribed Fire

- Very little long-term data.
- Most data is from 1 to 3 years following a burn.

Changes in Live Pricklypear Cover (%) on Burned and Unburned Areas

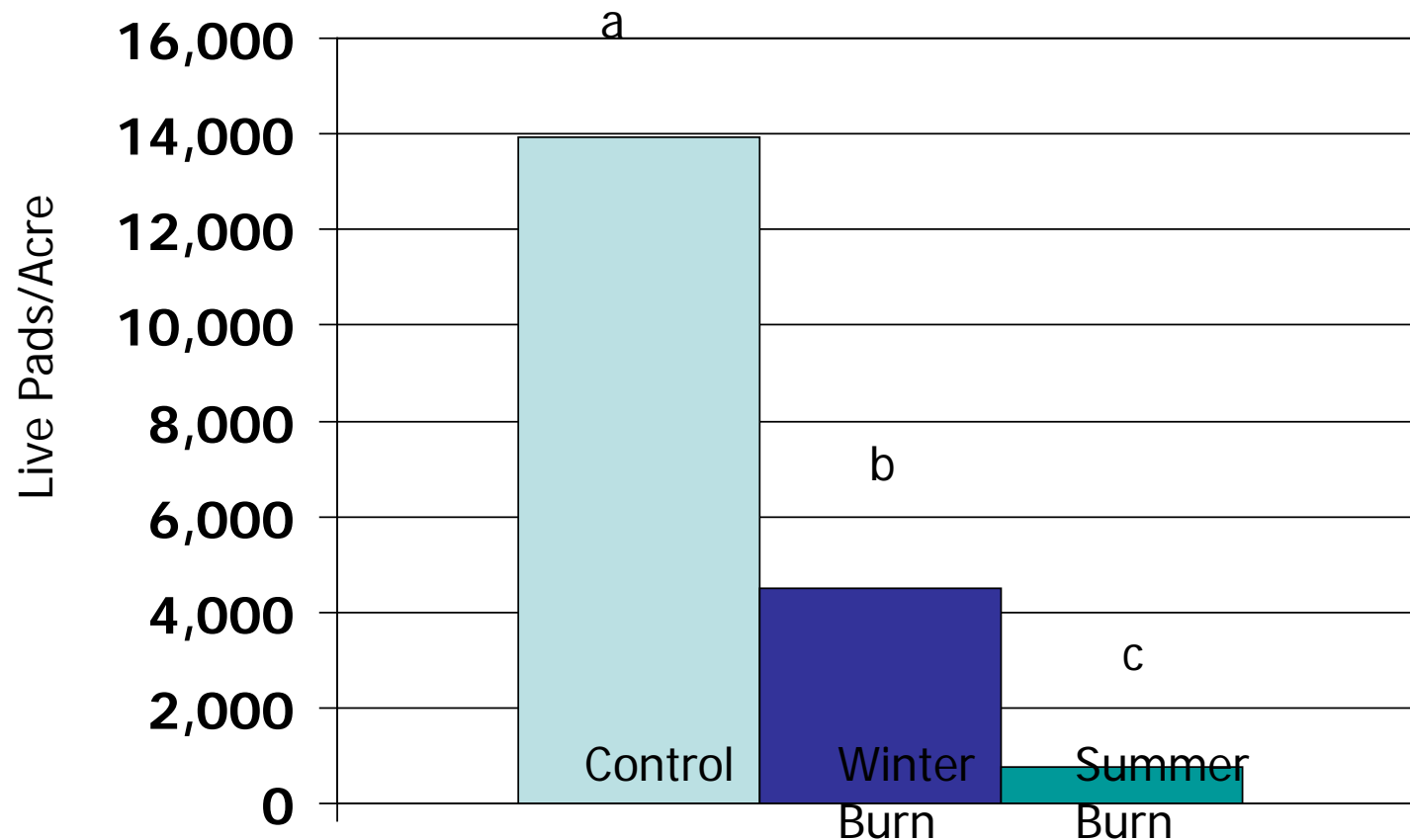


Cactus Response to Seasonal Fires

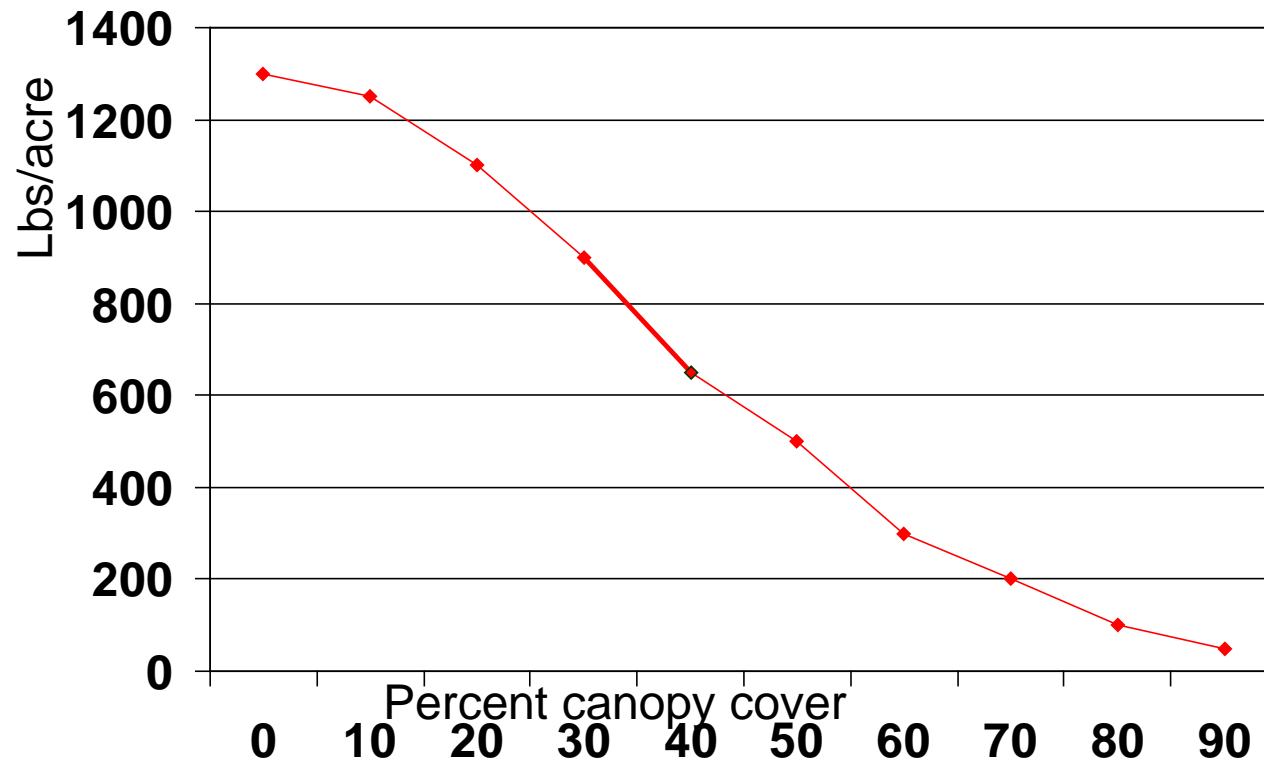


Source: Teague – AgriLife -Vernon

Prickly-pear Density (Live Pads per Pcre) Following No Burning, 3-Winter Burns and 3-Summer Burns



Redberry Juniper Foliage Cover and Forage Production are Inversely Related





Fire

- Kills non-sprouting woody plant species.
- Most browse species resprout from stem bases and roots following fire.
- Sprouts of browse species more palatable to deer following fire.

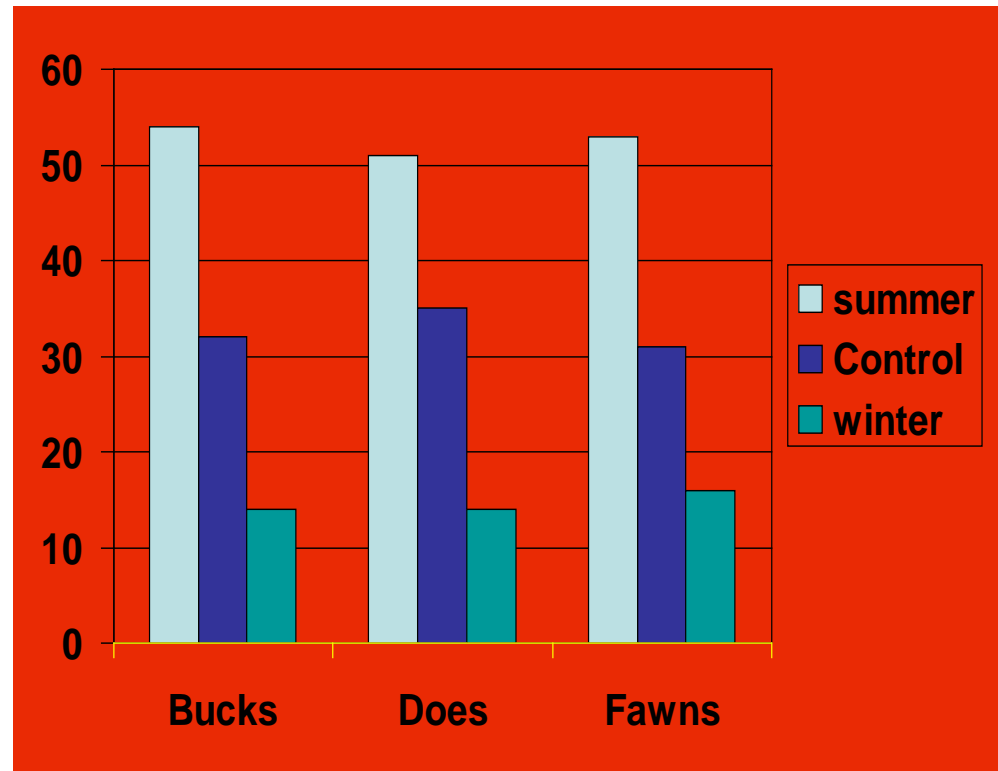


Wildlife are Immediately Attracted to a Burn



Time Spent Foraging (%) by White-tailed Deer in Summer and Winter Burned Patches and Control (No Burning) on the Sonora Station

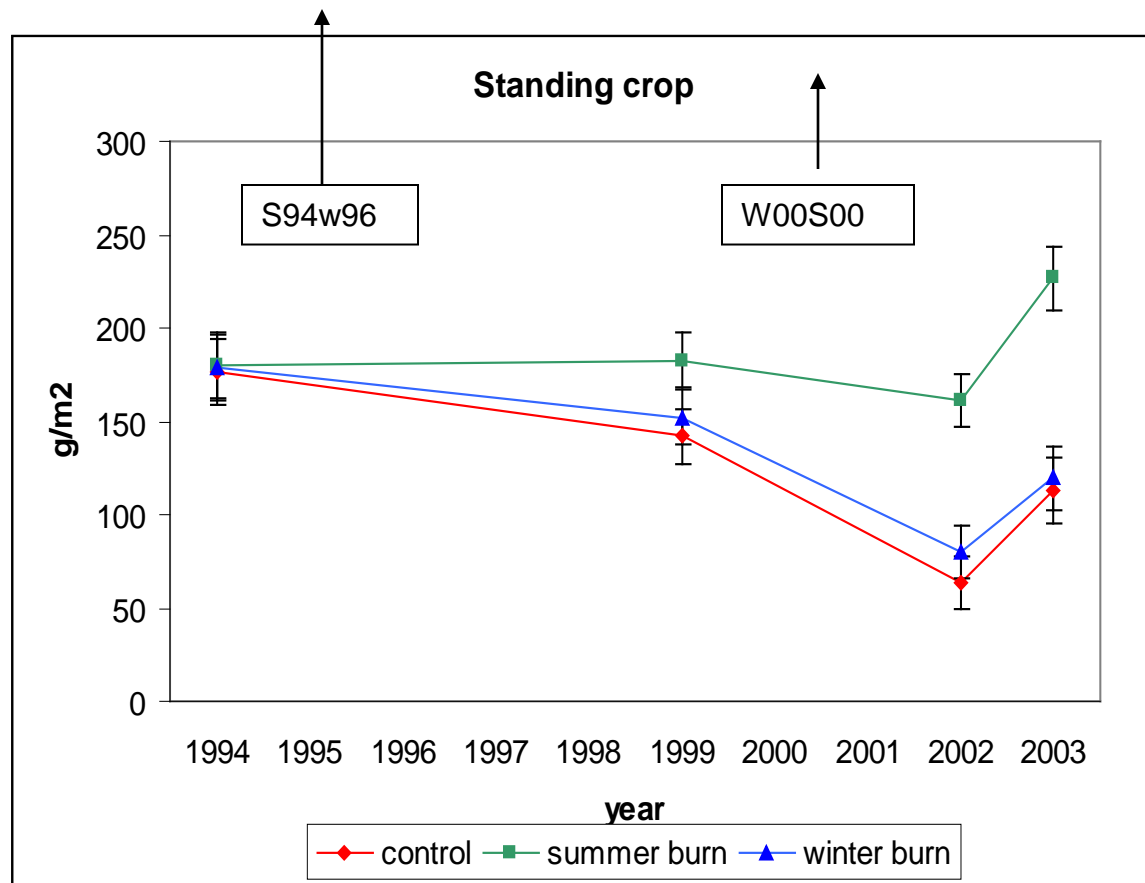
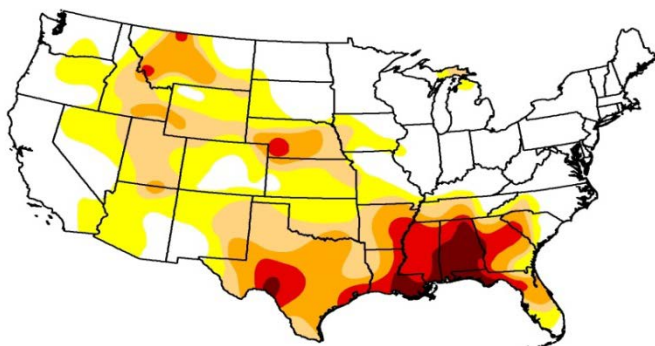
- Winter burns were conducted in January, 2006 - Summer burns were conducted in July, 2006.
- More forbs and browse available in summer burned treatments compared to control and winter burns.
- Deer spent time in control treatments foraging for pear apples which were not present in summer or winter burn treatments.



Data were collected from August 29, 2006 thru November 2, 2006.

Fire Effects on Grasses

August, 2000

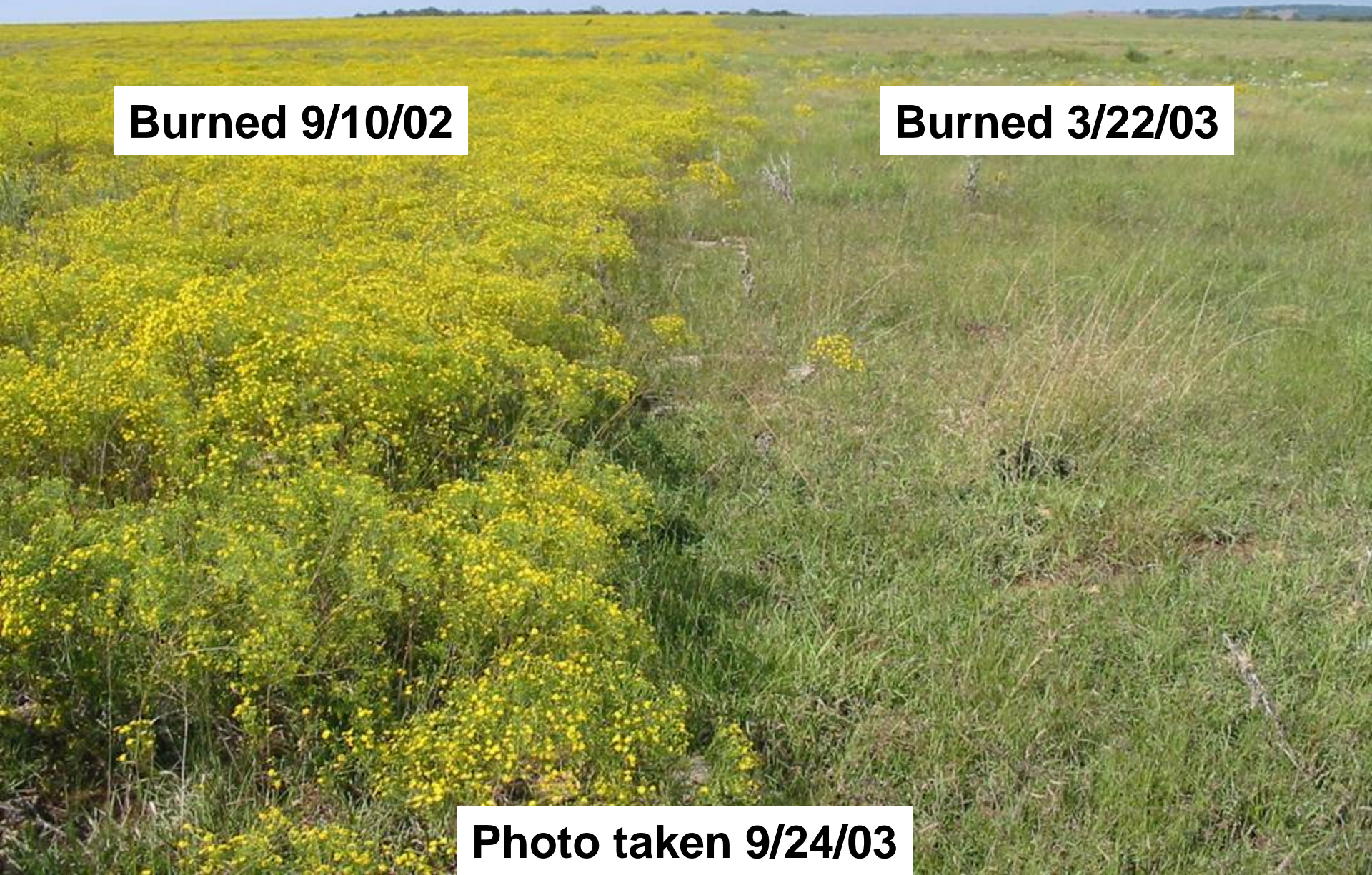


Fire Can Affect Annual Plants

Burned 9/10/02

Burned 3/22/03

Photo taken 9/24/03



Summary

- Burning hurts some plants - favors others.
- Animal mortality is minimal.
- Burning helped shape the early Texas landscape and can be very effective if used prudently.